DETAILED PROJECT REPORT (DPR)

WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

LAKE CHAUTAUQUA

REHABILITATION AND ENHANCEMENT

JUNE 1991

US Army Corps of Engineers
Rock Island District

LA GRANGE POOL
ILLINOIS WATERWAY
MASON COUNTY, ILLINOIS

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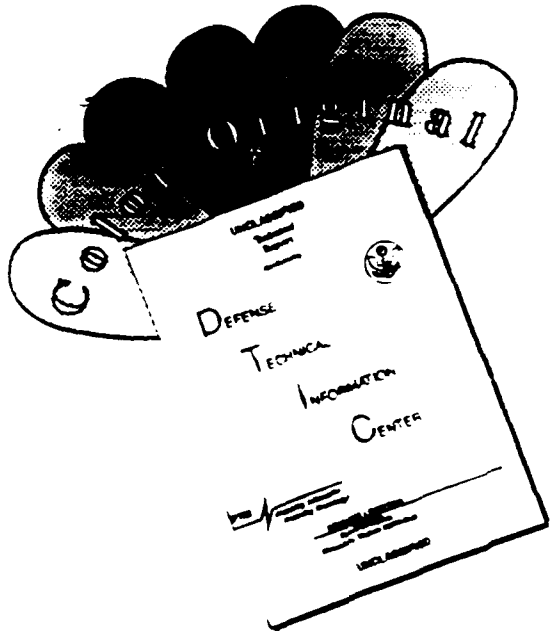

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DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING – P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO ATTENTION OF

June 3, 1992

Planning Division

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The enclosed revised Finding of No Significant Impact (FONSI) and Clean Water Act Section 404(b)(1) Findings of Compliance (FOC) for the Lake Chautauqua, Illinois, Habitat Rehabilitation and Enhancement Project (R-7PR) is provided for your information.

The original goals for this project were to enhance waterfowl and fishery habitat. To achieve these goals, the following project objectives were identified:

a. Increase availability of emergent and submergent aquatic vegetation. This objective will be met by improving Upper and Lower Lake water control capabilities.

b. Create flowing side channel and deep water slough habitat.

The original recommended project included:

a. Constructing a 41,000-gpm pump station to service both the Upper and Lower Lake;

b. Providing 10-year flood event protection for the Upper Lake by upgrading the existing cross dike and Upper Lake perimeter levee and modifying the existing radial gate structure;

c. Installing an Upper Lake gravity outlet structure;

d. Installing a stop log structure at the lower end of the Lower lake;

e. Dredging approximately 7,500 feet of drainage channels in the Lower Lake;

f. Excavating approximately 8,400 feet of Liverpool Ditch to 10 feet below current surface elevation and an additional 300-foot section to 16 feet below current surface elevation;

g. Installing an entrance closure structure with boater access notch at the upper end of Liverpool Ditch; and,

h. Constructing a boat ramp to provide Upper Lake management access.

The original FONSI and FOC for this project addressed the associated impacts and benefits on fish and wildlife resources. On June 18, 1991, these documents were signed by the Rock Island District Corps of Engineers (Corps) Commander, John R. Brown.

However, based on review by Corps higher authority, construction of flowing side channel and deep water slough habitat by excavation of the Liverpool Ditch has been deleted from the project. The decision to delete this element of the project was based on the lack of acceptable economic and habitat-based justification.

The Corps has prepared the revised FONSI and FOC (enclosures) to reflect the changes in the project. Since the changes to the project decrease the negative impacts associated with the project, a new Environmental Assessment (EA) will not be written. If additional impacts were to take place, a new EA would be written and distributed for public review.

By distributing the revised FONSI and FOC, the Corps is not seeking comments on this project. Questions regarding these documents should be directed to Mr. Joe Jordan of our Planning Division's Environmental Analysis Branch, telephone 309/788-6361, Ext. 6697.

Sincerely,

John R. Brown
Colonel, U.S. Army
District Engineer

Enclosures

FINDING OF NO SIGNIFICANT IMPACT (FONSI)
FOR
LAKE CHAUTAUQUA NATIONAL WILDLIFE REFUGE
REHABILITATION AND ENHANCEMENT

Having reviewed the information contained in this Environmental Assessment, I find that the proposed project will have no significant adverse impacts on the environment. This action is not a major Federal action, and therefore preparation of an Environmental Impact Statement (EIS) is not required. This decision may be reevaluated if developments warrant it.

This FONSI is a revised version of a FONSI signed June 18, 1991. The Corps has determined that the Liverpool Ditch Cleanout element of this project does not have acceptable economical and habitat-based justification for construction. Therefore, those impacts as outlined in this report will not occur. Conversely, any benefits derived from this element will not occur as well.

Factors that were considered in making the determination that an EIS is not required were:

a. Implementation of the selected plan will benefit nationally significant waterfowl and wetland resources.

b. The proposed action is complementary to the Lake Chautauqua National Refuge goals and objectives.

c. There were no significant adverse comments received on the project from public review.

d. Adverse effects on fish and wildlife resources from construction are temporary.

2 June 1992
Date

John R. Brown
Colonel, U.S. Army
District Engineer

REVISED JUNE 1992

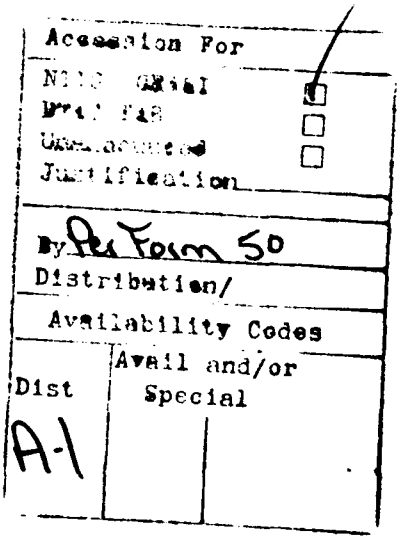
DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING—P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF:

CENCR-PD-W

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS



JUNE 1991

ACKNOWLEDGMENT

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

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PROJECT ENGINEER: Dan Holmes, P.E.

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CULTURAL RESOURCES: Ron Deiss

SOCIOECONOMIC ANALYSIS: Patricia Risser

GEOTECHNICAL: Gene Rand

COST ESTIMATE: Joe Ross, P.E.

WATER QUALITY: Clint Beckert, Ph.D.

EXECUTIVE SUMMARY

Lake Chautauqua is a 3,250-acre floodplain lake and wetland complex located in Mason County, Illinois, within the LaGrange pool of the Illinois Waterway between river miles 124 and 128 (see plate 1). The lake is formed by a 9-mile perimeter levee and is divided into an upper and lower lake by a cross dike. The area is presently managed by the U.S. Fish and Wildlife Service (USFWS) for migratory waterfowl as part of the Chautauqua National Wildlife Refuge.

Following the organization of the Chautauqua Drainage and Levee District in 1916, the area was drained and leveed for farming. However, recurrent flooding lead to the abandonment of the area in 1926. In 1936, the purchase of the Chautauqua Drainage and Levee District by the Department of Interior (USFWS) was approved, and Lake Chautauqua became a part of the National Wildlife Refuge System. The levee was retained for refuge water level control purposes. In 1969, a cross dike was constructed to divide the lake into upper and lower management units.

The lakes have since deteriorated due to frequent flooding and sedimentation. Suspended sediments carried in by floodwaters impede submergent and emergent plant growth by decreasing light penetration and creating a soft, flocculent lake bottom. Since 1978, there has been a documented, long-term decline in both the annual fall peak number of ducks in the refuge and the total fall use days.

The goals for this project are the enhancement of waterfowl and fishery habitats. In order to accomplish these goals, the following design objectives were identified: (1) increase submergent and emergent vegetation (2) create flowing side channel and deepwater slough habitat; and (3) reduce sedimentation. Five alternatives were considered to meet the stated objectives: (A) no Federal action, (B) improve water control, (C) construct barrier islands, (D) excavate flowing side channel, and (E) raise levee elevations.

Evaluation of the project alternatives was accomplished through the application of habitat value assessment methodologies. Aquatic models developed by the Waterways Experiment Station (WES) were used to evaluate existing aquatic and benthic resources and to quantify potential project outputs. The Wildlife Habitat Appraisal Guide, a habitat assessment methodology designed by the Missouri Department of Conservation in cooperation with the U.S. Soil Conservation Service, was used in the analysis of wetland and terrestrial habitats. The alternatives were evaluated on an individual and combined feature basis. As a result of the analysis, the construction of water control structures and side channel excavation (alternatives B and D) were recommended (see plate 2).

The proposed construction includes: raising approximately 3.8 miles of existing levee and cross dike to a 10-year level of protection; modifying

an existing radial gate structure; providing a pump station with 41,000 gpm capacity; providing gated gravity outlets for the upper and lower lakes; providing drainage channels to the pump station and gravity outlets; providing a boat ramp for upper lake management purposes; excavating a selected reach of side channel; and constructing a side channel entrance closure structure.

Development of the selected plan features will provide about 3,250 acres of manageable aquatic and wetland habitat and approximately 8,400 feet of flowing side channel. Migratory waterfowl habitat value will be enhanced by increasing the seasonal availability of reliable water, food resources, and resting, loafing, and nesting opportunities. Fisheries benefits will be accrued through the creation of off-channel, flowing water habitat and deepwater slough habitat.

It is proposed that selected quantitative physical, chemical, and natural resource parameter measurements, as specified in the project report, be collected following completion of construction to evaluate project performance with respect to the stated objectives. The Corps of Engineers would have responsibility for this data collection. Additional field observations would be gathered by the USFWS and submitted to the Corps of Engineers as part of the annual project monitoring plan.

Average annual operation and maintenance of the project, estimated to cost $29,800, will be satisfied through agreement between the U.S. Fish and Wildlife Service and the non-Federal project sponsor, the Illinois Department of Conservation (IDOC).

The U.S. Army Corps of Engineers will 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 Definite Project Report and that is needed as a result of specific storm or flood events. Rehabilitation of the project is considered reconstructive work which cannot be accurately estimated at this time.

The District Engineer has reviewed the project outputs and determined that implementation of the identified plan is justified and in the Federal interest. The project area is managed as a National Wildlife Refuge within the meaning of Section 906(e) of the 1986 Water Resources Development Act. Therefore, approval of the construction of Lake Chautauqua Habitat Rehabilitation and Enhancement project is recommended by the Rock Island District Engineer at 100-percent Federal expense estimated at $4,113,000.

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS

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LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS

1. INTRODUCTION

a. **Purpose.** The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of Lake Chautauqua. This report provides planning, engineering, and sufficient construction details to allow final design and construction to proceed upon approval of this document.

b. **Resource Problems and Opportunities.** Sediment and turbidity have been the principle problems associated with Lake Chautauqua. The accreting lake bed has resulted in decreasing water depths within the lake. With the limited depth, wind and fish-related turbulence results in resuspension of bed sediments and increased turbidities. These turbidities have seriously decreased water quality for migrating waterfowl benefits.

Sedimentation has been the major problem with Liverpool Ditch which runs along the riverside of the lower Lake Chautauqua levee and is one of the few side channel habitats in the Illinois Waterway. However, as a result of clogging and sedimentation, this habitat has been severely degraded. During low flows approaching flat pool elevations, Liverpool Ditch no longer acts as a side channel.

Deficiencies of existing refuge levees and water control structures have hindered the ability to manipulate water levels in upper and lower Lake Chautauqua for moist soil plant production. Several hundred acres of refuge are providing minimal to no benefit because of these deficiencies.

c. **Scope.** The project scope includes the Lake Chautauqua area and the adjacent Liverpool Ditch. Lake Chautauqua is a 4,200-acre lake/wetland complex within the floodplain of the Illinois River near Havana, Illinois, as shown on plate 1. Lake Chautauqua is formed by a 9-mile perimeter levee and is essentially divided into an upper lake and a lower lake by a cross dike. The lake varies between .5 to 1.5 miles in width and is over 6 miles long. The U.S. Fish and Wildlife Service (USFWS) presently operates the lake for migratory waterfowl as part of the Chautauqua National Wildlife Refuge.

Liverpool Ditch is a 3-mile-long side channel created when the area was used as borrow for construction of the levee. The configuration of the original ditch is not known because cross-sectional information is

unavailable for the time period. However, based on data collected at a later date, the ditch is estimated to have been between 12 to 15 feet deep and approximately 100 feet wide at the top when it was excavated. At or near flat pool, the current ditch section ranges from dry to a few inches deep and anywhere from a few feet to 30 feet wide. These estimated ditch sections are based on a flat pool elevation of 429.4 feet National Geodetic Vertical Datum (NGVD). The ditch is located within the Chautauqua National Wildlife Refuge.

The study focused on providing project features that would allow: (1) operation of the upper lake as a stable level lake during most years; (2) the independent operation of the lower lake as a moist soil management unit; and (3) rehabilitation of scarce side channel habitat in Liverpool Ditch. The ability to completely draw down the upper lake periodically was considered essential to allow consolidation and desiccation of the bed sediments, thereby improving water quality and encouraging the growth of submergent vegetation.

Field surveys, aerial photogrammetry, and hydrographic soundings were done to plan and assess proposed project alternatives. Soil borings were taken to assess sediment types, to verify foundations for proposed structures, and to determine excavation/dredging constraints. Water quality sampling was initiated as part of the study and will continue through construction.

This report follows a general problem solving format. The purpose and the problems are presented in Section 1. Section 2 provides an overview of how and why Lake Chautauqua 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 and 6 propose and evaluate project alternatives. Sections 7 and 8 describe the selected plan. Section 9 assesses the environmental effects from the proposed plan pursuant to the National Environmental Policy Act. Section 10 provides a summary of project accomplishments or benefits. Sections 11, 12, and 13 describe operation and maintenance considerations, performance monitoring, and detailed cost estimates for both initial construction and annual operation and maintenance. Sections 14, 15, 16, and 17 provide a summary of implementation requirements and coordination. Sections 18, 19, 20, and 21 present the conclusions, recommendations, Finding of No Significant Impact, and literature cited, respectively.

Drawings (plates) have been furnished to provide sufficient detail to allow review of the existing features and the proposed plan. Plates 1 through 6 show the project location, the recommended plan, and alternative plans. Plates 7 and 8 provide 16 years of hydrographic record for the Illinois River near the proposed project location. Plates 9 through 12 provide soil borings that were used to evaluate foundation conditions and excavation depths and methods. Plates 13 through 18 provide plan and profiles of the perimeter levee and cross dike. Plates 19 through 21 provide typical sections. Plates 22 through 25 and 27 provide structure details. Plate 26 provides the monitoring plan.

d. **Authority.** The authority for this report is provided by the 1985 Supplemental Appropriations Act (Public Law 99-38) 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 (UMRS), it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes.

(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 SELECTION PROCESS

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 USFWS, Region 3, and the five affected states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi 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.) Note: By letter of February 5, 1988, the Office of the Chief of Engineers directed that such projects not be pursued.

A number of innovative structural and non-structural solutions which address human-induced impacts, particularly those related to navigation traffic and operation and maintenance of the navigation system, could result in significant long-term protection of UMRS habitat. Therefore, proposed projects which include such measures will not be excluded categorically from consideration, but the policy and technical feasibility of each of these measures will be investigated on a case-by-case basis and recommended only after consideration of system-wide effects.

(3) **Subsequent Annual Addenda.** Subsequent annual addenda, of which the Fifth Annual Addendum is the most recent, provide a vehicle for reporting program progress and ensuring thorough coordination between 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 engineeringly 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 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 in the annual addendums, 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 Wildlife Area; the Chautauqua Refuge, encompassing sites adjacent to the LaGrange Pool of the Illinois Waterway; and the Peoria Lake project, located within the Peoria Pool, 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 in various stages of planning and design in preparation for implementation under the Environmental Management Program.

Restoration of habitat at Thompson Lake (LaGrange Pool, RM 120 to 126) through the acquisition of the Thompson Lake and Globe Drainage and Levee Districts is being considered by the USFWS. This project has significant land acquisition and development costs associated with it. The USFWS may submit the rehabilitation and enhancement of this site as an EMP habitat project at a later date should acquisition be accomplished.

All of these proposed or under-development projects address the specific need for enhanced aquatic and wetland habitat along the central reach of the Illinois River. 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 River, 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 deepwater slough habitat is virtually nonexistent along much of the Illinois Waterway, yet it is considered critical to fisheries.

The Lake Chautauqua area historically was part of a highly productive freshwater ecosystem. Flooding in the 1940's started a decline in the value of the lake's habitat. The loss of rooted aquatic plants, combined with sedimentation, has reached a point where wind fetch-generated wave action is capable of resuspending bottom flocculents. The soft bottom sediments are not allowed to compact due to this constant churning. The resulting increase in turbidity levels has reduced photosynthetic activities within the lake. Submergent and emergent vegetation that does develop under these conditions is unable to anchor itself to the lake bed, thereby allowing the natural buoyancy of the vegetation to defeat its establishment.

The Lake Chautauqua project site will provide tremendous opportunities for waterfowl and fisheries habitat restoration and enhancement. The selection of this site was based primarily upon project output potential; however, influencing parameters such as land ownership status, conservation management considerations, and navigational impacts have been considered.

3. ASSESSMENT OF EXISTING RESOURCES

a. Related Studies and Reports. A number of studies have been conducted which investigated the sedimentation problem in Lake Chautauqua. These studies are summarized below.

(1) *The Silting of Lake Chautauqua* (Stall and Melsted, 1951) presented a history of the lake and results of a 1950 sedimentation study. The study included analysis of the rising lake bed elevation and the fertility of the sediments. These analyses indicated that the lake was filling in at a rate of 0.38 inch per year, and the sediment in the lake had high fertility as measured in carbon and nitrogen.

(2) *Turbidity and Sedimentation at Lake Chautauqua, Illinois* (Jackson and Starrett, 1959) studied turbidities due to wind and fish resuspension of bottom sediments. This study concluded that due to the soft nature of sediments in Lake Chautauqua, wind and fish activity contributed to turbidity in the lake to the point that the lake rarely became clear. The study also concluded that important duck food plants had been adversely affected by a combination of sedimentation and severe flooding.

(3) *Sediment Deposition of Lake Chautauqua, Havana, Illinois* (Lee, 1976) studied the sedimentation from 1950 to 1976. It concluded that the sedimentation rate during the study period was 0.3 inch per year.

b. Resource History and Description of Existing Features. Prior to modern man's arrival, the Illinois River floodplain around Lake Chautauqua consisted of numerous lakes, sloughs, and backwaters. This was part of a river ecosystem that was considered to be one of the most productive freshwater ecosystems in the world. In the early 1900's a combination of deteriorating water quality from the discharge of Chicago sewage into the Illinois River and construction of agricultural levees eliminated most of these floodplain habitats. These and other perturbations have caused a long-term decline in the ecological resources of the Illinois River Valley (Mills, *et al.*, 1966) which includes Lake Chautauqua.

The Chautauqua Drainage and Levee District was organized in 1916. The district then proceeded to drain and levee the sloughs and backwaters of the Illinois River for agriculture. The Lake Chautauqua area was farmed until 1926 when it was abandoned due to recurrent flooding.

The Chautauqua National Wildlife Refuge was created in 1936 with the purchase of the Chautauqua Drainage and Levee District. Approximately 9 miles of levees were repaired and the 4,500-acre area (approximately 3,250 acres of water) began to be managed for migratory waterfowl. Water levels were maintained by gravity flow only, relying on favorable water levels on the river to either flood or to drain the lake.

Present ground elevations of the lake bed are approximately 430.5 NGVD. The present elevations of the perimeter levee range from 441 to 449 NGVD

in the upper lake and from 436.5 to 442 NGVD in the lower lake. The present elevations of the cross dike range from 439 to 446 NGVD, except at the breach, where the elevation goes down to 428 NGVD.

Water control is achieved by the perimeter levee system, a cross dike separating the north unit from the south unit, and other hydraulic controls. The existing water control features are summarized in table 3-1.

TABLE 3-1

Existing Features Data

Item	Location	Description	Remarks
Northern Perimeter Levee	North Unit	3.0 miles of eroded levee at average elevation 442; heavy wooded vegetation on outside slopes; moderate wooded vegetation on inside slopes.	Levee was rebuilt to 446 circa 1960.
Southern Perimeter Levee	South Unit	5.8 miles of eroded levee at average elevation 441; moderate wooded vegetation in most areas.	Levee was rebuilt to 446 circa 1960.
Cross Dike	Between North and South Unit	1.0 mile of eroded sand levee with 12:1 (horizontal:vertical) slopes at elevation 441 with light, woody vegetation	Constructed in 1969 to elevation 446±; breached circa 1970; breach never repaired.
Radial Gate Structure	North Unit	4 12-foot-wide radial gates manually operated, invert 433.5 NGVD.	
West Spillway	South Unit	2 components: (a) 18 feet of stoplog structure with sill at 433 with stoplog control to 437.5; and (b) 300 feet of uncontrolled spillway at 437.5.	
South Spillway	South Unit	1,000 feet of uncontrolled spillway at 437.5.	

TABLE 3-1 (Cont'd)

Item	Location	Description	Remarks
Gated Box Culvert	On Quiver Creek in South Unit	2 components: (a) Stoplog control of Quiver Creek to make impoundment with spillway at 439; and (b) 3-foot x 3-foot slide gate on box culvert for water diversion to south unit with invert at 433.	

The existing cross dike was constructed in 1969 to divide the lake into upper and lower pools of about 1,000 and 2,250 acres, respectively, in order to improve water level management capability. Shortly after its construction, wind and wave erosion created a breach in the cross dike that prevented independent operation of each lake.

c. **Land Use and Refuge Management Objectives.** The boundaries of the project area are approximately the same as those of the refuge. For the purpose of habitat analysis, the project area is bordered by Meyer's Ditch on the north, the riverward side of Liverpool Island on the west, the base of the river floodplain bluff on the east, and the river side of the levee at the downstream end. For the purpose of habitat analysis, the project area has been classified into habitat types and acreages as shown in table 3-2.

TABLE 3-2

Existing Land Use Classification

Component	Existing Habitat Classification: Aquatic (Deep Water) Acres	Non-Forested Wetland (Shallow, Open Water) Acres	Bottomland Hardwoods, Acres	Grassland Acres	Total, Acres
North Unit					
Upper Lake	--	1,000	100	--	1,100
Upper Levee	--	--	31	--	31
Cross Dike	--	--	23	--	23
South Unit					
Lower Lake	--	2,250	300	--	2,550
Lower Levee	--	--	64	--	64
Liverpool Side Channel Area					
Liverpool Channel	--	70	--	--	70
Liverpool Island	--	--	374	--	374
Total, Acres	--	3,320	892	--	4,212

Currently, the mallard duck is the most important species using the refuge. Management operations are directed at providing shallow, flooded, moist soil plants for migratory ducks (primarily dabblers), and open water areas for loafing and sanctuary. When conditions permit, the elevation of the lake(s) is drawn down in early summer to expose mudflats. Moist soil plants such as smartweed, wild millet, and amaranth colonize the mudflats and are allowed to mature until fall. The water elevation is gradually raised approximately 6 to 12 inches, enough to flood the plants, yet leave the seeds above the water. The entire drawdown, maturation, and flooding are timed to coincide with the fall migration of ducks.

Short- and long-range management goals are to increase submergent vegetation in the upper lake for diving ducks and secondarily for fish. Next in priority are increasing moist soil plants in the lower lake for dabbling ducks such as mallards. Outside of the leveed portion of the refuge, objectives are to improve Liverpool side channel habitat and to create deep water for wintering fish. Managers also will attempt to reestablish yellow perch in the upper lake.

Previous plans for meeting the waterfowl management objectives for the refuge included raising the entire 9-mile perimeter levee to an elevation of 453 NGVD (an approximate 50-year river event), rehabilitating the cross

dike, and installing a water control/pump structure to restore independent operation of the upper and lower lakes. Refuge managers had been pursuing these improvements prior to any EMP involvement.

In March 1988, the USFWS prepared an evaluation report generated from a workshop on the restoration of Lake Chautauqua. The purpose of the workshop was to make recommendations concerning the future management and developments of the refuge. Workshop participants from the State of Illinois and the USFWS stated that the preferred option was raising the entire perimeter levee to an elevation of 453 NGVD. The estimated cost of this option ($22 million) made it unlikely to ever be implemented. The USFWS's recommended alternative was a two-phase development of the upper and lower lakes similar to the alternatives in this report.

In the forseeable future, the management goals and refuge operations are unlikely to change. Productivity of aquatic and wetland (waterfowl) resources available on the refuge are likely to deteriorate in the forseeable future without significant EMP involvement. Sedimentation is projected to continue. As the bottom elevation increases due to sedimentation, emergent aquatic vegetation (such as *Sagittaria* sp. and cattail) should become reestablished. For a short period of time, waterfowl use should improve somewhat. However, this will pass as the open water areas succeed to scrub-shrub wetland dominated by willow (this is already occurring in the lower lake near the overflow structure). Waterfowl use of the area gradually will decline relative to the acreage of open water.

d. Wetland and Waterfowl Resources. The leveed area of Lower Lake Chautauqua consists of about 2,250 acres of open water that is classified as non-forested wetland. The average bottom elevation is approximately 431 NGVD. At a normal Illinois River pool elevation of 434 NGVD, the lake averages only 2 to 3 feet deep. Approximately 364 acres of bottomland hardwoods are present around the lower lake perimeter. Upper Lake Chautauqua has approximately 1,000 acres of non-forested wetland (open water) and 131 acres of bottomland forest. Submergent and emergent vegetation in both lakes varies from year to year depending upon the severity of flooding that occurs from the Illinois River.

Species composition of the adjacent bottomland hardwood is mostly cottonwood, silver maple, and hackberry, except for a small parcel of pin oak near the north radial gates. There are no mast-producing hardwoods in the immediate floodplain vicinity. Overall, the forest stand age ranges from sapling to mature parcels. Periodic levee maintenance over the refuge's existence has resulted in a patchwork of successional stages of timber on the levee itself.

Although the upper and lower lakes are currently managed as a single (because of the breach in the cross dike) moist soil unit, they perform this function very poorly due to the deleterious effects of irregular flooding and siltation. These two impacts greatly hinder the reliable production and availability of aquatic submergent and emergent food plants

needed by migratory waterfowl. With a spillway elevation of only 437.5 NGVD (the elevation of the 2-year flood event is 443.5), the lower lake is flooded at least once or twice annually.

Suspended sediments carried in by these floodwaters impede submergent and emergent plant growth by decreasing light penetration and creating a soft, flocculent lake bottom. This condition has been well documented at the refuge by Bellrose, *et al.*, (1979), which established an inverse relationship between water level fluctuation and aquatic plant growth. The flood of record that occurred in 1943 virtually eliminated from the refuge all species of *Potamogeton*, which is highly preferred by waterfowl. Subsequent floods eliminated other submergent aquatics such as coontail (*Ceratophyllum demersum*) and wild celery (*Vallisneria*). Observations by refuge personnel and Illinois Natural History Survey scientists indicate that these aquatic plant species are still present in the lake, but in such low densities that they provide negligible benefits to waterfowl.

Following the decline of aquatic vegetation, waterfowl continued to use the refuge in significant numbers, but they (primarily diving ducks) switched to an alternate food source of fingernail clams (*Spharidae* spp.). In 1954, however, the fingernail clam population precipitously declined due to a combination of pollution factors (Mills, *et al.*, 1966).

In addition to the detrimental effects of flooding, wind-generated waves across the long fetch of the lake regularly resuspend clay and silt sediments. This resuspension further increases turbidity and liquifies the bottom substrate. When aquatic vegetation was still present in the lake, it minimized the effects of wind-generated resuspension (Jackson and Starrett, 1959). This problem should be alleviated once a permanent cover is reestablished.

The lack of aquatic vegetation is greatly exacerbated by the inability to dewater the lake and to consolidate the sediments. The sill elevation of the lower lake water control structure is 433 NGVD (which is 2 feet above the average lake bottom elevation). Even when river water surface elevations permit, the lake can be drawn down far enough to expose only 200 acres (out of 3,300 total) of mudflats. This leaves 3,100 acres of flocculent lake bottom that rarely, if ever, dries out. The inability to completely dewater the lakes leaves the silty bottom sediments in a flocculent and unconsolidated state. This condition has been well documented (Starrett and McNeil, Jr., 1950). Any vegetation that does manage to germinate on such substrates is frequently dislodged by wind-generated waves.

Overall, waterfowl use at both the refuge and the entire Illinois River Valley has declined significantly in the past 30 years (see figures 3-1 and 3-2). The downward trend in waterfowl use at Lake Chautauqua is well documented from annual censuses performed by the Illinois State Natural History Survey and the USFWS. Causes for the Illinois River Valley decline have been well documented by studies such as Bellrose, *et al.* (1979).

Other significant factors in this decline extend beyond the United States border, such as the loss of breeding habitat in Canada.

Waterfowl use of the refuge and the Illinois River flyway has fluctuated yearly since censuses began in the 1940's. However, since 1978, there has been a steady decline in both the annual fall peak number of ducks in the refuge and the total fall use days. In 1978, there was a peak of 215,000 ducks of all kinds at the refuge. This fell to a peak of only 56,000 in 1989. The total number of dabbling duck use days on the refuge in the fall also declined from 6.4 million in 1978 to only 0.9 million in 1989. In contrast to the dabblers, diving duck use of the river valley and the refuge has remained fairly constant following a precipitous decline in 1955. From 1950 to 1954, total fall diving duck use days on the river ranged from 8.5 to 16.0 million. From 1955 until present, fall use days for divers has not exceeded 3.3 million. Bellrose, *et al.* (1979) attributed this to "... a catastrophic loss of fingernail clams ...."

e. **Aquatic Resources.** Historically, Lake Chautauqua had a diverse and productive fishery that was attractive to both commercial fishermen and anglers. The health of the fishery seemed to decline in stages related to certain biological, physical, and man-induced factors. The most detrimental effect was the artificial manipulation of water levels for waterfowl and irregular flooding from the Illinois River. In spite of this, the refuge's fishery was still excellent in its early years (1930's).

A significant decline in the lake's aquatic vegetation occurred following two major flood events in the 1940's. This caused a further decline of the fishery. A 10-year fishery investigation of the lake by Starrett and Fritz (1965) from 1950-1959 still showed the presence of 64 species. That same study also concluded that fluctuating water levels "... was probably the single most important factor affecting the dynamics of the fish population of Lake Chautauqua." The 1960's and 1970's saw an even greater increase in siltation rates (Bellrose, *et al.*, 1983) that virtually eliminated any quality fishery. The flocculent lake bottom, ongoing silt deposition, and lack of vegetation have caused such a decline in the quality of the fishery that it now consists mostly of rough fish; drum, catfish, and bullhead.

Periodic fish kills occur when water levels remain low for extended periods. Because of the inability to drain the lower lake, fish are trapped, even when the water control structure is open completely. At present, use of the lake for a sport fishery is sporadic. During periods of high water, other species such as bass, bluegill, and crappie will sometimes temporarily utilize it.

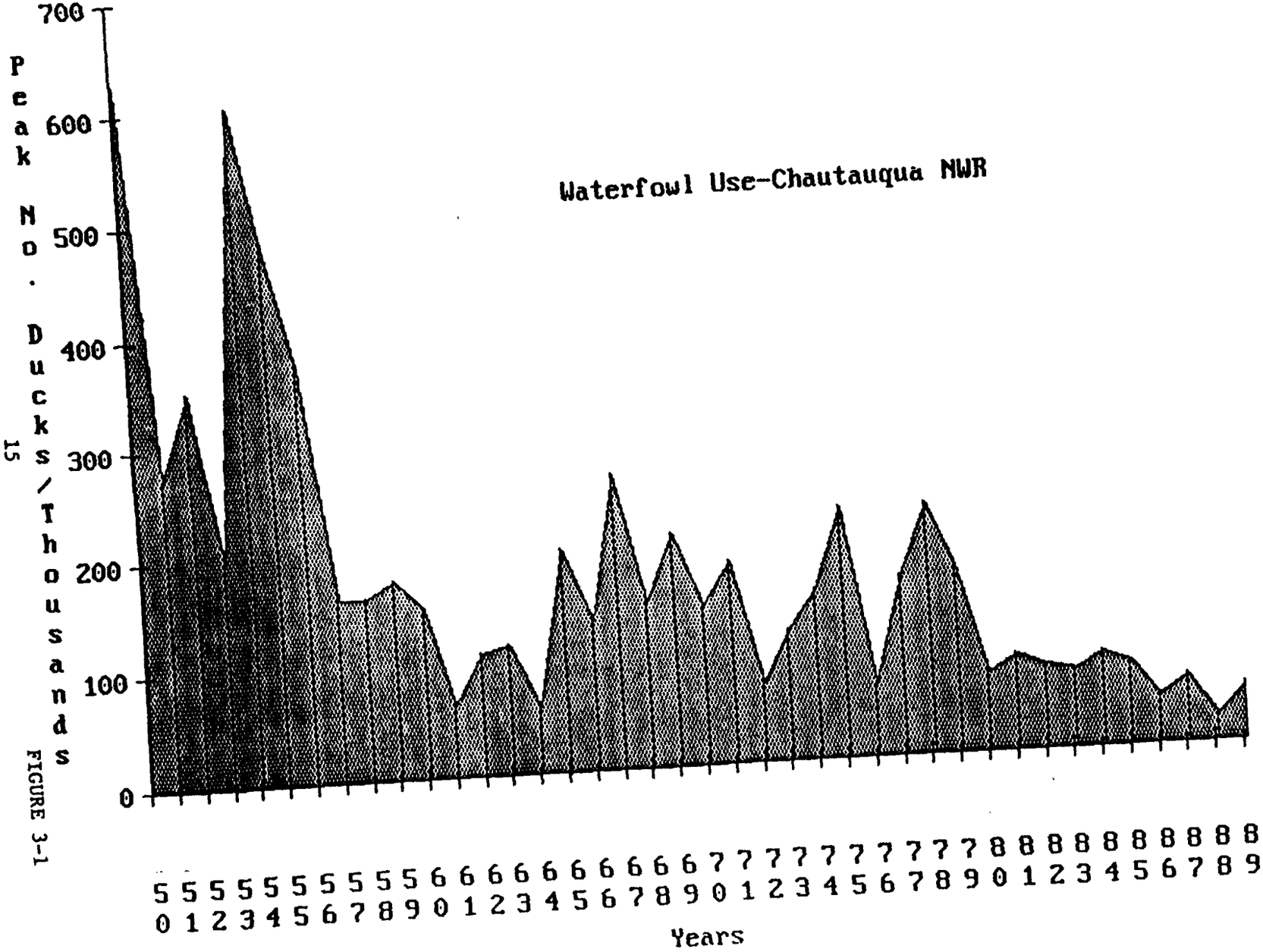

Waterfowl Use-Chautauqua NWR
Peak No. Ducks\Thousands
700
600
500
400
300
200
100
0
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
Years

FIGURE 3-1

Waterfowl Use-Illinois R.
Peak Mo. Duck/Million
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
55555555556666666667777777778888888888
01234567890123456789012345678
Years

FIGURE 3-2

Immediately adjacent to the levee and surrounding the lake are Liverpool Ditch (lower lake) and Meyer's Ditch (upper lake). These channels were created during the construction of the levee. At a point just above the cross dike, Liverpool Ditch intersects the main river. The additional water from the main river creates a "flowing" side channel for approximately 3 miles until it rejoins the river. It is one of the few remaining side channels on the entire Illinois River (Havera 1980). Sedimentation in the ditch, however, has eliminated most of its aquatic value. When the ditch was excavated in about 1922, its elevation is estimated to have been between 416 and 418 NGVD, or about 13 feet below flat pool elevation of 429.4. The average bottom elevation of the channel presently is 430 NGVD and thus provides no permanent water. High flows during flood episodes appear to maintain the channel boundary between the levee and the land mass between Liverpool Ditch and the Illinois River, created by the silting in of Liverpool Lake, henceforth referred to as Liverpool Island.

Management of the lake for fish is secondary to waterfowl. Fish management is thwarted by the frequent overtopping of the levees which allows reintroduction of rough fish into the lake. Since the lake cannot be completely drained, it is difficult to eliminate rough fish. There is no active fish management other than the permitting of commercial fishermen to harvest rough fish. In 1989, 13 permittees harvested 176,183 pounds of carp, buffalo, and drum. At present, there is no fish sampling program within Lake Chautauqua to provide information on sportfish.

The USFWS plans to reintroduce yellow perch to the refuge following completion of the EMP project. Yellow perch, which were once common in lakes along the Illinois River until 1943, have not been collected at Lake Chautauqua since before 1975. They are now virtually extirpated from the Illinois River. As the aquatic vegetation began to decline, so did the yellow perch population.

f. **Water Quality.** Water quality is possibly the most important single factor that controls the health of the lake's aquatic resources; suspended sediments and dissolved oxygen probably are the two most important parameters for aquatic organisms. The influx of sediments from the Illinois River causes elevated turbidity levels that decrease light penetration. This limits the depth at which rooted aquatic vegetation can survive. As this suspended sediment enters the quiet water of the lake, it settles out on the lake bottom. The levee around the refuge exacerbates this problem by retaining silt-laden floodwaters after floodwaters recede.

Due to the long expanses of open water in the lake, wind-generated waves (and rough fish to a lesser degree) tend to resuspend these sediments during non-flood periods. This resuspension creates an additional problem for aquatic vegetation because the lake bottom never solidifies. Vegetation that does manage to become established often is uprooted by wave/wind action. This problem is well documented and discussed on the Illinois River (Mills, *et al.*, 1966).

g. **Bottomland Hardwoods.** The most significant non-aquatic habitat within the leveed area is Melz Slough (see plate 2), a 100-acre parcel of floodplain forest located in the southwest corner of the upper lake. This is a mature stand of bottomland forest dominated by silver maple, cottonwood, ash, and hackberry. This stand produces most of the wood ducks hatched on the refuge. Melz Slough also provides important habitat for wintering bald eagles. The slough is a designated "Natural Area" representative of high quality bottomland hardwood forest that was once common along the Illinois River. Outside of the leveed area are approximately 800 acres of upland and bottomland forest. There is a wide variation in the quality of this 800 acres. The 374 acres on Liverpool Island is mature floodplain forest similar to that found in other tracts along the river. Cottonwood, silver maple, green ash, and hackberry dominate the canopy.

Among this 800 acres is approximately 118 acres of second growth forest located on the upper and lower lake levees and cross dike. This 118 acres includes all forest growth from the riverward toe of the levee to the lakeside toe. All of this forest has been classified as bottomland hardwoods for this report, in spite of the fact that the elevation of much of the levee is indicative of an upland environment, most noticeably on the crown of the levee. Because of the narrow width of the levee, it was difficult to delineate between upland and bottomland. Except for the highest portions of the levee, where some species of oak (*Quercus* sp.) and mulberry were growing, the species composition was relatively similar to the adjacent floodplain forest. The maturity of these 118 acres varied considerably. All of this forest is second growth timber originating no earlier than when the levee was constructed in the early 1900's. Since its construction, the upper and lower lake levees were repaired, as needed, in specific locations. This has resulted in a patchwork of stands. Some portions of the levee have trees that are up to 70 years old, while at other locations where the levee has recently been repaired they may be less than 10. All the trees on the cross dike have volunteered since its construction in 1965 and consist of very low quality, immature stands that are more of a scrub-shrub environment.

The eastern edge of the refuge is bordered by oak-hickory forest on a sandy bluff about 70 feet above the lake. This eastern boundary is the only portion of the refuge that is virtually free from flooding. Numerous springs emerge from the bluff along the 4 miles of eastern shoreline. These springs sometime generate enough flow to affect lake drawdown.

Approximately 28 species of mammals have been identified on the refuge, the most common of which are red fox, eastern cottontail rabbit, raccoon, fox squirrel, beaver, muskrat, and mice. Muskrats are of particular importance due to the damage they inflict upon the refuge levee. White-tailed deer are also common throughout the refuge.

h. **Endangered Species.** The federally endangered American bald eagle is commonly found on the refuge during the winter months. Eagles commonly use the Melz Slough area during the winter months as a roosting area and feed on winter-killed fish in the refuge.

The peregrine falcon also is observed occasionally during migration but does not nest or remain on the refuge for extended periods.

There is a possibility that the Indiana bat (*Myotis sodalis*) could use the Liverpool Ditch corridor since it provides a habitat very similar to that favored by bats in the summer months. Indiana bats prefer small streams with adequate riparian vegetation to form a closed canopy or tunnel-like environment over the stream. The stream corridor approaches this habitat type at some locations near the junction of Meyer's and Liverpool Ditches. However, to date there is no information to indicate their presence.

The decurrent false aster (*Boltonia decurrens*), which is a federally threatened plant, has historically been found in Mason County and more recently in adjoining Fulton County. No recent specimens have been found in or near the refuge.

Several State-listed species also have been observed in the refuge vicinity. A heron rookery is located north of the project area in Clear Lake. In addition to the great egret and the great blue heron, the black-crowned night heron is known to frequent that area. It is likely that the black crown also uses the refuge area on occasion. The pied billed grebe also is seen regularly on the refuge.

i. **Cultural Resources.** For more than 70 years, the Illinois River has been known for the high frequency of prehistoric cultural resources and major archeological investigations. Archeological assessment and evaluation of the proposed Lake Chautauqua HREP to contain historic properties potentially eligible to the National Register of Historic Places was conducted through a joint effort of the State of Illinois, the Corps, and the USFWS. Coordination with the Illinois State Historic Preservation Office (SHPO) concerning the Lake Chautauqua HREP is required by the National Historic Preservation Act of 1966 (as amended); Executive Order 11593; and Title 36 of the Code of Federal Regulations, Parts 60-66 and 800 (as appropriate). The purpose of this section is to summarize the cultural resources and coordination.

Rock Island District historic/cultural scoping revealed limited potential for historic properties, due to the preponderance of inundated lands. Documentary research indicated that the subject area was formerly wetlands. The Corps provided this information and proposed project details to the USFWS, Fort Snelling, Twin Cities, Minnesota, for coordination with the SHPO.

On November 15, 1989, the SHPO recommended a Phase I archeological survey along the areas of Liverpool and Meyer's Ditches, an archeological survey following dewatering of the lake, and possible trenching to determine if sedimentation had buried cultural deposits (Appendix A, page A-1). To address these concerns, representatives from the SHPO; the Corps; the USFWS; Western Illinois State University, Macomb, Illinois; and the

Illinois State Museum's Dickson Mounds Museum, Lewiston, Illinois, met on site December 11, 1989.

This meeting was convened to address the concerns of the SHPO and interested parties in an attempt to reduce the potential for affecting cultural resources through the avoidance of high potential areas through protection and preservation. An informal reconnaissance of the levee revealed disturbed sandy soil from previous levee construction. Dewatering of the lake bed for historical/cultural investigative purposes would not provide a stable, dry surface conducive to exploratory trenching. By confining proposed construction dredging to historic ditches and areas of low relief, an archeological survey was determined to be unnecessary. Proposed construction details also revealed that lake sediments and slurry remaining after dewatering the lake would not provide suitable survey visibility, and flocculate levels would prohibit surface testing and access.

During the December 1989 meeting, concerns also were expressed on effects to the Liverpool Lake site, a National Register of Historic Places eligible prehistoric occupation or village site, located adjacent to the Lake Chautauqua HREP. Although the Liverpool Lake site is not located directly within the Lake Chautauqua HREP, potential affects to the Liverpool Lake site associated with excavating Liverpool Ditch were considered.

Increased flow and velocities from proposed construction in the area of the entrance to Liverpool Ditch could increase erosion. Therefore, riprap was proposed for this area to reduce erosion to Liverpool Island which contains the NRHP eligible Liverpool Lake site. The riprap would be placed without additional disturbance to the site. This remedial riprap would be monitored annually by USFWS personnel.

On April 26, 1990, the USFWS provided the proposed dredging and riprapping modifications to the SHPO for approval (Appendix A, page A-3). The SHPO concurred with the Corps and USFWS finding of no significant historic properties and stated that the Lake Chautauqua HREP was in compliance with the National Historic Preservation Act of 1966, as amended (Appendix A, pages A-5 and A-7).

Through December 1990 to January 1991, the Corps determined that the level of existing flood protection throughout the Lake Chautauqua HREP was in error due to levee damage from previous overtopping events. For the project to be feasible, levee and cross dike repair became the primary objectives, and the ensuing changes in design plans were provided to the USFWS for recoordination with the SHPO. Due to the proposed cross dike repair, the USFWS also recommended that the Corps consider the construction of a boat ramp and parking area for access to the upper lake.

On January 18, 1991, the USFWS received notification from the SHPO that the levee and cross dike enhancement, related dredging activities, the boat ramp and parking area, and disposal areas would have the potential to affect undocumented, buried historic properties. The SHPO recommended

a Phase I archeological survey of the aforementioned improvements and related activities.

On February 11, 1991, the SHPO requested that the Corps-documented finding of no significant historic properties for the Lake Chautauqua HREP be documented by an Archeological Survey Short Report (ASSR). A documents search and geomorphological analysis were conducted of the areas that the SHPO recommended for a Phase I archeological reconnaissance or avoidance. The Corps ASSR was provided to the USFWS and recommended project approval under compliance with Section 106 of the National Historic Act, as amended, and its implementing regulation, 36 CFR Part 800: "Protection of Historic Properties." On March 20, 1991, the SHPO concurred with the Corps and the USFWS Finding of No Significant Properties for the proposed Lake Chautauqua HREP (Appendix A, page A-29).

j. **Sedimentation.** A sedimentation study was conducted to evaluate sedimentation in Lake Chautauqua. The scope of this study, as presented in this section, consisted of determining net erosion from 1909 (pre-9-foot Illinois Waterway) through 1989 and evaluating proposed project impacts on sedimentation.

Baseline elevations were established from 1909 and 1935 topographic maps. Additional topographic photography was taken during 1988, and hydrographic surveys were performed during 1988, 1989, and 1990. Elevations in 1909 and 1935 were compared with present elevations to determine net changes. All the data were collected and input into a digital terrain modeling program. This program analyzes the modeled surfaces and can produce a report showing the volumetric change between the surfaces as cut (erosion) and fill (sedimentation). This analysis gives an average sedimentation rate of 0.39 inch per year in the entire lake.

Sedimentation in Liverpool Ditch was determined to estimate the life of the proposed channel. The 1909 maps showed what is now Liverpool Ditch as being the same elevation as the surrounding soil, approximately 431 NGVD. The 1935 maps show a clearly defined ditch but give no soundings. It appears that the ditch is actually the result of excavation of borrow for the construction of the perimeter levee. No excavation plans or sections were available. An estimate of the original excavation section was made with knowledge of the original levee section and the borings. This information leads to an original ditch at least 12 feet deep. The estimated annual sedimentation rate in the ditch is approximately 1.94 inches per year.

4. PROJECT OBJECTIVES

a. **Objectives and Potential Enhancement.** The project goals, objectives, and enhancement potential are summarized in table 4-1. The first two columns of numbers indicate the number of Average Annual Habitat Units (AAHUs) calculated over the 50-year project life. For example: Over 50 years, an average of 2,099 Habitat Units (HUs) will be produced on the upper and lower lakes without the implementation of any alternatives. If water control is implemented, this will increase to an average of 3,655 HUs per year over 50 years. The second set of numbers shows that at present there are only 200 acres of submergent/emergent vegetation on the two lakes, but with the project there will be 3,250 acres of submergent/emergent vegetation. Potential alternatives were developed in consideration of improving existing habitat weaknesses and utilizing resource opportunities. Detailed development of alternatives is presented in Section 5.

b. **Criteria for Potential Alternatives.** Table 4-2 presents general and specific criteria developed to evaluate potential alternatives. Potential alternatives are presented in Section 5 and evaluated in Section 6.

c. **Proposed Management Plan.** Tables 4-3 and 4-4 present the proposed management plan for the upper and lower lakes. These plans were prepared by the USFWS and IDOC biologists in conjunction with Corps of Engineers staff.

This proposed management plan is based on management practices implemented at other waterfowl refuges where it has proven to be an effective strategy for establishing submergent vegetation. This management technique has been successfully used at Agassiz National Wildlife Refuge (NWR) in Minnesota, Swan Lake NWR in Missouri, and DeSoto Bend NWR in Nebraska. Water level drawdown with gradually increasing depths also is recommended as a standard management practice in Smith, *et al.* (1989). It also takes fish management objectives into consideration with negligible waterfowl impacts.

Project Goals, Objectives, and Enhancement Potential

			Enhancement Potential					
			Habitat Units Generated by WHAG Analysis			Physical Value Based		
Goal	Objective	Potential Alternative	Unit	Without Alternative	With Alternative	Unit	Without Alternative	With Alternative
Enhance Waterfowl Habitat	Increase submergent and emergent vegetation	Provide Water Control Upper & Lower Lake)	Average Annual Habitat Unit 1/	2,099	3,635	Acres of Submergent/ Emergent Vegetation	200	3,250
		Barrier Islands 2/ (Upper Lake Only)	Average Annual Habitat Unit	722	775	Acres of Submergent Vegetation	0	300
Enhance Fishery Habitat	Create flowing side channel and deepwater slough habitat	Side Channel Excavation 3/	Average Annual Habitat Unit	3	16	Surface Acres of Flowing Channel	0	10 4/
	Reduce sedimentation	Raise Levee Above Minimum Management Plan Requirements	5/	5/	5/	Annual Acre-Feet of Sedimentation	100	50

1/ The average number of habitat units generated over the 50-year project life for target species only.

2/ A Barrier Island would consist of a formed embankment which would function as a breakwater to dampen wave action and reduce re-suspension of sediment. This alternative affects the upper lake only.

3/ Side Channel Excavation would consist of excavating a side channel of the Illinois Waterway that would provide flowing water habitat.

4/ This does not include any benefits from the 4 acres created by the pump station access channel.

5/ Not assessed due to economic infeasibility.

TABLE 4-2

Potential Alternatives Development Criteria

Item	Purpose of Criteria
A. General Criteria	
Locate and construct features consistent with EMP directives.	Comply with Public Law 99-662 regarding enhancement of fish and wildlife habitat.
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).
Locate and construct features consistent with best engineering practice.	Provide basis for project evaluation and alternative selection.
B. Water Control	
Locate on lands that enhance waterfowl support.	Improve existing habitat suitability for waterfowl.
Locate excavation in areas of lowest historical elevations.	Minimize possibility of encountering archeological sites which exist in area.
Provide features that allow independent operation of the north and south units.	Allow south unit to be operated as a moist soil unit and the north unit to be operated as a stable level lake.
Provide reliable levee system consistent with management goals.	Provide flood protection to meet seasonal/annual goals.
C. Side Channel Excavation Site Criteria	
Locate channel to enhance fishery habitat.	Improve existing habitat suitability for fish.
Design channel diversion point to provide stable flows.	Ensure navigation channel and archeological sites are not affected.
Locate site on Government-owned lands.	Meet program guidance and provide clear ownership of material placement sites.

TABLE 4-3

Proposed 10-Year Cycle Management Plan for the Upper Lake

Year	Management Action	Purpose
1	Dewater the lake following a levee overtopping river elevation exceeding a 10-year event.	Solidify lake bottom, establish submergent vegetation, and eliminate rough fish.
2	Gradually increase water levels using spring flow and stock with yellow perch and other predatory sport fish.	Establish submergent vegetation and reestablish predatory fish to control rough fish.
3-10	Maintain optimum water depths for diving ducks of 3 to 4 feet in summer/fall, up to 6 feet in winter (434-436), and re-stock as necessary.	Provide optimum water depths for waterfowl resources. Maximum elevation of 436 minimizes impacts to bottomland hardwoods in Melz Slough.

TABLE 4-4

Proposed Annual Management Plan for Lower Lake

Month	Management Action	Purpose
June-September	Dewater lake by gravity or pump station.	Establish moist soil vegetation.
October-December	Gradually increase average water depth.	Provide moist soil plants for dabbling ducks during fall migration.
January-May	Maintain water levels as high as possible (437.5 maximum due to existing elevations of spillways) by: a. Using Quiver Creek diversion gate; or b. Capturing river flows exceeding 433 (concrete sill of existing west spillway stop-log structure).	Minimize overtopping flood damage and enhance fishery and furbearer habitat.

5. ALTERNATIVES

Habitat enhancement alternatives consist of construction features in combination with appropriate resource management that meet specific habitat goals and objectives. Alternatives were developed using the following process: (1) Existing habitat weaknesses and opportunities were identified through existing data or application of habitat analyses (i.e., WHAG); (2) goals and objectives then were developed in response to these habitat weaknesses/opportunities; and (3) alternatives then were developed to meet specific objectives. Alternatives normally should be measurable from a physical sense (acres, turbidity, etc.) and from a habitat value sense (habitat suitability index, habitat unit, etc.).

a. **Alternative A - No Federal Action.** No Federal action would consist of no Federal funds being provided to meet the project purposes. State and local funds would be required to restore and enhance wetland and aquatic habitat.

b. **Alternative B - Water Control.** This alternative consists of hydraulically separating the upper lake from the lower lake by repairing the existing breach in the cross dike and by raising the upper lake levee system. The upper lake then would function as a stable level lake with the intent to establish submergent vegetation throughout the 1,000-acre lake. The lower lake with approximately 2,250 acres would be operated as a moist soil unit.

This alternative consists of 7 construction features: (1) a cross dike and upper lake perimeter levee raise; (2) modification of the existing radial gate structure; (3) construction of a pump station; (4) construction of a gravity outlet for the upper lake; (5) construction of a stoplog structure in the lower lake; (6) excavation of drainage channels in the lower lake; and (7) construction of a replacement boat ramp.

Floodwater entry would be prevented by raising the perimeter levee system to a 10-year event elevation, which is considered the minimum height to meet the management plan presented in table 4-3. Adjacent borrow would be used for levee construction. During operational dewatering of the upper lake, drainage would follow the natural sloping terrain to the south, intercept the adjacent borrow ditch of the cross dike, and be pumped out by the pump station. See Section 8 for additional levee height considerations and levee embankment erosion protection.

Interior water control would be provided by a combination of the new pump station and an existing radial gate structure in the upper lake. Lower lake water control would be provided by a combination of new stoplog structure, pump station, excavation of drainage channels, and the existing Quiver Creek diversion structure. In the upper lake, water supply for filling purposes would come from natural seepage springs. Quiver Creek would be the water supply source for the lower lake.

This alternative also includes replacing the existing boat ramp which presently serves the south unit. Because the lower lake unit will be operated as a moist soil unit with full drawdown capability and the breech in the cross dike will be closed, the existing boat ramp will essentially become nonfunctional. Operation of the upper lake as a stable water unit (average depth of 3 to 4 feet) will necessitate a boat ramp for management purposes.

c. **Alternative C - Barrier Islands.** This alternative consists of constructing earthen embankments that would function as breakwaters. Wind-generated waves would be prevented from reaching the leeward side of the islands. With the elimination of significant waves, unconsolidated bottom sediments would consolidate and provide suitable substrate for the establishment of submergent vegetation.

d. **Alternative D - Side Channel Excavation.** This alternative consists of excavating sediments from Liverpool Ditch to provide usable flowing side channel habitat. Currently, while the ditch flows at normal pool elevations, the existing condition provides very little benefit. At flows near flat pool, the existing ditch is approximately 1 inch deep.

Consideration was given to excavating 1.2 or 3.6 miles of side channel. Flowing side channel could be provided by excavating along the existing Liverpool Ditch and exiting at the existing confluence, a distance of 3.6 miles paralleling the existing levee system. Side channel also could be provided by excavating the same ditch with exit through Liverpool Island, a distance of 1.2 miles. These distances are both measured from the water control pump station to distinguish additional side channel habitat from the required channel to the pump station which is needed for water supply purposes.

Regardless of the selected lengths, this alternative consists of four general features/reaches: (1) channel excavation from the mouth to the pump station needed for water supply purposes; (2) channel excavation from the pump station to the river confluence; (3) a channel entrance closure structure to minimize future side channel sedimentation; and (4) a deep-water slough off of the main channel for wintering fish.

e. **Alternative E - Sedimentation Reduction.** This alternative consists of raising the entire perimeter levee to the 50-year flood event, approximately 453 NGVD.

6. EVALUATION OF ALTERNATIVE PLANS

The alternatives listed in Section 5 were evaluated based on engineering considerations, local restrictions or constraints, and their ultimate contribution to the project goals and objectives. These development criteria are summarized in table 4-2. Alternatives that were not feasible for engineering or other considerations were not subject to further evaluation. Once this screening was completed, the remaining alternatives were evaluated from an incremental cost viewpoint. The average annual costs were compared to the AAHUs to determine the optimum size and configuration of the alternatives.

A numerical habitat appraisal methodology was used to evaluate existing conditions, to predict the future with- and without-project conditions, and to ultimately derive the HU values that were used in the incremental analysis procedure. The selected methodology was developed by the Missouri Department of Conservation (MDOC) and the Soil Conservation Service and is known as the Wildlife Habitat Appraisal Guide (WHAG). WHAG incorporates concepts from a similar technique known as HEP (Habitat Evaluation Procedures) developed by the USFWS, whereby wildlife habitat value can be quantified numerically.

Qualitative and quantitative assessments of the habitat types were accomplished by the WHAG study team comprised of members from the IDOC, USFWS, and the Corps. The team developed Habitat Suitability Indices (HSIs) for each habitat type based on the numeric ranking of site characteristics. The HSI values provide an indicator of the habitat quality for a particular target species based on the life requisites (food, cover, etc.) of the target species. HUs then were generated by multiplying HSI values by the acreage of that particular habitat type.

The annual calculated HUs for each alternative are subsequently annualized over the 50-year life of the project and compared to the summation of the annualized first cost and the estimated annual operation and maintenance costs. The increment with the minimum cost per HU then was identified. This comparison is shown in table 6-1.

a. **Alternative A - No Federal Action.** This alternative would not meet the project objectives of improving wetland and aquatic habitat.

b. **Alternative B - Water Control.** Providing water control in the upper lake would increase submergent vegetation on nearly 1,000 acres of wetland. The increment of adding the lower lake would increase the wetland vegetation by approximately 2,250 acres of emergent vegetation with minimal additional cost. The incremental analysis in table 6-1 shows that providing water control capability in both the upper and lower lakes is the best use of funds on a cost-per-HU basis. Section 8 provides additional design and construction considerations regarding the levee height and levee embankment erosion protection.

TABLE 6-1

Comparison of Alternatives and Incremental Analyses

Alternative	Increment	Annual Cost [1] Total Annual $	Annual Cost [1] Incremental $	Habitat Value Gain AAHU	Habitat Value Gain Incremental AAHU	Cost Per Gained Habitat Value $/AAHU	Cost Per Gained Habitat Value Incremental $/AAHU
Water Control	Upper Lake	258,700		627		413	
			26,000		909		29
	Upper and Lower Lake	284,700		1,536		185	
Barrier Island	2.0 Miles	51,400		53		970	
Side Channel	1.2 Miles [2]	76,900		13		5,900	

[1] Annualized costs include initial construction costs and annual operation and maintenance costs based on a 50-year project life, 8.750 interest rate.

[2] Channel increment from pump station downstream to confluence with main river channel.

c. **Alternative C - Barrier Islands.** Barrier islands in the upper lake would break up the approximately 2-mile wind fetch distance. Barrier islands of approximately 2 miles in length would be required to provide protection from wave-related resuspension of sediments on the leeward side of the islands. This should enhance consolidation of the soft sediments to allow establishment of submergent vegetation. The acreage of submergent vegetation would be limited to the acreage in the shadow of the islands.

d. **Alternative D - Side Channel Excavation.** Excavation to provide flowing side channel is considered to be very beneficial because of the conspicuous lack of flowing side channel on the Illinois River (Havera 1980). The 3.6-mile reach was eliminated as a potential increment due to an initial high cost of approximately $2.6 million. Increments of other lengths for Liverpool Ditch excavation were not evaluated for the following reasons: (1) The 1.2-mile reach is the only route short of dredging the entire ditch that avoids cutting through Liverpool Lake; (2) shorter lengths would cause the channel connection to be excavated through locations of known archeological sites; and (3) the proposed alignment follows a former natural side channel bed. It is also noted that the existing WHAG model cannot differentiate fish benefits based on differences in channel lengths alone. For example, a 0.5-mile channel will have one-half the benefits of a 1-mile channel and one-fourth the benefits of a 2-mile channel.

Figure 9-1 shows that the Average Annual Habitat Units (AAHUs) generated by the side channel improvement increase from 3 AAHUs without the project to 16 with the project. This was a 400+ percent improvement, or the highest of any alternatives evaluated. The fact that the WHAG analysis showed an increase of only 13 AAHUs is not an indication that Liverpool Channel improvement is a marginal benefit. The low numerical increase is misleading for the two reasons discussed below.

The species models for walleye, catfish, and largemouth bass only calculate the benefits to fish in Liverpool Ditch. Actually, the side channel and backwater pocket will provide wintering habitat for fish from more distant locations in the pool. Fisheries studies have shown that overwintering fish will migrate several miles to utilize temporary winter habitats. At this time, the fish models cannot quantify the benefits accruing to the fishes in other locations of LaGrange pool. If one could determine the amount of these additional acres and calculate their Habitat Suitability Indices (HSIs), the resulting AAHU improvement would be several times greater than the 13 generated in this analysis. Such an analysis would be possible but would demand considerably more time and effort than is possible in the preparation of the Definite Project Report.

The HSI for channel catfish, walleye, and largemouth bass under existing conditions is 0.1 for each species (where 0 equals no habitat value for that species and 1 means that all life requirements are met). By target year 20 after construction, the HSI increases to .61 for catfish, .54 for walleye, and .72 for largemouth bass. The fact that only 13 AAHUs were

generated is due more to the fact that only 11.6 acres of habitat are affected compared to the several thousand improved for waterfowl.

e. **Alternative E - Sediment Reduction.** Sediment reduction would be desirable to prolong the useful life of this valuable wetland habitat. Raising the cross dike to protect from a 50-year event was briefly considered. This level of protection is considered a minimum to significantly reduce sediment. This alternative was eliminated from further consideration because it was prohibitively expensive at $15 million. In addition, 50-year levee elevations have typically not been supported by cost-benefit analyses completed for similar projects.

7. SELECTED PLAN WITH DETAILED DESCRIPTION

a. **General Description.** The alternatives of water control and flowing side channel (see plate 2) were selected to be recommended for project construction. These alternatives were individually evaluated relative to the project goals and objectives as presented in Section 6.

b. **Water Control.** The water control features are summarized in table 7-1.

TABLE 7-1

Water Control Features

Item	Description	Feature's Purpose
1. Existing cross dike and perimeter levee raise	Raised levee to a 10-year elevation (449 NGVD)	Provides flood protection against 10-year events
2. Existing radial gate structure modification	Existing concrete sill elevation raised 4 feet with integral gated gravity openings	Structure modification provides 10-year level of protection and allows gravity drainage to existing sill elevation of 433
3. New pump station	Concrete gated structure with 41,000 gpm capacity	Provides capability to: (1) dewater upper and lower lakes; (2) pump from the river to the upper and/or lower lake; and (3) connect the upper and lower lakes by gravity flow
4. New gravity outlet in upper lake	Concrete gated structure with 60-inch diameter pipe	Provides capability to: (1) gravity control/dewater the upper lake and (2) allow river water supply to the upper lake
5. New stoplog structure in lower lake	Concrete stoplog structure with 4 bays of 5 feet opening reach	Provides capability to gravity dewater the lower lake

TABLE 7-1 (Cont'd)

Item	Description	Feature's Purpose
6. New drainage channels in the south lake	Excavated drainage channels/ditches	Ensures gravity flow from the south lake to the proposed stoplog structure and pump station
7. Replacement boat ramp in upper lake	Single-lane ramp with associated parking	Provides lake access for management personnel and mitigates the loss of boat ramp usage of the south lake during drawdown periods

Tables 4-3 and 4-4 summarize proposed management plans to meet project goals and objectives for the upper and lower lakes, respectively. The selected water control features of table 7-1 are consistent with these plans. General water control instructions for the upper and lower lakes are presented in table 11-2.

The upper lake will be managed as a stable water lake to meet fishery and waterfowl objectives. The improved levee system will provide a 10-year level of protection. The modified radial gates will allow floodwater entry prior to forecasted overtopping events, which will minimize levee overtopping damage. Floodwaters in the lake will drain by gravity back to the river through: (1) the same radial gates; (2) the gated openings of the modified radial gate sill; and (3) through the upper lake gravity outlet structure. The gated openings of the modified radial gate sill and the upper lake gravity outlet will allow partial dewatering by gravity during seasonal low river flows. The pump station will provide complete dewatering capability. After dewatering, water levels in the upper lake will be established and maintained by using: (1) the adjacent bluff seepage flows; (2) diverted Quiver Creek flows; and/or (3) the pump station, respectively.

The lower lake will be managed as a moist soil unit during June through December of each year. Water should be drained by gravity through the proposed stoplog structure when low river levels allow. The pump station will have the capability to completely dewater the south unit. Once moist soil plants are established, water levels will be increased gradually from 1 to 2 feet in depth during the fall migration by using the existing Quiver Creek diversion as the water source. After the fall migration, water levels could be increased until the spillway elevations are reached (approximately 5 to 6 feet in depth), if it was determined to be beneficial by the site manager.

(1) Cross Dike and Upper Lake Perimeter Levee. To achieve the goal of separate operation of the upper lake as a stable level lake and the lower lake as a moist soil management unit, it is necessary to have a functional cross dike and perimeter levee. The purpose of this section is to present the selected construction plan of the cross dike and perimeter levee.

It is proposed to raise and strengthen the cross dike and upper lake levee by excavating adjacent soil for placement as levee embankments. The levees will be raised to elevation 449, a 10-year river event. The side slopes of the cross dike will be 6:1 Horizontal:Vertical (H:V) on the downstream slope with 4:1 on the upstream slope. The perimeter levee slopes will be 4:1. The completed embankment will be seeded. Maintenance mowing will be required on a central 30-foot-wide zone. Within this zone on the cross dike, a 10-foot-wide crushed stone access road will be provided for access to the pump station. A 40-foot-wide non-disturbed zone will separate the borrow edge from the levee toe. The borrow will be approximately 50 feet wide at the top, 25 feet at the bottom, and 10 feet deep.

It is proposed to require the north lake to be dewatered during construction, which will serve several purposes: (1) facilitates excavation and embankment placement; (2) provides consolidation of lake bed sediments; and (3) provides opportunity to eliminate all rough fish which impact rooted vegetation growth and increase suspended sediments. To most efficiently eliminate rough fish, it is proposed that the upper lake be maintained in a dewatered condition over several winter months. Due to the presence of spring flow, fish populations may still survive. It is proposed to apply a fish toxicant (rotenone) at recommended rates/precautions to accomplish complete rough fish removal. Application of this treatment after ice melt and prior to flood flows would increase toxicity due to water temperature. This process has been used successfully on several Illinois river lakes by the IDOC.

(2) Modification of the Existing Radial Gate Structure. The top of the steel gates of the radial gate structure is elevation 445.5. An approximate 4-foot raise is needed to meet the proposed 10-year level of protection. A 4-foot-high concrete sill will be placed on the existing concrete sill to provide this equivalent protection. Stoplogged openings, each 3 feet high by 4 feet wide, through this sill will be provided to allow gravity drainage of the upper lake to the existing gate sill elevation of 433.5. A total of 8 such openings in conjunction with the pump station gates and upper lake gravity outlet were required to provide interior water levels within 0.5 foot of exterior river levels within 7 days of the river reaching a constant elevation. Riprap will be placed around the structure to minimize erosion damage.

(3) Pump Station. It was required to have the flexibility to pump from both the upper and lower lakes and from the river to either lake to meet the management plan (see tables 4-3 and 4-4). Therefore, the pump station was located at the intersection of the cross dike and the perimeter levee. The pump station was sized to meet several drawdown scenarios. To

meet the management objectives shown in tables 4-2 through 4-4, a station capacity of 41,000 gpm was selected. Operational drawdown times are presented in table 11-2. The selected pump will be a horizontal propeller type with a 36-inch discharge tube.

(4) **Gravity Outlet for Upper Lake.** A gravity outlet is needed to meet drawdown requirements of the upper lake. This structure will be a 60-inch-diameter culvert with a sluice gate/gatewell on the river side. Trash racks will be provided at both ends due to potential flow reversal and associated debris. The structure will be enveloped with riprap. See discussion in 7b(2) for hydraulic sizing.

(5) **Stoplog Structure for Lower Lake.** The purpose of this structure is to allow gravity drawdown of the lower lake. The structure consists of 4 openings, each 5 feet wide, for a total hydraulic opening of 20 feet. The structure was sized to work in conjunction with the existing west stoplog structure. The existing structure only allows gravity drawdown to 433. The proposed structure will allow complete gravity drawdown under favorable river conditions. (Elevation 431 is considered empty). The sill of the proposed structure at 429 will enhance gravity drawdown and drainage within the lower unit during drawdown. The structure will be enveloped with riprap. The structure was sized to ensure that interior water levels would be within 1 foot of exterior levels within 7 days after the river reaches a constant elevation. Continued gravity drainage could occur if favorable river levels prevail or the pump station could be activated.

(6) **Drainage Channels for Lower Lake.** Both drainage channels are proposed to facilitate drainage to the stoplog structure and the pump station. Typical channels will be approximately 35 feet in width and 2 feet deep with an elevation of 429. Excavated material will be sidecast.

(7) **Replacement Boat Ramp.** Because the existing boat ramp of the south unit will become disfunctional during south unit drawdown, a replacement ramp was selected to meet the changed water control plan. The ramp will be located off of the northern perimeter levee and will include a short access road and improvement of an existing parking lot.

c. **Side Channel Excavation.** The proposed channel excavation located in Liverpool Ditch is shown on plate 2. Table 7-2 provides a summary of the construction features of this alternative.

TABLE 7-2

Side Channel Excavation Features

Item	Description	Feature's Purpose
1. Channel from mouth to pump station	Trapezoidal excavated channel with 35 feet bottom width and initial bottom elevation 10 feet below flat pool	1) Provides reliable water source to the pump station, and 2) Provides flowing side channel habitat
2. Channel from pump station to river confluence	Trapezoidal excavated channel with 35 feet bottom width and initial bottom elevation 10 feet below flat pool	Provides flowing side channel habitat
3. Channel entrance closure structure	Rock-filled closure dam with top elevation at flat pool	1) Prevents excessive diversion of river flows, and 2) Reduces side channel sediment deposition
4. Deepwater slough area	Trapezoidal excavated channel, 300 feet long, with 35-foot bottom width and initial bottom elevation 16 feet below flat pool	Provides deepwater overwintering fish habitat

Excavation depth in Liverpool Ditch was based on providing a flowing side channel for the project life of 50 years. In this phase, "flowing side channel" is defined as providing a minimum water depth of 2 feet in the excavation channel from a flat pool elevation of 429.4 NGVD. With an estimated sedimentation rate of 1.94 inches per year in the ditch, a 10-foot-deep channel would be needed.

(1) Channel from Mouth to Pump Station. The proposed excavation can be divided into two reaches. Both reaches will have the same section, with bottom widths of 35 feet, side slopes of 2:1, and bottom elevations of 419.4. The first reach consists of approximately 2,200 feet which will serve the purpose of providing a reliable water supply for the pump station. Material from the excavation will be placed on the adjacent levee.

(2) Channel from Pump Station to River Confluence. The second reach continues 6,200 feet down Liverpool Ditch and meets the objective of

providing flowing side channel habitat. Material from the excavated channel adjacent to the levee will be placed on the levee. The remainder of the excavated material will be sidecast onto the adjacent willow and brush area. The location of this excavation was selected to take advantage of an existing channel and to minimize cutting through original land.

(3) **Channel Entrance Closure Structure.** Potential problems associated with excavating Liverpool Ditch were considered. The opening of Liverpool Ditch may result in the capture of an unacceptable amount of Illinois River flow. The channel currently captures approximately 2 percent of the river flow. Under the proposed side channel configuration, the side channel would capture 8 to 10 percent of the river flow. A rock control structure is proposed at the entrance of Liverpool Ditch which will limit the diversion of river flow from 4 to 8 percent.

The increased side channel flows also have the potential of increasing the sedimentation rate of the newly excavated channel. The rock structure also will reduce the sedimentation rate in the side channel.

Increased flows and velocities in the area of the entrance to Liverpool Ditch could increase erosion. Therefore, riprap has been recommended for this area to reduce erosion to Liverpool Island which contains the National Register of Historic Preservation (NRHP) eligible Liverpool Lake Site. The riprap would be placed without additional disturbance to the site. This remedial riprap will be monitored annually by USFWS personnel.

(4) **Deepwater Slough Area.** This component of the side channel excavation is proposed to provide deepwater for overwintering fish purposes. This area will be approximately 300 feet long and have the same cross-sectional dimensions as the adjacent side channel, except with a construction depth of 16 feet from flat pool.

8. DESIGN AND CONSTRUCTION CONSIDERATIONS

a. **Levee Heights.** It is proposed to repair both the cross dike and the north levee to a 10-year elevation and to use adjacent borrow as part of Alternative B. The purpose of this section is to present the basis for selection of the level of protection for the cross dike and upper lake levee and to suggest a levee height for the south lake which could be implemented under future stages.

A 10-year event system is the minimum frequency which will allow the proposed management plan (see tables 4-3 and 4-4) to operate. It is noted that a 10-year event has a probability of occurrence in any one year of 10 percent. Because there is a 10-percent chance of this event in any given year, the following 10-year operating scenario is presented to provide "the average" scenario.

The north unit will be dewatered in Year 1. Further dewatering of the north unit should not be needed for the next 9 years (on the average), assuming Year 1 follows a major flood event. During this interval, fish stocking may occur as desired, and water levels may be increased in the north unit as desired by the existing radial gates, or natural seepage/run-off. After Year 1, the pump in the pump station should be operationally changed in position to dewater the south unit. With a 2-year levee in the south (future development), the south unit could successfully operate free of flood events as a moist soil unit 50 out of 50 years during a July, August, and September drawdown based on 50 years of records. Table 8-1 shows overtopping frequencies versus various elevations.

A lower event levee in the north (such as a 2-year or 5-year levee) is not compatible with the desired management plan. It is desired to maintain dewatered conditions in the north for 2 to 4 years to allow submergent/emergent vegetation to become firmly established. Near the end of the 5th year, the north unit would be established and fully available to provide submergent/emergent vegetation in stable water levels. With a 2-year or 5-year levee, the north unit would require full dedication of the pump station due to recurrence of events to maintain low water levels. These events would typically last 1 month and would require at least 1 additional month for dewatering. A 5-year levee also would allow overtopping just when vegetation is predicted to be at a maximum benefit. There would be no stable (flood-free) period following the predicted year of maximum vegetation value. Fish stocking efforts under these scenarios also would be less profitable.

Although a levee higher than a 10-year event height would decrease overtopping events, a higher levee was not selected principally due to significant floodway flood height impacts. The selected 10-year event produces an increase of 0.1 foot in flood heights, which is the maximum allowable under Illinois floodplain permit regulations. For the same reason, freeboard on top of the 10-year elevation was not added.

Because the pump station is economically designed to pump from one unit at a time, the south unit could not be dewatered for moist soil operation during drawdown of the north unit. Without pump dewatering of the south unit, the south unit cannot reliably or consistently be drawn down for moist soil operation due to normal river stages during July, August, and September. For example, river elevation 429 is needed for complete gravity drawdown of the south unit. However, elevation 429 has been exceeded 50 out of 50 years of record during each of the months of July, August, and September (see table 8-1). Consequently, the pump station is needed on an annual basis for the south unit which is only possible with infrequent use for the north unit, such as in once in 10 years. Therefore, a 10-year levee in the north and a 2-year levee in the south meets management objectives and is operationally efficient.

It is suggested that the south lake levee system be constructed at a future date to the 2-year event elevation plus 2 feet. The existing spillways would be modified/raised to the 2-year event with length sized to allow 1 foot of uncontrolled spillway water head to fill the interior lake prior to overtopping with less than 1 foot of head differential from outside to inside.

b. **Levee Embankment Erosion Protection.** Three principal mechanisms have contributed to the erosion of the existing cross dike and perimeter levee system. These mechanisms are interactive and consist of: (a) embankment material type; (b) overtopping erosion; and (c) wave erosion. Each aspect will be discussed separately as a basis of consideration for the proposed design presented in Section 7.

(1) **Embankment Material Type.** Both the north levee sand slopes and the sand cross dike slopes have eroded extensively, principally due to overtopping erosion. The overtopping erosion pattern is evident on the northern dike by a sand plume downstream of the levee and by a virtual lack of dike vegetation on the downstream dike slope due to a continual loss of soil substrate. This same sand plume pattern is evident on the cross dike.

Where woody vegetation has survived on the downstream/inside dike slopes, exposed 2 to 3 feet of upper root masses connect larger trees to the soil substrate. Surviving trees are predominantly anchored into the underlying clay substrate. Previously placed small riprap (2- to 4-inch size pieces) are generally also now lying on the firm underlying clay substrate.

TABLE 8-1

Flood Overtopping Events by Month by Select Elevation [1]

Month	Elev. 429.0	West Spillway Stoplog Sill Elev. 433.0	West Spillway Stoplog Elev. 437.5	2-Year Event, River Elev. 443.2	5-Year Event, River Elev. 446.8	10-Year Event, River Elev. 449.0
	Number of Times Overtopped in 50 Years					
January	50	40	20	2	--	--
February	50	44	24	5	--	--
March	50	49	34	9	3	3
April	50	49	38	11	4	1
May	50	48	36	9	4	1
June	50	43	28	4	2	1
July	50	39	23	1	--	--
August	50	25	7	--	--	--
September	50	17	7	--	--	--
October	50	18	8	1	1	--
November	50	22	8	1	2	--
December	50	35	13	2	--	--

[1] Period of Record - 1940-1989 (50 years), at river mile 129.4 (radial gate structure)

Sand is considered to be a highly erodible material when exposed to running water. Velocities less than 1 foot per second will roll sand particles; velocities greater than 2 feet per second will physically pick up or scour most fine to medium sands. With each overtopping event, the sand was transported downstream and now forms a relatively stable beach with slopes of 10-20:1.

Overtopping damage may have occurred in the past if the existing radial gates were not opened in sufficient time to allow interior pool levels to approximately equalize river stages before levee overtopping. However, overtopping damage is preventable by use of proper soil types and proper operation of the existing radial gates. An embankment constructed from select clay and maintained with seeded turf is considered erosion resistant. Using velocity as an indicator of erosion resistance, clay will tolerate velocities up to approximately 6 feet per second without appreciable scour. Clay with liquid limits greater than 40 and with plasticity index plotting above the "A" line (which is a geotechnical index line used to classify soils based on the soil's fluid properties) is considered erosion resistant. This type of clay is available as adjacent borrow. The adjacent clay borrow consists principally of fat clays with in-situ water contents of 30 to 50 percent. The liquid limits of the actual borrow vary from 46 to 91, and all soils plot above the "A" line.

The erosion-resistant clay will receive additional protection by a maintained seeded turf with foreshore woody vegetation. The perimeter levee and cross dike will be reconstructed to least disturb existing woody vegetation (willows). Eventual dominance by bottomland hardwoods (as on the exterior of the perimeter levee) is anticipated.

(2) **Overtopping Erosion.** With the proposed cross dike in place, (elevation 449) the existing radial gates, the gravity outlet structure, and the pump station gravity gates can be operated to prevent overtopping damage of the upper lake levee. (A flood monitoring and response plan will be developed as part of the project operation and maintenance manual.) Gates should be fully opened when the river reaches elevation 446 with stages higher than 449 predicted. When the gates are operated in this manner, interior pool levels will equalize with river levels within 2-3 days. Table 8-2 provides a summary of river elevation versus interior pool levels when the gates are fully opened as shown.

TABLE 8-2

Operating Scenario of Upper Chautauqua Lake
for Predicted River Stages Exceeding a 10-Year Event

End Time Period in Days	River Elevation	Upper Lake Elevation	Differential Head Between River and Upper Pool, feet
0.0 [1]	446.0	435.0	11.0
0.5	446.5	437.7	8.8
1.0	447.0	440.5	6.5
1.5	447.5	443.7	3.8
2.0	448.0	447.0	1.0
2.5	448.5	448.0	0.5
3.0	449.0	448.5	0.5

[1] All 4 radial gates fully opened; the upper lake gravity outlet fully opened, and the pump station gravity gates fully opened.

To facilitate opening these gates to minimize overtopping damage, all gates will be fitted with gate operators that allow a portable power wrench to quickly open the gates. A power wrench will be provided to the site manager for off-site storage.

(3) **Wave Erosion.** Another form of potential erosion on the cross dike is from wind-generated waves. A wave analysis was performed to estimate wave effects. Results of this analysis and other design considerations are presented in table 8-3.

The design wave of 3.5 feet will break on the slope at a water depth of approximately 6 feet. The predominant energy of the wave is released

TABLE 8-3

Wave Analysis for Cross Dike

Design Parameters	Value	Remarks
Wind	70 mph	Fastest mile adjusted for height and over-water conditions (closely approximates 100-year wind with 6-hour duration).
Water depth	8 feet	Normal high water (25 percent exceedence/elevation 437.7).
Fetch for downstream cross dike slope	4 miles	Consistent with design wind direction, averaged over 24-degree arc.
Significant wave on downstream cross dike slope	3.5 feet	At toe of cross dike, period = 3.6 seconds, minimum wind duration = 21 minutes.
Cross dike slope		
- Downstream	6:1 H:V	Based on existing 6:1 stable slopes of north levee, same soil type, adjusted for fetch/wind direction.
- Upstream	4:1 H:V	Same above explanation.
Water depth at wave breaking	6 feet	May vary from 5 feet to 7 feet.
Breaker travel distance	13 feet	Measured from point where water depth causes wave breaking.
Distance to shoreline from end of breaker travel distance	40 feet	May vary from 29 feet to 52 feet.
Cohesive (clay) embankment liquid limit	55 percent	Clay is considered erosion resistant when the liquid limit is greater than 40 and plasticity index plots above the "A" limit line.
Embankment cover	Seeded turf	Eventual dominance by naturally colonized woody growth.

The design wave of 3.5 feet will break on the slope at a water depth of approximately 6 feet. The predominant energy of the wave is released during the next 13 feet of wave travel distance. This is the critical zone of wave impact that is the basis for traditional revetment protection or structural design. An additional 40 feet of distance is available to the shoreline after this breaker zone due to the flat 6:1 slope. The actual wave/energy delivered to the shoreline is a small fraction of the unbroken design wave.

For the above reasons, a flat slope of 6:1 combined with a cohesive (clay) soil meets design standards and is consistent with engineering judgment in providing a stable cross dike. A 4:1 slope on both sides of the upper lake levee and on the upstream side of the cross dike is considered to be adequate.

c. **Construction Sequence.** The probable construction sequence is summarized in table 8-4.

d. **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 are included in this report. A floodplain construction permit from the Illinois Department of Transportation, Division of Water Resources will be obtained prior to advertisement.

e. **Lower Lake Future Improvements.** The purpose of this section is to present findings from this study for the lower lake which were determined during the course of normal study for the upper lake.

As presented in section 8a, a 2-year levee for the lower lake area will meet management goals of providing accessible, moist soil plants during the fall migration. A 2-year elevation has only been exceeded once for 1 month for 50 years of record during the July, August, and September period.

The present project 20-foot stoplog structure is adequate for gravity draining of the south unit. However, additional inflow capacity is needed to allow year-round frequent, non-damaging overtopping events to occur. Elimination of the west and south spillway (including the existing stoplog structure) is necessary in raising the existing levee to the 2-year event. Construction of a second 20-foot stoplog structure in future phases with sill at 429 and a 700-foot spillway structure at the exact 2-year elevation will allow inflow without significant overtopping damage. Due to this spillway, the levee system should be constructed at the 2-year event plus 2 feet, which allows a 1-foot head on the new spillway.

The pump station at the present project will meet the drawdown requirements of the lower unit. Similar construction methods using adjacent clay borrow should be used for embankment construction.

TABLE 8-4

Probable Construction Sequence

Sequence	Construction Work Item	Special Instructions	Purpose
1	Close cross dike breach	Use existing sand from top of cross dike	Allows required dewatering of upper lake
2	Dewater upper lake	Furnish portable pumps	Allows excavation in the dry and allows lake sediment consolidation during excavation
3	Clear specified vegetation from cross dike and upper perimeter levee	Place debris in piles a) Perimeter levee: place base of pile below elev. 434 b) Cross dike: place debris adjacent to toe of new embankment	Required for embankment preparation a) Provides fish habitat b) Provides slope erosion protection
4	Excavate embankment fill/allow consolidation/repeat as necessary	Use adjacent borrow [1]	Multiple passes required for material stand-up
5	Shape uncompacted levee	--	--
6	Seed levee	--	--
-	Pump station, water control structures, drainage channels, side channel excavation	No sequence required	

[1] Embankment material between station 16 to 35± (Melz Slough) will be used from stockpiled material near either station 16 or 35. Adjacent excavation for borrow through Melz Slough will not be permitted.

9. ENVIRONMENTAL EFFECTS

a. **Summary of Effects.** Overall, the project will result in an increase of waterfowl and fish habitat consistent with the management objectives of the Lake Chautauqua National Wildlife Refuge. It also supports the goals and objectives of the North American Waterfowl Management Plan. Increased water level control in the upper lake will create additional submergent aquatic vegetation preferred by diving ducks and some fish such as yellow perch and largemouth bass. Water level control in the lower lake will increase the acreage of moist soil plants used by dabbling ducks. Excavation of Liverpool side channel will create aquatic habitat diversity and wintering fish habitat by restoring flow and deep water. Figure 9-1 summarizes the total change in average annual habitat values for key target species evaluated. (Note: Target species for alternatives B1, B2, and C are diving ducks and mallards. Target species for alternative D are channel catfish, walleye, and largemouth bass.)

These improvements will impact bottomland forest and non-forested wetland. Approximately 7.3 acres of marginal bottomland forest on the upper lake levee will be cleared for construction access, dredged material placement, and pump station construction. Another 6.1 acres of non-forested wetland in the upper lake will be converted to scrub-shrub wetland and bottomland forest habitat from a drainage channel excavation. Cross dike repair will temporarily eliminate 14 acres of early successional bottomland hardwoods. Restoration of Liverpool Channel will temporarily eliminate 11.2 acres of adjacent bottomland forest. Most of these impacts to wetlands or forest are temporary in that the successional stage of the habitat will be set back several years. Figure 9-2 summarizes the percentage of habitat improvement for target species.

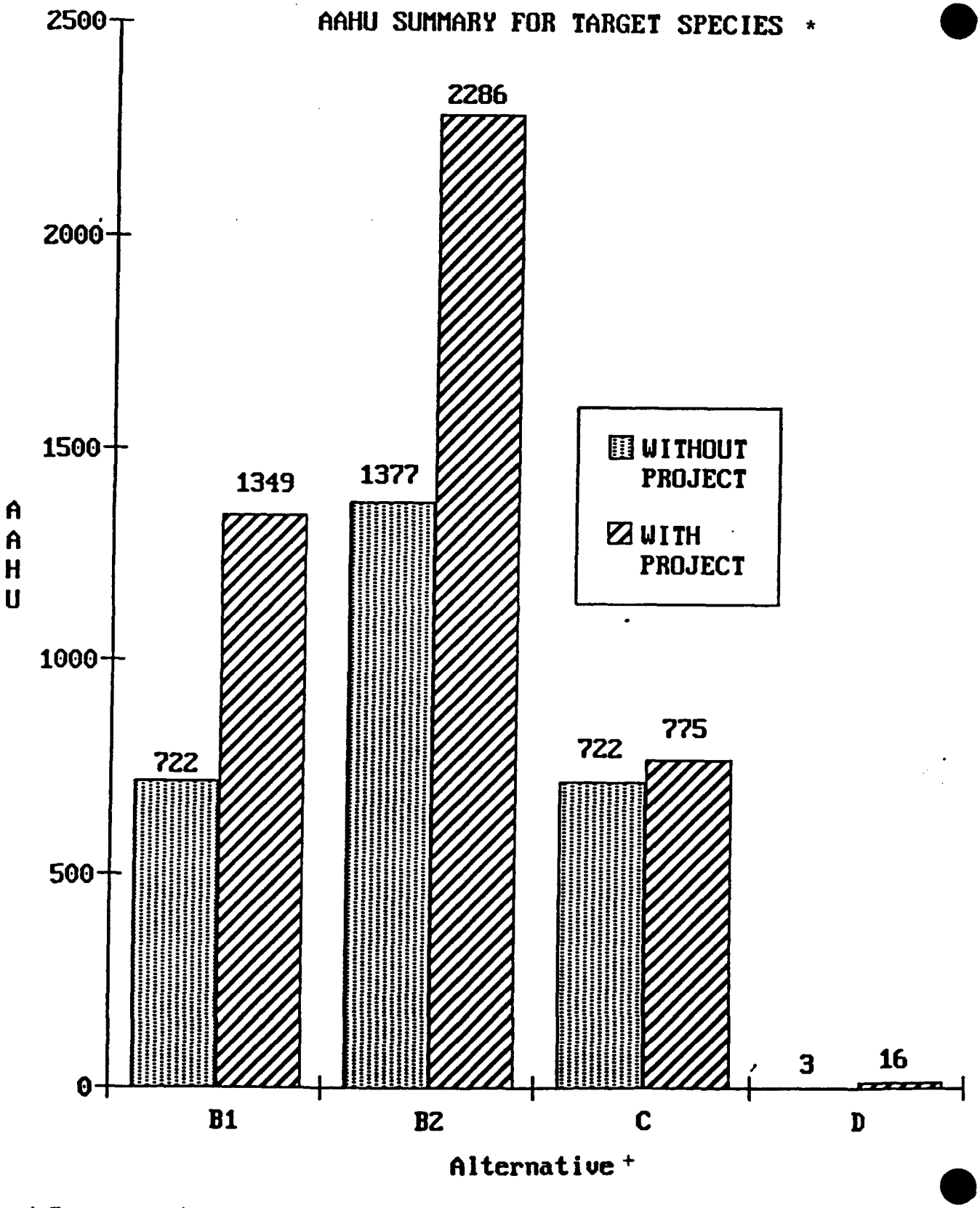
In cases where habitat loss is permanent (i.e., levee access road and pump station), the overall improvements to wetlands overcome the short-term losses. This is clearly shown in the habitat analysis. The impacts to these resources were accounted for in the WHAG habitat analysis. Mitigation for these habitats as a separate plan is not necessary since the proposed improvements include their own "mitigation."

b. **Economic and Social Impacts.**

(1) **Community and Regional Growth.** No impacts to community or regional growth would result from the project.

(2) **Displacement of People.** No residential displacements would be necessitated by the proposed environmental enhancement project.

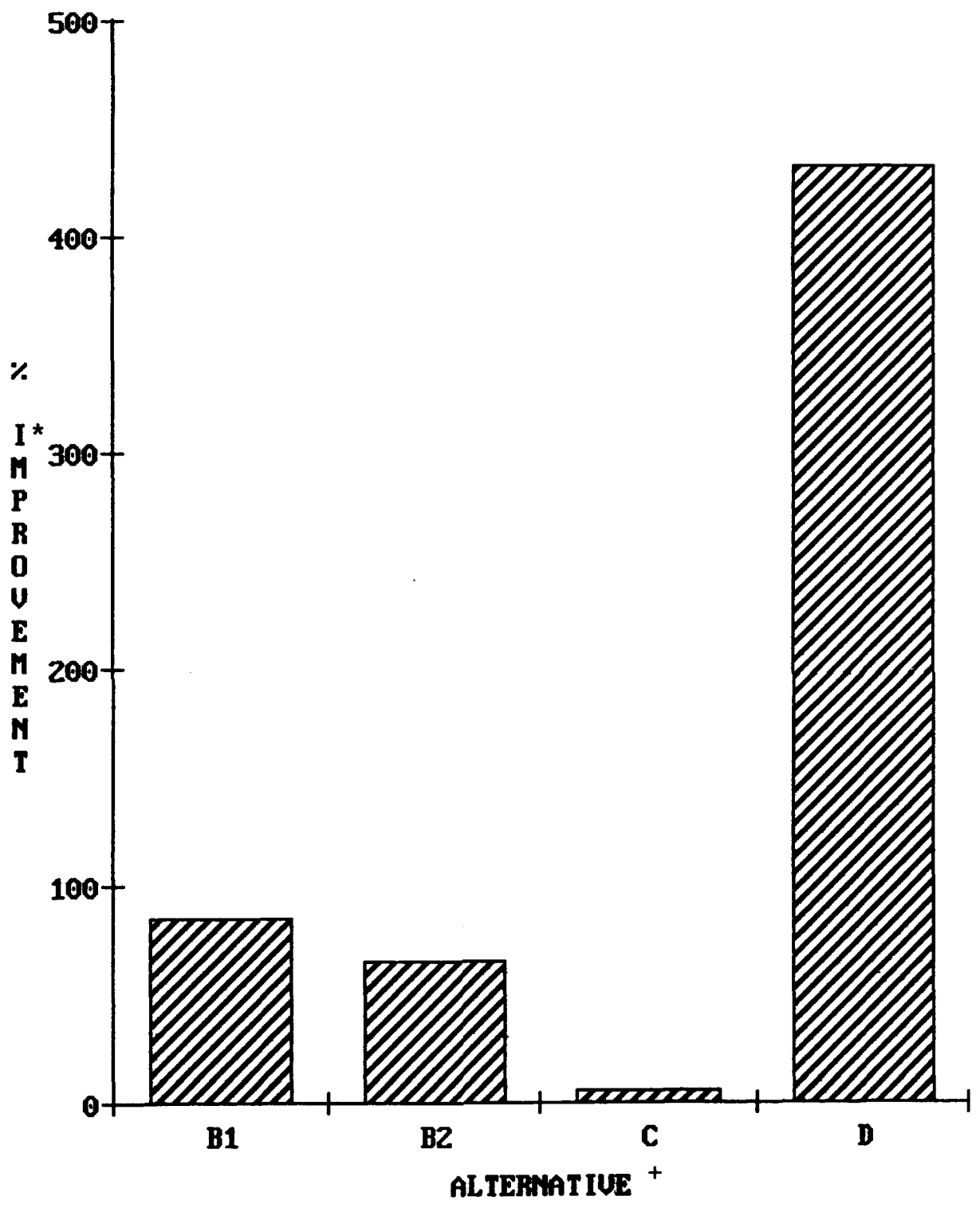
(3) **Community Cohesion.** No significant impacts to community cohesion would result, given the nature of the project and its limited area of influence. The site is managed as a national fish and wildlife refuge by the U.S. Fish and Wildlife Service, and is located in a rural surrounding with limited residential development.



* Target species are divers and mallards for B1, B2, and C, and largemouth bass, catfish, and walleye for D.

\+ See table 9-1 for alternative definitions

FIGURE 9-1



* Based on % increase of habitat units-w/o project compared to w/project (see Figure 9-1).

\+ See table 9-1 for alternative definitions.

FIGURE 9-2

(4) **Property Values and Tax Revenues.** The potential value of property within the project area could increase slightly as a result of the proposed habitat improvement project. This land is in Federal ownership, however, so an increase in its value would not increase local tax revenues.

(5) **Public Facilities and Services.** The proposed environmental enhancement project would maintain and enhance fish and wildlife habitat within a national wildlife refuge. The project would increase submergent vegetation and moist soil plants for both waterfowl and fish. The habitat improvement project also would create deep water areas for wintering fish and would improve side channel habitat. Without the project, increasing sedimentation would transform this important fishery and migratory waterfowl area into lowland brush habitat.

The Lake Chautauqua National Wildlife Refuge is zoned for low density recreation and serves as an important fishing and hunting area for the general public in Mason County and outlying areas. The proposed habitat improvement project at Lake Chautauqua would enhance the attraction of the refuge and surrounding areas for fishing, hunting, and related recreation activities.

(6) **Life, Health, and Safety.** The Lake Chautauqua Refuge poses no threat to life, health, or safety of recreationists or others in the vicinity. The proposed habitat improvement project would not affect current conditions in regards to these areas of concern.

(7) **Employment and Labor Force.** Project construction would result in a slight increase in short-term employment opportunities in the project vicinity. The project would not directly affect the permanent labor force or employment rate in Mason County, Illinois, or surrounding areas.

(8) **Business and Industrial Activity.** No significant change in business and industrial activity would result during or after project construction. The project would require no business relocations.

(9) **Farm Displacement.** No farms or farm lands would be affected by the proposed environmental enhancement project, as the project site is in public ownership.

(10) **Noise Levels.** Heavy machinery would generate an increase in noise during project construction. This increase would disturb wildlife and recreationists within the vicinity of the refuge. However, the project site is located in an area with limited residential or other development, and no significant long-term noise impacts would result.

(11) **Aesthetics.** The proposed habitat improvement project would enhance and maintain the aesthetics of the affected refuge. The project would increase water cover over barren or sparsely vegetated grounds and would increase the growth of submergent and moist soil vegetation.

Improved water quality in both the upper and lower lakes also would enhance aesthetics.

c. **Natural Resources Impacts.** Impact of the proposed construction on aquatic, wetland, and terrestrial resources of the refuge was evaluated using a modified Habitat Evaluation Procedure (HEP) developed by the Missouri Department of Conservation and the Soil Conservation Service. This Wildlife Habitat Appraisal Guide (WHAG) compares existing and projected future habitat values with habitat values resulting from the proposed project. The WHAG calculates both positive and negative impacts to habitat. The WHAG evaluation was performed by the USFWS and the Corps of Engineers in coordination with IDOC biologists. Results of the WHAG evaluation are summarized in table 9-1 for the species of primary interest and a more detailed analysis is included in appendix K.

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

Upper Lake - Improved water level control will result in an increase in submergent aquatic vegetation in the upper lake needed by migratory waterfowl (primarily divers) and fish. Approximately 1,000 acres of low quality wetland will be improved. Aquatic plants such as *Potamogeton* sp., *Valisneria* sp., and *Ceratophyllum demersum* will increase throughout the upper lake as a result of the capability to periodically dewater sediments and maintain stable water levels. As discussed previously under "Wetland and Waterfowl Resources," some submergent aquatic vegetation still reappears in the lake. Although no recent investigations have been done, Illinois Natural History biologists and U.S. Fish and Wildlife Service refuge biologists believe that an ample seed bank still exists (as evidenced by the occasional growths of submergents). The benefits of dewatering upon submergents have been shown at many waterfowl management areas throughout the country. It is recommended as a management practice by Korschgen, Stuzenbaker, and Weller in *Habitat Management for Migrating and Wintering Waterfowl in North America* (Smith, Pederson, and Kaminski, 1989).

Fish kills in the upper lake should decrease with the ability to maintain deeper water in the winter. The ability to dewater the upper lake will allow the eradication of any rough fish that may become established.

Along with a stable water level, the biggest benefit to fish will be an increased habitat diversity created by submergent vegetation. This should create conditions favorable to several species of fish; yellow perch in particular.

Lower Lake - Improvements in Lower Lake Chautauqua will not create or improve permanent deep water aquatic habitat as will the upper lake, since it will be drained yearly. As previously discussed, the lower lake levee is overtopped once or more yearly. During the critical drawdown and

TABLE 9-1

Chautauqua National Wildlife Refuge HREP - WHAG Analysis Summary

ALTERNATIVES
A - NO ACTION
B1 - UPPER POOL WATER LEVEL CONTROL
B2 - LOWER POOL WATER LEVEL CONTROL
C - UPPER POOL BARRIER ISLANDS
D - LIVERPOOL DITCH CLEANOUT - UPPER END

WITHOUT COLUMNS FOR ALL ALTERNATIVES B1 - D = ALTERNATIVE A
NE - NOT EVALUATED
AAHU - AVERAGE ANNUAL HABITAT UNIT
PERCENT CHANGE - POSITIVE NUMBER INDICATES INCREASE IN HABITAT UNITS, NEGATIVE NUMBER INDICATES DECREASE IN HABITAT UNITS

EVALUATION SPECIES	ALTERNATIVE B1 WITHOUT	WITH	PERCENT CHANGE	ALTERNATIVE B2 WITHOUT	WITH	PERCENT CHANGE	ALTERNATIVE C WITHOUT	WITH	PERCENT CHANGE	ALTERNATIVE D WITHOUT	WITH	PERCENT CHANGE	
* MALLARD	412	618	50%	679	1498	121%	412	442	7%	109	124	14%	AAHU'S
* DIVING DUCKS	310	731	136%	696	788	13%	310	333	7%	NE	NE	NE	AAHU'S
WOOD DUCK	88	82	-7%	NE	NE	NE	88	88	0%	212	240	13%	AAHU'S
GREEN-BACKED HERON	819	837	2%	1501	1039	-31%	819	896	9%	178	275	54%	AAHU'S
* CHANNEL CATFISH	100	194	94%	225	225	0%	NE	NE	NE	1	5	400%	AAHU'S
* WALLEYE	110	213	94%	225	225	0%	NE	NE	NE	1	5	400%	AAHU'S
* LARGEMOUTH BASS	110	281	155%	225	225	0%	NE	NE	NE	1	6	500%	AAHU'S

****

* Denotes Target Species

waterfowl migration periods (approximately July-December), it is overtopped every other year on the average. The lower lake gravity drainage improvements will not change the frequency of flooding, but will significantly increase the acreage that can produce moist soil plants from 200 existing to 2,250.

Construction of the new water control structure will allow the lower lake to be completely drained for moist soil plant production. Proper management (and favorable river stages) will promote the growth of annual plants such as smartweed, millet, pigweed, and rice cutgrass favored by dabbling ducks. Other wetland birds such as rails, herons, and songbirds also will benefit. Aquatic mammals such as muskrats will be impacted due to elimination of all standing water during drawdown.

The existing water control structure's elevation of 432.5 NGVD now allows extensive areas of ponded shallow (1 to 2 feet) water to remain over several hundred acres of the lower lake. These shallow areas which contain some fish will be eliminated. Fish that are able to utilize these shallow ponds are mostly rough fish such as carp and buffalo. Elimination of these fish from the lower lake will be beneficial because their activities impact desirable aquatic vegetation. Material excavated from the proposed 7,500 feet of drainage channels will be side cast onto the adjoining wetland. Since the existing lake bottom is mostly devoid of any kind of vegetation (submergent or emergent), the placement of silt on silt will cause no loss of habitat. The slight increase in bottom elevation could be a benefit in terms of vegetation diversity. (See Appendix G - Water Quality and Appendix B - Section 404(b)(1) Evaluation.)

Liverpool Side Channel - Excavation of Liverpool Ditch will create 16.1 acres of 9-foot-deep flowing water. Excavation of the first 2,200 feet upstream of the new pump station is needed for efficient pump station operation. Excavation of the remaining 6,200 feet will provide the downstream connection with the main river. Near the downstream mouth of Liverpool Channel, a backwater "pocket" will be constructed. This 0.7-acre pocket will be 16 feet deep, providing deep oxygenated water with low velocity. This type of habitat is critical to wintering fish but is almost totally absent on the river. Wintering fish must find habitat that is oxygen rich but with little velocity. High velocity waters cause fish to expend energy reserves needed to sustain their metabolism throughout the winter. Most locations on the river with low velocity also are shallow with low dissolved oxygen. Conversely, areas with good dissolved oxygen levels (i.e., main channel) have unacceptably high velocities.

(2) **Bottomland Hardwoods.** Approximately 48.6 acres of woodland habitat will be impacted by the project. These acres vary markedly in their quality. The 14 acres occurring on the cross dike were not classified as bottomland hardwoods because of their low quality and the fact that they were growing on an almost 100 percent sand substrate (which was transported from an upland location when the cross dike was constructed in the mid-1960's). The remaining 34.6 acres is located on the north levee and along the Liverpool Channel excavation, 17.7 acres and 16.9

acres, respectively. The following discussion focuses on the location and nature of these impacts.

Upper Lake - The most notable effect of the proposed project in the upper lake will be the loss of various types of woodland. Reconstruction of the cross dike will impact about 14 acres of sapling to pole-sized scrub-shrub woodland (consisting mostly of silver maple, cottonwood, and mulberry), not classified as bottomland hardwoods. Approximately 17.7 acres of the north levee from the intersection of the cross dike upstream will be cleared. Most of this clearing will be along the levee top and the interior slope, except for about 3.5 acres of the levee's riverside slope which will be cleared immediately upstream of the cross dike. Several of the trees are mature cottonwood and silver maple.

Most of the levee acreage is second growth, which has developed since the levee was built in the early 1900's. Cottonwood, silver maple, green ash, and mulberry account for more than 80 percent of tree cover. Valuable mast-producing species such as pin oak are virtually absent. Proper maintenance of the levees in past years normally would have prevented this second growth forest from becoming established. Impacts to more valuable, pre-levee bottomland forest along the levee's interior slope and adjacent floodplain in the Melz Slough area will be avoided by transporting borrow from outside the slough.

About 90 percent of the approximately 80 acres of bottomland hardwoods in Melz Slough lie at an elevation below 435.8 NGVD. Melz Slough could experience some minimal adverse effects from the long-term maintenance of 3- to 4-foot water depths in the upper lake. Although Melz Slough is frequently flooded in excess of the projected lake management levels, it is rarely for extended periods of time.

At present, upper lake levels cannot be drawn down below the sill elevation of 433.5 NGVD. The average fall/winter elevations now range from 434 to 436 NGVD. The proposed management plan for the upper lake, after construction, calls for an average summer depth of 3 to 4 feet and a winter depth of 5 to 6 feet, if necessary, to protect fish resources. This would increase the average water depth by approximately 1 foot. Since the increase would occur during the winter months when trees are dormant, it is possible, but unlikely, that the project would cause any impacts to timber. The WHAG evaluation showed no adverse impacts, probably because it was not sensitive enough to discriminate a long-term average increase of 1 foot. USFWS and Corps of Engineers foresters did not believe that any long-term adverse impact to bottomland hardwoods is likely to occur.

Lower Lake - Construction of a water control structure and drainage channels in the lower lake will not adversely impact any bottomland hardwoods. Installation of the new sill (elevation 429 NGVD) will allow water levels to be drawn down 2 feet below the currently obtainable minimum. This could result in an increase of woody vegetation around the lower lake.

Liverpool Channel Excavation - Material excavated from the inlet channel will be placed on the levee. The levee vegetation is predominantly pole/mature size silver maple and cottonwood with mulberry common on the levee tops. A total of 5.0 acres of the lower lake's levee downstream of the cross dike and 6.2 acres on Liverpool Island will be cleared for material placement. Another 5.7 acres of Liverpool Island will be excavated for the channel itself, resulting in a total initial loss of 16.9 acres of bottomland forest from the Liverpool side channel improvement. Except for the 5.7 acres of woodland converted to channel, all of the cleared acreage eventually should succeed to bottomland forest. A backwater slough of .7 acre and 16 feet deep at flat pool will be created just upstream of the mouth. This will remove an equal area of bottomland forest. Excavated material will be placed among the trees adjacent to the slough.

(3) **Endangered Species.** Based on current information and the CAR, no effects to endangered species are anticipated. The USFWS, however, has indicated that they are planning a bat survey for portions of the refuge. They have indicated that even if Indiana bats are found to be present, it will not jeopardize implementation of any recommended alternatives. If necessary, special conditions will be placed in the construction plans and specifications to protect any bat habitat.

(4) **Mineral Resources.** There are no known mineral resources present in the project area.

d. **Cultural Resources.** The documents search revealed that the area was historically comprised of wetlands, sloughs, and intermittently and seasonally inundated floodplain. Little improvements were made to the lands presently contained within the Lake Chautauqua HREP until the early twentieth century. At this time, attempts at draining and diking for cultivation were partially successful under the direction of the Chautauqua Drainage and Levee District between 1916 and 1926, when it was abandoned. For approximately 10 years, the abandoned district was susceptible to flooding and heavy siltation.

In 1936, the land was purchased from the Chautauqua Drainage and Levee District and became part of the National Wildlife Refuge System. Since this time, the levees were repaired to retain water for migratory waterfowl management, but also function as flood storage and for conservation and recreation use. No significant historic properties relative to the historic assessment of the Lake Chautauqua HREP were discovered in the aforementioned articles, river charts, and photographs, nor in the references and sources described and listed within the ASSR.

As a result of the November 15, 1990, request by the SHPO for a Phase I archeological investigation, the Corps undertook a geomorphological analysis to locate historic properties and determine the potential for buried cultural deposits at the Chautauqua Wildlife Refuge on February 7 and 8, 1991. Frozen ground and accessibility precluded more conventional methods of soil investigation. However, the use of a portable gasoline-powered auger, in conjunction with sampling tubes and bucket augers,

provided information regarding subsurface soil conditions along the northeastern and northwestern margins of the refuge.

From the geomorphological analysis, Lake Chautauqua was determined to be a wetland slough and backwater area throughout its recent geologic past. Although the wetland area now included within Lake Chautauqua may have been used during prehistory, wet, riverine histosols were not conducive to occupations. Surface relief within Lake Chautauqua is minimal, further limiting the potential for prehistoric sites.

The documentary search and geomorphological analysis indicate that, as designed, the Lake Chautauqua HREP has little potential for disturbing historic properties eligible for listing on the National Register of Historic Places. It is the documented opinion of the Corps, the USFWS, and the SHPO that no significant historic properties will be affected by the Lake Chautauqua HREP (Appendix A, pages A-1, A-3, A-5, A-7, and A-29).

The Lake Chautauqua HREP has been designed to reduce turbidity and accretion through levee and cross dike repair and to avoid and preserve areas potentially sensitive to buried, undocumented historic properties. Although this is the case, if undocumented significant historic properties are encountered during construction of the proposed Lake Chautauqua HREP, the Corps and the USFWS will resume consultation with the Illinois State Historic Preservation Office, as required by Section 106 of the National Historic Preservation Act of 1966, as amended.

e. **Adverse Effects Which Cannot Be Avoided.** The most significant, unavoidable adverse effect is the clearing of bottomland hardwoods for the cross dike, construction access, and placement of excavated material. These impacts are not permanent, although it will require 50 or more years to replace some of the cleared timber. Liverpool Channel and interior drainage channel excavation temporarily will degrade water quality, primarily from increased turbidity.

Loss of fish due to the complete drawdown of the lower lake is unavoidable.

f. **Short-Term Versus Long-Term Productivity.** Short-term productivity of the refuge is impaired due to the inability to control water levels and halt the ongoing sedimentation in the lake. Refuge productivity will continue to be impaired if the proposed project is not constructed. Continued sedimentation eventually will convert the refuge lakes to woody vegetation. Improved water level control can offset the adverse effects of sedimentation and prolong the refuge's ability to provide waterfowl habitat.

g. **Irreversible or Irretrievable Resource Commitments.** Other than fuel, construction materials, and manpower none of the proposed actions are considered irreversible.

h. **Compliance With Environmental Quality Statutes.** Environmental laws and regulations applicable to the proposed project are listed in table 9-2.

TABLE 9-2

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, 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
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
River 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.

i. **Mitigation**. The habitat evaluation (WHAG analysis) performed for this project indicates that, over the 50-year life of the project, there will be a net gain in wildlife habitat. Following the construction phase, the analysis shows a net decrease in habitat for a few years due to loss of forest habitat. However, these losses are overcome by project benefits and reestablishment of forest losses by natural succession. Although not discussed in detail (but a critical part of the WHAG analysis), the future without-project condition of the refuge indicates that a decline in non-forested wetland habitat will occur by the end of the 50 years. Much of the non-forested wetland will succeed to other habitat types of lower value to waterfowl and fish. In other words, if the project is not built, there is a strong likelihood that wetland habitat needed to meet refuge objectives at Lake Chautauqua will decline.

The WHAG analysis has been criticized for being biased toward only a few particular (target) species and failing to consider impacts to other species. There was some concern that these non-target species, impacted by the project, should be mitigated. The primary purpose of the WHAG was to determine the optimum project design for improving fish and waterfowl habitat. According to law, the USFWS must direct their primary management efforts at Chautauqua National Wildlife Refuge toward migratory birds and fish. This was the basis for selection of target species. Analysis of impacts to other species, although important, was considered to be secondary.

The WHAG analysis was performed on 12 species for the forested wetland habitat type (includes bottomland hardwoods). These included such non-target species such as beaver, northern parula, king rail, and others. These species were included in the preliminary analysis but not carried through the complete 50-year evaluation. This preliminary analysis gave an adequate indication as to whether or not any non-target species impacts would be unacceptable. When the consequences of an action are considered for this many species, it is inevitable that some species will gain at the expense of others. No matter how the project is designed, some species will be affected. As stated previously, even the "no action" alternative will result in species impacts. Based on the preliminary analysis, it is felt that no mitigation for any non-target species is needed.

The construction of Liverpool Channel and improvement of the upper lake levee will impact 34.6 acres of bottomland hardwoods of varying quality. Of this 34.6 acres, only the 11.9 acres to be cleared on Liverpool Island is considered to be of any value. No mitigation was considered necessary for two reasons: (1) The resulting deepwater aquatic habitat is much scarcer on the Illinois River and, hence, considerably more valuable on an acre-per-acre basis; and (2) although there is a net loss, the continuity of the forest resource on the entire woodland on Liverpool Island and adjacent areas remains intact. In addition, the refuge has an ongoing forestry program that establishes and improves bottomland forest resources on Lake Chautauqua refuge.

10. SUMMARY OF PROJECT ACCOMPLISHMENTS

The proposed project consists of the construction of water control features in both the upper and lower lake to allow the independent operation of the upper lake as a stable level lake and the lower lake as a moist soil management unit. A selected reach of Liverpool Ditch will be excavated to restore flowing side channel habitat.

Water control features in the upper lake will include raising the upper levee and cross dike to a 10-year event elevation (includes closing an existing breach) construction of a pump station, modification of an existing radial gate structure, and construction of a gravity outlet. These features will provide for annual operation as well as periodic draw down for bed consolidation. These functions will improve water quality and allow establishment of submergent vegetation to benefit the diving duck target species. Also, plans to stock and operate the upper lake in an attempt to reestablish yellow perch, which were abundant in the lake at one time, have been developed.

Water control features in the lower lake will include drainage channel excavation and construction of a stoplog water control structure. The pump station is designed to pump from both lakes. These features will provide the ability to operate the lower lake as a moist soil management unit to the benefit of migrating dabbling ducks.

Excavation of approximately 8,400 feet of Liverpool Ditch will restore flowing side channel habitat at this location. Excavation of a 300-foot slough off the new channel will provide overwintering fish habitat for a significant portion of the LaGrange Pool's fish population.

A summary of habitat unit improvement for the proposed alternatives are presented in figure 9-1. A summary of percentage improvement of habitat for the proposed alternatives is presented in figure 9-2.

11. OPERATION, MAINTENANCE, AND REHABILITATION CONSIDERATIONS

a. **Project Data Summary.** This section provides an overview of the operation, maintenance, and rehabilitation aspects of this project and serves as a preliminary first draft of the Operation and Maintenance manual. Table 11-1 presents a summary of project data.

TABLE 11-1

Lake Chautauqua Project Data Summary

Feature	Measurement	Unit of Measure
Upper Lake Perimeter Levee		
Length	15,400	Feet
Crown width	12	Feet
Side slopes	4:1	Horizontal:Vertical
Level of protection	10	Year event
Elevation	449.0	NGVD
Embankment volume	196,000	Cubic yards
Riprap	2,400	Tons
Cross Dike		
Length	4,950	Feet
Crown width	15	Feet
Side slopes		
Upper lake	4:1	H:V
Lower lake	6:1	H:V
Level of protection	10	Year event
Elevation	449.0	NGVD
Embankment volume	121,000	Cubic yards
Permanent erosion matt	1,500	Square yards
Temporary erosion matt	6,000	Square yards
Crushed stone access road	1,600	Tons
Modification of Radial Gate Structure		
New sill elevation	437.5	NGVD
New level of protection	10	Year event
Top of closed gate elevation	449.5	NGVD
Riprap	3,000	Tons
Hydraulic openings through new sill		
Number of stoplog openings	8	Each, 3 feet x 4 feet
Sill elevation of gates	433.5	NGVD

TABLE 11-1 (Cont'd)

Feature	Measurement	Unit of Measure
Pump Station		
Submersible pump	1	41,000 gpm at 7.0 TDH
Station invert	424.0	NGVD
Trash racks	3	Each, 3" bar spacing
Slide gates	2	Each, 5 feet x 5 feet
Discharge pipe		
Diameter	48	Inches, welded steel
Length	200	Feet
Flap gate diameter	48	Inches
Power		
Electric	3	Phase, 12,500/480 volt
Transformer	150	KVA
Buried primary feeder length	5,500	Feet
Riprap	620	Tons
Gravity Outlet for Upper Lake		
Slide Gate	1	Each, 5 feet x 5 feet
Concrete pipe culvert		
Diameter	60	Inches
Length	140	Feet
Station invert	429.0	NGVD
Trash rack	1	Each, 3" bar spacing
Riprap	380	Tons
Stoplog Structure for Lower Lake		
Hydraulic opening	20	Feet
Concrete sill elevation	429.0	NGVD
Riprap	155	Tons
Drainage Channels for Lower Lake		
Length	7,500	Feet
Invert	429.0	NGVD
Bottom width	50	Feet
Excavation volume	29,500	Cubic yards
Replacement Boat Ramp		
Ramp width	16	Feet
Access road	700	Lineal feet
Parking lot	3	Management vehicles with trailers

TABLE 11-1 (Cont'd)

Feature	Measurement	Unit of Measure
Side Channel from Mouth to Pump Station		
Length	2,200	Feet
Construction bottom elevation	419.4	NGVD (10 feet deep)
Construction bottom width	35	Feet
Side slopes	2:1	H:V
Excavated volume	44,900	Cubic yards
Surface area	4	Acres at flat pool
Side Channel from Pump Station to River Confluence		
Length	6,200	Feet
Construction bottom elevation	419.4	NGVD (10 feet deep)
Construction bottom width	35	Feet
Side slopes	2:1	H:V
Excavated volume	139,000	Cubic yards
Surface area	11	Acres at flat pool
Side Channel Entrance Closure Structure		
Top elevation	429.4	NGVD
Rock fill	800	Tons
Riprap	5,570	Tons
Boat access opening		
Width	15	Feet
Water depth at flat pool	3.5	Feet
Deepwater Slough Area		
Length	300	Feet
Construction bottom elevation	413.4	NGVD (16 feet deep)
Construction bottom width	35	Feet
Side slopes	2:1	H:V
Excavated volume	12,000	Cubic yards
Surface area	0.7	Acres at flat pool

b. **Operation.** Table 11-2 summarizes the general operating requirements to manage water levels in the upper and lower lakes.

Estimated annual operation costs are presented in table 13-2.

c. **Maintenance.** The proposed features have been designed to ensure low annual maintenance requirements with the estimated annual maintenance costs presented in table 13-2. These quantities and costs may change during final design.

TABLE 11-2

Operating Requirements to Manage Water Levels in the Upper and Lower Lakes

Desired Function	Operating Scenario	Operating Time	Remarks
Emergency Fill of Upper Lake	When river levels reach 446 with stage higher than 449 predicted, completely open all 4 radial gates, slide gate upper, and both gates of the pump station	3 days to equalize levels between river and upper lake	Prevents overtopping damage
Independent Dewatering of Upper Lake	1) Open radial gates and slide gate upper for gravity draining until radial sill elevation of 437.5 is reached	1) Dependent on river stage	1) --
	2) Close radial gates	2) --	2) --
	3) Open radial gate stoplogs until sill elevation of 433.5 is reached	3) Dependent on river stage	3) --
	4) Close gates when river reaches lowest elevation	4) --	4) --
	5) Use pump station to complete dewatering	5) 32 days	5) Operating time based on an initial upper lake elevation of 437.5 (radial gate sill elevation and 50 percent June elevation duration during a 10-year flood season)
Fill Upper Lake Using:			
Spring Flows	Close all gates and allow spring flow to fill unit	Approximately 1 year	Operating time based on filling to elevation 435 with an effective spring flow of 5 cfs.

TABLE 11-2 (Cont'd)

Desired Function	Operating Scenario	Operating Time	Remarks
Quiver Creek	Open both gates at the pump station and divert water from Quiver Creek. Close all other gates.	Approximately 3 months	Operating time based on existing capacity of Quiver Creek diversion structure and includes filling both the lower and upper units to elevation 435
River	1) Open pump station upper slide gate 2) Open pump station flap valve 3) Close all other gates 4) Activate the pump station to pump from the river to the upper unit	30 days	Operating time based on filling to elevation 435
Dewater Lower Lake	1) Close Quiver Creek water supply gate	1) --	1) --
	2) Open west spillway and lower unit stoplog structure for gravity draining	2) Dependent on river stage	2) Continue gravity draining during low, favorable river stages
	3) Close both stoplog structures	3) --	3) --
	4) Use pump station	4) 30 days	4) Operating time based on an initial elevation of 435 (approximately 10 percent exceedence probability of lowest monthly July elevations)
Fill Lower Lake Using:			
Quiver Creek	1) Close both stoplog structures and pump station lower gate	1) --	1) --

TABLE 11-2 (Cont'd)

Desired Function	Operating Scenario	Operating Time	Remarks
	2) Open Quiver Creek water diversion gate	2) 20 days	2) Operating time based on filling to 433 and adequate Quiver Creek flows. Filling time limited by size of existing gated diversion structure.
River	1) Close both stoplog structures	1) --	1) --
	2) Open pump station lower gate. Maintain upper gate pump station closed.	2) --	2) --
	3) Activate pump station from the river to the lower unit.	3) 30 days	3) Operating time based on filling to 433.

12. PROJECT PERFORMANCE ASSESSMENT

This section summarizes the monitoring and data collection aspects of the project. The primary project objectives are to: (1) increase submergent vegetation in the upper lake; (2) increase the availability of moist soil plants in the lower lake; and (3) restore flow and deep water to Liverpool Side Channel. Vegetation monitoring is the primary element in determining the success in meeting the first two objectives. Post-construction aerial photographs and ground-truthing of the refuge will be compared to vegetation maps prepared prior to the project. Fishery use of Liverpool Channel will be sampled by IDOC and/or USFWS biologists. Sedimentation transects of the channel also will be taken by the Corps of Engineers.

Table 12-1 presents the principal types, purposes, and responsibility of monitoring and data collection. Table 12-2 provides a summary of actual monitoring and data parameters grouped by project phase and also shows data collection intervals.

Table 12-3 presents the post-construction evaluation plan. The monitoring parameters of this plan were developed to measure the effectiveness of the stated goals and objectives. As shown in table 12-1, these post-construction quantitative measurements will be the responsibility of the Corps of Engineers. The USFWS field personnel also should follow table 12-3, as shown, to make annual field observations. The annual field observations and the quantitative monitoring parameters will form the basis of project evaluation.

TABLE 12-1

Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Remarks
Pre-Project	Sedimentation Problem Analysis	System-wide problem definition. Evaluates planning assumptions.	USFWS	USFWS (EMTC)	LTRM	--
	Pre-Project Monitoring	Identify and define problems at HREP site. Establishes need of proposed project features.	Sponsor	Sponsor	Sponsor	--
	Baseline Monitoring	Establish baselines for performance evaluation.	Corps	Field station or sponsor thru Cooperative Agreements or Corps.	LTRM	See Table 12-2.
Design	Data Collection for Design	Include quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP	See Table 12-2.
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met.	Corps	Corps	HREP	See State Section 401 Stipulations.
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives.	Corps (quantitative) and sponsor (field observations).	Field station or sponsor thru Cooperative Agreement, sponsor thru O&M, or Corps.	LTRM	See Table 12-3.
	Biological Response Monitoring	Evaluate predictions and assumptions of habitat unit analysis beyond the scope of performance evaluation.	Corps	Corps	LTRM	--

TABLE 12-2

Resource Monitoring and Data Collection Summary [1]

Type Measurement	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA			Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
POINT MEASUREMENTS													
Stations [3]	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR							Corps Pre-Project
Turbidity	2W	M											
Photosynthetically Active Radiation	2W	M											
Secchi Disk Transparency	2W	M											
Dissolved Oxygen	2W	M											
Specific Conductance	2W	M											
Water Temperature	2W	M											
Velocity	M	M											
Water Depth	2W	M											
Water Elevation	2W	M											
Percent Ice Cover	-	M											
Ice Depth	-	M											
Percent Snow Cover	-	M											
Snow Depth	-	M											
Substrate Particle Presence	6M	6M											
Substrate Hardness	6M	6M											
pH	2W	M											
Chlorophyll	2W	M											
Suspended Solids	2W	M											
Wind Direction	2W	M											
Wind Velocity	2W	M											
Wave Height	2W	M											

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA			Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
POINT MEASUREMENTS													
Stations [4]	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR							Corps Design Phase
Turbidity			2W	M									
Photosynthetically Active Radiation			2W	M									
Secchi Disk Transparency			2W	M									
Dissolved Oxygen			2W	M									
Specific Conductance			2W	M									
Water Temperature			2W	M									
Velocity			M	M									
Water Depth			2W	M									
Water Elevation			2W	M									
Percent Ice Cover			-	M									
Ice Depth			-	M									
Percent Snow Cover			-	M									
Snow Depth			-	M									
Substrate Particle Presence			6M	6M									
Substrate Hardness			6M	6M									
pH			2W	M									
Chlorophyll			2W	M									
Suspended Solids			2W	M									
Wind Direction			2W	M									
Wind Velocity			2W	M									
Wave Height			2W	M									

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA			Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
POINT MEASUREMENTS													
Stations [5]	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR							LTRM/Corps Post-Construction
Turbidity					2W	M							
Photosynthetically Active Radiation					2W	M							
Secchi Disk Transparency					2W	M							
Dissolved Oxygen					2W	M							
Specific Conductance					2W	M							
Water Temperature					2W	M							
Velocity					M	M							
Water Depth					2W	M							
Water Elevation					2W	M							
Percent Ice Cover					-	M							
Ice Depth					-	M							
Percent Snow Cover					-	M							
Snow Depth					-	M							
Substrate Particle Presence					6M	6M							
Substrate Hardness					6M	6M							
pH					2W	M							
Chlorophyll					2W	M							
Suspended Solids					2W	M							
Wind Direction					2W	M							
Wind Velocity					2W	M							
Wave Height					2W	M							

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA			ENGINEERING DATA			NATURAL RESOURCE DATA			Remarks
	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
POINT MEASUREMENTS										
Stations [6]	APR-SEP OCT-MAR	APR-SEP OCT-MAR	APR-SEP OCT-MAR							
Bulk Sediment and Elutriate		1								Corps

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA			Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase	
	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR							
Select Point Locations													
Soil Borings [2]							1	1					Corps
TRANSECT MEASUREMENTS													
Transects [7]													
Lake Sedimentation Transects								1	5Y				Corps
Transects [8]													
Side Channel Sedimentation and Velocities								1	5Y				Corps
Transects [7]													
Vegetation												2Y	
Transects - Levee System													
Cross section at even 500-foot intervals and profile of cross dike and perimeter levee								1	5Y				Corps
AREA MEASUREMENTS													
Vertical Stereo Areal Photographs (1:5000)											1	4Y	Corps
Land Topographic Mapping (1' contours)								1					Corps

TABLE 12-2 (Cont'd)

Legend

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

1 See monitoring plan drawing for locations of sampling points, transects, areas except as noted.

2 See soil boring location drawing.

3 Water Quality Stations, Pre-Project Phase

Current Station Code	Previous Designation	
W-1126.8T	LCL-1	1987 only
W-1130.8W	UCL-3	1989 only

4 Water Quality Stations, Design Phase

W-1124.8R	--	initiated 1990
W-1128.7W	UCL-1	initiated 1989
W-1128.8F	LD-1	initiated 1990
W-1129.2V	UCL-2	initiated 1989

5 Water Quality Stations, Post-Construction Phase

W-1124.8R	--	--
W-1127.9W	--	--
W-1128.8T	--	--
W-1128.8W	--	--
W-1129.4T	UCL-2	--

6 Water Quality Bulk Sediment & Elutriate Stations

W-1126.6P	LCL-2	Lower Lake
W-1126.9M	LD-2	Liverpool Ditch
W-1126.8T	LCL-1	Lower Lake
W-1128.7W	UCL-1	Upper Lake
W-1128.8F	LD-1	Liverpool Ditch
W-1129.4T	UCL-2	Upper Lake
W-1129.6F	MD-1	Meyer's Ditch

TABLE 12-2 (Cont'd)

7 Corps Lake Sedimentation/Vegetation Transects

S-I124.8P V	Lower Lake
S-I126.0P V	Lower Lake
S-I126.9P V	Lower Lake
S-I127.9P V	Lower Lake
S-I128.8P V	Upper Lake
S-I129.0P V	Upper Lake
S-I129.4P V	Upper Lake

8 Corps Side Channel Sedimentation Transects

S-I127.6N	Liverpool Ditch, Cross Section
S-I128.0N	Liverpool Ditch, Cross Section
S-I128.6N	Liverpool Ditch, Cross Section
S-I128.7M	Liverpool Ditch, Thalweg

TABLE 12-3

Post-Construction Evaluation Plan

Goal	Objective	Alternative	Enhancement Feature	Enhancement Potential: Unit	Year 0 Without Alternative	Year X With Alternative[1]	Year 50 Target With Alternative	Feature Measurement Reference Table 12-2	Annual Field Observations by Site Manager
Enhance Waterfowl Habitat	Increase areal extent of submergent and emergent vegetation for waterfowl	Water Control	Aquatic vegetation bed	Acres of aquatic vegetation	200	--	3,250	Perform vegetation transects note 7, table 12-2 and aerial photography	Estimate acres of emergent/submergent and floating vegetation
			Improved water quality	mg/l suspended solids	200	--	50	Perform water quality tests at stations note 5, table 12-2	Describe presence of resuspended sediments due to rough fish/wind
			Perimeter levee and cross dike	Lineal feet of eroded levee	20,400	--	0	Perform levee system transects and profiles	Describe effects of erosion, distinguishing between wave and overtopping erosion
Enhance Fishery Habitat	Provide flowing side channel aquatic habitat	Flowing side channel	Side channel excavation	Surface acres of flowing channel	0	--	12	Perform sedimentation transects note 8, table 12-2	Describe presence of snags, channel sedimentation, or vegetation
				Cross-sectional sq ft of flowing channel	0	--	500	As above	--
				Velocity of flowing channel feet/sec	0	--	1	As above	Describe bank erosion (if any) at mouth of Liverpool Ditch for protection of historic site

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

13. COST ESTIMATES

A detailed estimate of project design and construction costs is presented in table 13-1. A detailed estimate of operation, maintenance, and rehabilitation costs is presented in table 13-2. Table 13-3 presents the estimated annual monitoring costs as described in Section 12. Quantities may vary during final design.

TABLE 13-1

CHAUTAUQUA LAKE
REHABILITATION AND ENHANCEMENT EMP
IL RIVER MILE 124 - 129.5

PROJECT COST SUMMARY
DIVISION OF COST

MARCH 1991

ACCOUNT	FEATURE	CURRENT WORKING ESTIMATE (CWE)		FULLY FUNDED ESTIMATE (FFE)	
		FEDERAL	NON-FEDERAL	FEDERAL	NON-FEDERAL
06.	FISH AND WILDLIFE FACILITIES	3,740,000		4,026,110	
30.	PLANNING, ENGINEERING AND DESIGN	669,000		676,309	
31.	CONSTRUCTION MANAGEMENT	245,000		258,990	
	SUBTOTAL	4,654,000	0	4,961,409	0

SUMMARY OF COST APPORTIONMENT

	CWE	FFE
1. TOTAL COST SUMMARY		
TOTAL PROJECT COSTS	4,654,000	4,961,409
NON-FEDERAL LANDS & DAMAGES	0	0
TOTAL PROJECT COSTS SEE NOTE 1.	4,654,000	4,961,409
2. NON-FEDERAL COSTS		
REQUIRED NON-FEDERAL CASH CONTRIBUTION	0	0
NON-FEDERAL LANDS & DAMAGES	0	0
TOTAL NON-FEDERAL COST	0	0
3. FEDERAL COST		
TOTAL FEDERAL COSTS	4,654,000	4,961,409
GENERAL DESIGN, DEFINITE PROJECT REPORT	(541,000)	(541,000)
REMAINING FEDERAL COSTS	4,113,000	4,420,409

NOTES:

1. TOTAL PROJECT COST IS 100% FEDERAL COST; PROJECT LANDS ARE GOVERNMENT OWNED.
2. CONSTRUCTION SCHEDULED FOR MAR 92 - SEP 93. FULLY FUNDED ESTIMATE (FFE) IS BASED ON MIDPOINT OF CONSTRUCTION DATE OF DEC 92, RESULTING IN INFLATION FACTORS OF 1.0571 FOR SALARIES AND 1.0765 FOR ALL OTHER COSTS PER CECW-B MEMO, 3 APR 90, SUBJECT: FACTORS FOR THE FY 1992 BUDGET SUBMISSION.

TABLE 13-1 (Cont'd)

CHAUTAUQUA LAKE
REHABILITATION AND ENHANCEMENT EMP
PROJECT COST ESTIMATE
MARCH 1991 PRICE LEVEL

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %	REASONS
06.	FISH AND WILDLIFE FACILITIES							
06.-.-.-	UPPER LAKE WATER CONTROL, PUMP STATION							
06.0.5.B	DEWATERING	1	LS	22000.00	22,000	5,500	25.0%	1
06.0.5.C	STRUCTURAL CONCRETE	360	CY	450.00	162,000	24,300	15.0%	4,6
06.0.5.E	SLIDE GATES, 5'X 5'	2	EA	12000.00	24,000	3,600	15.0%	3,6
06.0.5.E	TRASH RACK ASSEMBLYS	3	EA	4300.00	12,900	1,935	15.0%	4,6
06.0.5.E	DISCH PIPE 48" STEEL	200	LF	240.00	48,000	9,600	20.0%	4,6
06.0.5.E	FLAP GATE, 48"	1	EA	4000.00	4,000	600	15.0%	3,6
06.0.5.B	RIPRAP	620	TON	27.00	16,740	5,022	30.0%	2,3
06.0.5.R	BURIED PRIMARY FEEDER	5500	FT	11.75	64,625	9,694	15.0%	1,5
06.0.5.R	TRANSFORMER	1	EA	12300.00	12,300	1,845	15.0%	6
06.0.5.R	MISC. ELECTRICAL	1	LS	7670.00	7,670	1,534	20.0%	6
06.0.5.R	ELECT PLATFORM ASSEMBLY	1	LS	15300.00	15,300	2,295	15.0%	6
06.0.5.E	SUBMERSIBLE PUMP & ACCS	1	LS	101000.00	101,000	20,200	20.0%	3,6
	TOTAL				490,535	86,125		
06.-.-.-	NORTHERN LEVEE REPAIR							
06.0.1.B	STRIPPING	5800	CY	1.50	8,700	1,740	20.0%	1,5
06.0.1.B	UNSUITABLE SOIL EXCAVATION	12500	CY	2.40	30,000	4,500	15.0%	1,5
06.0.1.B	CLEARING/GRUBBING	17.7	ACR	1810.00	32,037	6,407	20.0%	1,5
06.0.1.B	SEEDING	17.7	ACR	1150.00	20,355	4,071	20.0%	5,6
06.0.1.B	EMBK FILL, PLACE & SHAPE	176000	CY	3.55	624,800	124,960	20.0%	1,5
06.0.1.B	EMBK FILL, SHAPE	20000	CY	1.60	32,000	6,400	20.0%	1,5
06.0.1.B	RIPRAP	2400	TON	28.00	67,200	20,160	30.0%	2,3,5
	TOTAL				815,092	168,238		
06.-.-.-	CROSS DIKE REPAIR							
06.0.A.-	MOB & DEMOB	1	LS	19100.00	19,100	1,910	10.0%	2
06.0.1.B	EMBK. FILL, PLACE AND SHAPE	121000	CY	3.40	411,400	82,280	20.0%	1,5
06.0.1.B	CLEARING AND GRUBBING	5.2	ACR	1810.00	9,412	1,882	20.0%	1,5
06.0.1.B	SEEDING	11	ACR	1150.00	12,650	2,530	20.0%	5,6
06.0.C.B	CRUSHED STONE (PERM. ACCESS RD.)	1600	TON	19.30	30,880	6,176	20.0%	2,3
06.0.1.B	PERMANENT EROSION MATT	1500	SY	10.00	15,000	3,000	20.0%	1,6,3
06.0.1.B	TEMP EROSION CNTRL MATT	6000	SY	1.25	7,500	1,500	20.0%	1,6,3
	TOTAL				505,942	99,278		

TABLE 13-1 (Cont'd)

CHAUTAUQUA LAKE
REHABILITATION AND ENHANCEMENT EMP
PROJECT COST ESTIMATE
MARCH 1991 PRICE LEVEL

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %	REASONS
06.-.-.-	FISH TOXICANT TREATMENT							
06.0.1.B	FISH TOXICANT TREATMENT, UPPER LAKE	1	LS	60000.00	60,000	12,000	20.0%	4,6
06.-.-.-	UPPER LAKE GRAVITY OUTLET							
06.0.5.B	DEWATERING	1	LS	17000.00	17,000	4,250	25.0%	1
06.0.5.B	STRUCTURAL CONCRETE	47	CY	450.00	21,150	3,173	15.0%	4,6
06.0.5.B	60" RCP	172	LF	240.00	41,280	6,192	15.0%	1,3,5
06.0.5.E	TRASH RACK ASSEMBLY	1	LS	2300.00	2,300	345	15.0%	4,6
06.0.5.E	SLIDE GATE ASSEMBLY	1	LS	12100.00	12,100	1,815	15.0%	3,6
06.0.5.B	RIPRAP	380	TON	27.00	10,260	3,078	30.0%	2,3
	TOTAL				104,090	18,853		
06.-.-.-	MODIFICATION OF EXISTING RADIAL GATE STRUCTURE							
06.0.5.B	SITE PREPARATION	1	LS	10000.00	10,000	3,000	30.0%	1,5,6
06.0.5.B	STRUCTURAL CONCRETE	110	CY	455.00	50,050	7,508	15.0%	4,6
06.0.5.E	STOP LOG ASSEMBLY	8	EA	2000.00	16,000	3,200	20.0%	4,6
06.0.5.E	BAR GRATES	8	EA	1000.00	8,000	1,600	20.0%	4,6
06.0.5.P	PORT GATE POWER GENERATOR	1	EA	3000.00	3,000	600	20.0%	3,6
06.0.5.Q	GEARED GATE LIFTERS	4	EA	1200.00	4,800	960	20.0%	4,6
06.0.5.B	RIPRAP	3000	TON	27.00	81,000	24,300	30.0%	2,3,5
	TOTAL				172,850	41,168		
06.-.-.-	LWR LAKE WATER CONTROL, STOP LOG STRUCTURE							
06.0.5.B	DEWATERING	1	LS	15800.00	15,800	3,950	25.0%	1,4
06.0.5.B	EXCAVATION	325	CY	3.95	1,284	193	15.0%	1
06.0.5.B	STRUCTURAL BACKFILL	250	CY	17.20	4,300	1,075	25.0%	2,3,4
06.0.5.C	STRUCTURAL CONCRETE	211	CY	365.00	77,015	11,552	15.0%	2,3,5
06.0.5.E	STEEL POSTS W/SAFETY CHAIN	25	LF	22.00	550	110	20.0%	6
06.0.5.-	STOP LOGS	310	LF	2.55	791	158	20.0%	6
06.0.5.B	RIPRAP	155	TON	27.00	4,185	1,256	30.0%	2,3
	TOTAL				103,924	18,293		

TABLE 13-1 (Cont'd)

CHAUTAUQUA LAKE
REHABILITATION AND ENHANCEMENT EMP
PROJECT COST ESTIMATE
MARCH 1991 PRICE LEVEL

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %	REASONS
06.0.5.B	LOWER LAKE EXCAVATION	29500	CY	3.80	112,100	28,025	25.0%	1,5
06.-.-.-	BOAT RAMP REPLACEMENT	1	LS	60500.00	60,500	15,433	25.0%	1,4,6
06.-.-.-	SIDE CHANNEL EXCAVATION							
06.0.A.-	MOB AND DEMOB	1	LS	80,200.00	80,200	8,020	10.0%	2
06.0.1.B	CLEARING/GRUBBING	16.9	ACR	1,810.00	30,589	6,118	20.0%	1,5
06.0.1.B	EXCAVATION	195900	CY	1.90	372,210	55,832	15.0%	1,5
06.0.1.B	ROCKFILL	800	TON	29.85	23,880	3,582	15.0%	2,3,5
06.0.1.B	RIPRAP	5700	TON	33.70	192,090	28,814	15.0%	2,3,5
06.0.1.B	SEEDING	19	ACR	1,150.00	21,850	4,370	20.0%	5,6
	TOTAL				72[illegible],819	106,735		
	SUBTOTAL, FISH AND WILDLIFE FACILITIES				3,145,852			
	CONTINGENCIES; AVERAGE OF	18.9%				594,148		
06.	TOTAL, FISH AND WILDLIFE FACILITIES				3,740,000			

REASONS FOR CONTINGENCIES: 1. UNKNOWN SITE CONDITIONS, 2. UNKNOWN HAUL DISTANCE, 3. UNIT PRICE UNKNOWN, 4. QUANTITY UNKNOWNS, 5. DIFFICULT SITE ACCESS, 6. UNKNOWN FINAL DESIGN

30.	PLANNING, ENGINEERING AND DESIGN		669,000	
	DEFINITE PROJECT REPORT	541,000		
	PLANS AND SPECIFICATIONS	112,000		
	ENGINEERING DURING CONSTRUCTION	16,000		
31.	CONSTRUCTION MANAGEMENT		245,000	
	CONTRACT ADMINISTRATION	91,000		
	REVIEW OF SHOP DRAWINGS	9,000		
	INSPECTION AND QUALITY ASSURANCE	145,000		
		TOTAL	4,654,000	

TABLE 13-2

Estimated Annual Operation and Maintenance Costs
(March 1991 Price Level)

	Qty	Unit	Unit Cost ($)	Total Cost ($)
Operation				
Pump station power	67,200	kWh	.075	5,040
Pump station operation	120	Hr	23.00	2,760
Gate operation	80	Hr	23.00	1,840
Maintenance				
Levee inspection	40	Hr	23.00	920
Levee mowing (once/yr min.)	21	Ac	45.00	945
Pump replacement ($125,000 in year 25, annualized)	1	Job	SUM	1,400
Pump station maintenance	20	Hr	100.00	2,000
Access road crushed stone	20	Ton	20.00	400
Debris removal	40	Hr	50.00	2,000
Sediment excavation [1] ($245,000 in year 25, annualized)	1	Job	SUM	2,700
Stoplog replacement	10	Ea	10.00	100
Riprap	120	Ton	28.00	3,360
Levee erosion control	20	Hr	100.00	2,000
Rehabilitation [2]				
			Subtotal	25,465
Contingencies				4,335
			TOTAL	29,800

[1] For pump station channel maintenance, the upper portion of Liverpool Ditch will require re-excavation in approximately 25 years.

[2] 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 the result of major storms or flood events.

TABLE 13-3

Estimated Post-Construction Annual Monitoring Costs ($)
(March 1991 Price Level)

Item	Annual Cost ($)
Water Quality Data [1]	6,400
Engineering Data [1]	3,000
Natural Resource Data [1]	2,000
Subtotal	11,400
Contingencies	1,710
Subtotal	13,100
Planning, Engineering, Design [2]	1,300
Contract Management	1,000
Total	15,410

[1] Reference tables 12-2 and 2-3.

[2] Includes cost of annual evaluation report.

14. REAL ESTATE REQUIREMENTS

a. **General.** All project features are located on lands owned by the Department of the Interior, USFWS.

b. **Local Cooperation Agreements/Cost-Sharing.** The project is proposed for 100 percent Federal funding for first costs. The Lake Chautauqua project area is part of the Chautauqua National Wildlife Refuge. The Water Resources Development Act of 1986 (Public Law 99-662) is the basis for first cost Federal funding and provides:

Section 906. FISH AND WILDLIFE MITIGATION.

(e) ... the first cost of such enhancement shall be a Federal cost when -

(3) such activities are located on lands managed as a national wildlife refuge.

c. **Construction Easements.** All project features are located on lands owned by the Federal Government. The USFWS has provided a letter of consent authorizing work on Department of Interior lands.

15. SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 15-1 presents the schedule of project completion steps.

TABLE 15-1

Project Implementation Schedule

Requirement	Scheduled Date
Submission of Draft DPR to Corps of Engineers, North Central Division for Review	Aug 90
Distribution of DPR for Public and Agency Review	Mar 91
Submission of Final and Public Reviewed DPR to North Central Division	Jun 91
Receive Plans and Specifications Funds	Jun 91
Construction Approval by Assistant Secretary of the Army (Civil Works)	Nov 91
Submit Final Plans and Specifications to North Central Division for Review and Approval	Dec 91
Obtain Approval of Plans and Specifications	Jan 92
Advertise Contract	Jan 92
Award Contract	Mar 92
Complete Construction	Sep 93

16. 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 detailed 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 is the Federal sponsor of the project and will determine that all project features are compatible with Refuge purposes and in compliance with the National Historic Preservation Act. The USFWS will ensure that operation and maintenance functions, described in table 13-2 of this report, are performed in accordance with Section 906(e) of the 1986 Water Resources Development Act. A draft Memorandum of Agreement between the Corps of Engineers and the USFWS is included in appendix C. 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. Authorization has been provided to the Corps of Engineers for construction on USFWS-owned lands.

c. **Illinois Department of Conservation.** The IDOC, the non-Federal sponsor of the project, has provided technical and other advisory assistance during all phases of the project and will continue to provide assistance during project implementation. The IDOC will cooperate with the USFWS to ensure that operation and maintenance, and any mutually agreed-upon rehabilitation, will be accomplished in accordance with the Water Resources Development Act of 1986.

17. COORDINATION, PUBLIC VIEWS, AND COMMENTS

a. **Coordination Meetings.** Close coordination between the Corps of Engineers, the USFWS, and the IDOC was effected during the study period. A listing of meetings follows:

(1) November 15, 1988. On-site meeting conducted with IDOC, USFWS, and CENCR to scope proposed project.

(2) November 28, 1989. Off-site meeting conducted with USFWS, IDOC, and CENCR to develop design alternatives.

(3) December 11, 1989. On-site meeting conducted with USFWS, SHPO, and CENCR to discuss archeological sites known to exist on the site and SHPO concerns.

(4) March 26, 1990. On-site meeting conducted with IDOC, USFWS and CENCR to discuss feasibility of alternatives.

(5) January 3, 1991. Off-site meeting conducted with IDOC, USFWS, and CENCR to coordinate design changes and confirm management plan.

(6) April 15, 1991. A public information meeting was jointly conducted by the USFWS, CENCR, and IDOC.

b. **Environmental Review Process.** This project meets the requirements of the National Environmental Policy Act as evidenced by the attached Environmental Assessment and Finding of No Significant Impact.

18. CONCLUSIONS

Lake Chautauqua has experienced deterioration of its habitat value as a result of sedimentation and inability to manage water levels. Waterfowl usage of this area has declined. Fisheries have been severely impacted by reduced water quality, depths, and lack of preferred habitats. The lake's wetland communities have lost prime habitat as a result of sedimentation. The broad expanse of the lake, in combination with the extremely soft sediments which make up the lake bed, promote wind fetch and rough fish generated turbidity, thereby inhibiting photosynthetic activity and lake bed consolidation. This, combined with the inability to dewater the lakes efficiently, precludes aquatic vegetation rooting, growth, and survival.

The proposed construction features meet the project objectives of increasing submergent and emergent vegetation in the upper and lower lakes and creating flowing side channel and deepwater slough habitat. By reestablishing Liverpool side channel flow and improving water control capability for both the upper and lower lakes of Lake Chautauqua, the project area and its environments should realize improved fisheries and expanded waterfowl usage throughout the 50-year project life expectancy.

Complete implementation of these project features will result in the following habitat outputs: increased submergent vegetation in the upper lake needed by waterfowl (primarily divers) and fish; increased moist soil plants in the lower lake for dabbling ducks and other wetland birds; off-channel deep water for wintering fish; flowing side channel habitat; and stable levels to benefit freshwater fishery resources.

19. RECOMMENDATIONS

I have weighed the accomplishments to be obtained from this habitat rehabilitation and enhancement project against its cost and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, this project, as proposed, justifies expenditures of Federal funds. I recommend that the Secretary of the Army for Civil Works approve construction to include: raising approximately 3.8 miles of existing levee and cross dike; construction of a pump station, 2 gravity outlet structures, and requisite drainage channels; and side channel excavation.

The estimated construction cost of this project is $4,113,000. Total project cost estimate, including general design, is $4,654,000. All project costs are to be 100 percent Federal costs.

At this time, I further recommend that funds in the amount of $112,000 be allocated for the preparation of plans and specifications.

John R. Brown
Colonel, U.S. Army
District Engineer

FINDING OF NO SIGNIFICANT IMPACT
FOR
LAKE CHAUTAUQUA NATIONAL WILDLIFE REFUGE
REHABILITATION AND ENHANCEMENT

Having reviewed the information contained in this Environmental Assessment, I find that the proposed project will have no significant adverse impacts on the environment. This action is not a major Federal action, and therefore preparation of an Environmental Impact Statement (EIS) is not required. This decision may be reevaluated if developments warrant it.

Factors that were considered in making the determination that an EIS is not required were:

a. Implementation of the selected plan will benefit nationally significant waterfowl and wetland resources.

b. The proposed action is complementary to the Lake Chautauqua National Refuge goals and objectives.

c. There were no significant adverse comments received on the project from public review.

d. Adverse effects on fish and wildlife resources from construction are temporary.

18 June 1991
Date

John R. Brown
Colonel, U.S. Army
District Engineer

REVISED JUNE 1991

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APPENDIX A

CORRESPONDENCE

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS

APPENDIX A
CORRESPONDENCE

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Illinois Historic
Preservation Agency

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

217/785-4997

Mason County
Chautauqua National Wildlife Refuge
Lake Chautauqua Habitat Rehabilitation
and Enhancement Project
IHPA Log #89103001

November 15, 1989

United States Department of the Interior
Fish and Wildlife Service
Attn: Matthias A. Kerschbaum
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Dear Sir:

Thank you for requesting comments from our office concerning the possible effects of the project referenced above on cultural resources. 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".

We have reviewed the above referenced project and are concerned about the extent of mechanical dredging of the Liverpool ditch, Meyers ditch and the excavation of the lake bottom for island construction. While your statement that underwater archaeology is problematical is valid, we are more concerned about impacts of this project on the ditch edges (widening), disposal areas for the dredged material and disturbance of possibly now inundated sites located on the lake bed. Prehistoric occupations were often located on small floodplain ridges, and as noted in your letter, these are the very places most likely for excavation of material for island construction.

We are unsure from the project submittal if the lake level will be lowered during the project activities. If so, this would present an opportunity to conduct an archaeological survey at that time of any exposed land surface. If not, a review of the cores taken from the lake bed by an archaeologist may provide insights into the potential location of prehistoric sites in the dredging areas.

At this time, it is our opinion a Phase I archaeological reconnaissance survey should be conducted along the areas of Liverpool and Meyers ditches to be dredged and all disposal area for dredged materials that have not been previously disturbed. The Phase I archaeological reconnaissance survey would possibly require trenching to determine if sedimentation has buried cultural occupations.

Illinois Historic
Preservation Agency

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

We would like additional information on the extent of lowering of Lake Chautauqua and the amount of land potentially exposed.

Enclosed you will find an attachment briefly describing Phase I surveys and listing archaeological contracting services. A copy of our letter should be provided to the selected professional archaeological contractor for his information.

If you have any further questions, please contact Paula G. Cross, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-4998.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:PGC:kh

Enclosure - Arch. Cont. Surv.

FWS/ARW-SS

APR 26 1990

Mr. Michael Devine
State Historic Preservation Officer
Illinois Historic Preservation Agency
Preservation Services Division
Old State Capitol
Springfield, Illinois 62701

Dear Mr. Devine:

This letter is a continuation of consultation regarding the Lake Chautauqua Habitat Rehabilitation and Enhancement Project at Chautauqua National Wildlife Refuge in Mason County. Your letter dated November 15, 1989 (IHPA Log #89103001), identified potential for the project to affect archeological resources and led to an on-site meeting on December 11, 1989. Since that time the U.S. Army Corps of Engineers, Rock Island District, has modified the project in an effort to address the concerns raised by Ms. Paula Cross of your office. On April 25, 1990, John Dobrovolny of our office discussed these recent developments with Ms. Cross.

Enclosed for your information are drawings of the modified project including penciled-in changes provided by the Rock Island District. The substantive project modifications are listed as follows. The multiple-branched channel originally proposed for the Upper Lake has been replaced by one channel that will be confined to inundated floodplain of historically low relief, areas probably devoid of prehistoric habitation because of wetland conditions. Channel dredging in the Lower Lake would be restricted to two short segments, similarly placed in areas of low relief. Dredging of existing ditches would be limited to removal of accumulated silt. At the opening of Liverpool Ditch at the Illinois River, both banks would be riprapped to prevent any erosion, which would thus protect the prehistoric Liverpool Lake Site.

In our opinion these project modifications succeed in avoiding impacts to archeological properties that meet the criteria for the National Register of Historic Places. If you disagree, please provide us with a suggested research strategy to guide an archeological study. Otherwise we would appreciate your

concurrence that this redefined project will have no effect on eligible properties. The Rock Island District has requested decisions be made by June 1990, so we would appreciate your response as soon as possible before May 31, 1990.

Sincerely,

/s/ Matthias A. Kerschbaum

Matthias A. Kerschbaum

Enclosure

bcc: CTQ
COE, Rock Island
SS

Illinois Historic Preservation Agency

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

217/785-4997

MASON COUNTY
Chautauqua National Wildlife Refuge
Lake Chautauqua Habitat Rehabilitation
and Enhancement Project

May 25, 1990

Mr. Matthias A. Kerschbaum
United States Department of the Interior
Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Dear Sir:

Thank you for the additional information on the above referenced project. The revisions proposed address our previous concerns regarding this project and its potential affect on historic resources. Riprapping of both banks should prevent erosion of the Liverpool Lake site (11-Mn-163), located adjacent to the proposed activities. Accordingly, it is our opinion no significant archaeological, historical or architectural resources are located within the project area and that the preventive measures (riprapping) will cause the project activities to have no effect on the Liverpool Lake site.

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

If you have any further questions, please contact Paula G. Cross, Senior Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-4998.

Sincerely,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:PGC:bb

cc: Bill Callahan

United States Department of the Interior

FISH AND WILDLIFE SERVICE

CHAUTAUQUA NATIONAL WILDLIFE REFUGE
R. R. 2, BOX 61-B
HAVANA, ILLINOIS 62644
Telephone 309/535-2290

IN REPLY REFER TO:

September 12, 1990

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

Dear Sir:

I would like to comment on the Draft Definite Project Report for Lake Chautauqua, Illinois, Habitat Rehabilitation and Enhancement Project.

Water Control Structure. The text calls for the water control structure on the south end to have a sill elevation of 429.0' NGVD (page 37). This appears to me to be an adequate elevation. However, if I read the design properly on Plate 16, the sill is to be at 431.0' This elevation would not adequately drain the lake.

Cross Dike Repair. I am again concerned that riprap was not included to protect the dike. During high water and high southwest winds, the 3-1/2 mile open stretch of water creates waves of 3 - 4 feet. Even with slopes at 6:1 grade, waves of that magnitude will devastate the unprotected levee. Even if we were fortunate to have grass become established before high water comes, which is doubtful, long periods of high water which have happened historically here, including 1990, will kill the grass. I do not want to see a repeat of the 1969 dike construction which failed due to lack of armoring. Since money is an obstacle, I recommend eliminating the pump station from this proposal. The monies saved could be used to purchase riprap. The pump station would be useless without a functional cross dike. Some riprap is found on the existing dike and could be re-used. Some form of structure at the pump site would still be needed to allow full dewatering of the Upper Lake through the Lower Lake if river conditions allowed.

The only way I see the cross dike holding without riprap is to construct the slopes at similar grade as exists on natural beaches.

Sincerely yours,

Glen R. Miller
Refuge Manager

GRM/ac

Illinois Historic Preservation Agency

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

Suite 4-900 State of Illinois Center 100 W. Randolph Chicago, IL 60601 (312) 814-1409

217/785-4997

MASON COUNTY
Chautauqua National Wildlife
Refuge Lake Chautauqua Habitat Rehabilitation
and Enchancement Project

IHPA LOG #89103001

September 21, 1990

Mr. Jerry A. Skalak, Manager
Rock Island District Habitat Program
District Engineer, US Corps of Engineers
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204-2004

Dear Sir:

Thank you for requesting comments from our office concerning the possible effects of the project referenced above on cultural resources. 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".

Thank you for the opportunity to comment on the Lake Chautauqua Rehabilitation and Enchancement Draft Report. Our staff has reviewed this document and has determined that adequate consideration was given to cultural resources in the planning stages of this project. As presently proposed, no significant historic, architectural, and archaeological resources are located within the area to be impacted by construction activities.

If you have any further questions, please contact Joyce A. Williams, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-1279.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:JAW:bb0968A/75

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fisheries Assistance Office
P. O. Box J
Carterville, Illinois 62918
(618) 997-6869

IN REPLY REFER TO:

12/7/90

U.S. Army Corps of Engineers
Clock Tower Bldg.
P.O. Box 2004
Rock Island, IL 61204-2004

ATTN: Planning Division
Dan Holmes

Dear Mr. Holmes

This is in response to a request by Chautauqua National Wildlife Refuge to comment direct on some important changes to the Lake Chautauqua DPR.

My understanding of the major change is to delete the deep dredging in the interior of the North Pool and raise the North Pool levee to protect from 10-year flood events. Interior borrow for the levee would provide some deep water habitat along the levee base.

I support the revisions 100 percent. Flood related sedimentation at the site is a major problem and any thing that can reduce this is a worthwhile investment.

Problems related to insufficient deep water overwintering habitat should be solvable with a water management plan which permits us to hold water above winter pool level in the Illinois River.

This is short and sweet but I hope it address your concerns. If you have questions please call 618-997-6869.

Sincerely,

Charles J. Surprenant
Project Leader

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-1696

Rock Island District Corps of Engineers
Lake Chautauqua EMP
Log #C-864-90

December 13, 1990

Mr. Jerry Skalak
Rock Island District Corps of Engineers
Planning Division
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204

Dear Mr. Skalak:

We have reviewed the revision to Alternative B of the Lake Chautauqua EMP project, dated November 26, 1990. We have no objection or comment on the deletion of plans to excavate the Upper Lake drainage channel and reconstruct the cross dike and northern levee.

The proposed levee work, using material excavated from adjacent borrow areas within the lake, must have adequate erosion and sediment controls to prevent loss of this material to the lake or unnecessary resuspension during dredging. We recommend that all in-lake construction be conducted in the dry, as noted in the draft report (p. 30).

Please advise this office of any subsequent changes to the Lake Chautauqua EMP project. If you have any questions on these matters, contact Bruce Yurdin of my staff.

Very truly yours,

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

TGM:BY:bjh/4251n/99

cc: IEPA Records

CHAUTAUQUA NATIONAL WILDLIFE REFUGE
Established 1936

Compatibility Study
LAKE CHAUTAUQUA REHABILITATION

Establishment Authority:

Chautauqua National Wildlife Refuge was established on December 23, 1936, by Executive Order 7524.

Purpose for Which Established:

The lands purchased under Executive Order 7524 were acquired as a refuge and breeding ground for migratory birds and other wildlife.

Description of Proposed Use:

The proposal is a Habitat Rehabilitation and Enhancement Project (HREP) authorized by the Water Resource Development Act of 1986 (Public Law No. 99-262). The Army Corps of Engineers (COE), as part of the environmental management program derived from construction of a new dam and enlarged lock at Alton, Illinois, has proposed to construct a HREP project located on Lake Chautauqua, Mason County, Illinois, adjacent to the Illinois River between river miles 124 and 128. The project area includes a 3,500 acre floodplain lake and wetland complex managed by the U. S. Fish and Wildlife Service.

The project area has formerly been extensively used by migratory waterfowl. Historically, this wetland complex supported substantial populations of waterfowl, including large numbers of both dabbling and diving ducks. This use has declined as a result of the detrimental effects of sedimentation, which has resulted in the subsequent decline of aquatic vegetation and loss of wetland habitat. High wind fetch has further contributed to the resuspension of sediment. Additional problems include irregular flooding and structural inadequacies which currently make habitat management difficult and only marginally effective.

The proposed project would involve the repair of the existing cross dike between the upper and lower pools to a 10-year flood event elevation of 449 NGVD.

Additionally, the northern perimeter levee would be repaired to a 10-year flood event elevation of 449 NGVD.

The project will also include installation of a pump at the intersection of the cross dike and perimeter levee to further enhance water management capabilities.

An additional project feature will be a stoplog structure placed in the lower lake to facilitate lake drawdown.

The project will also involve excavation of lower lake drainage channels to provide drainage to the pump station and stoplog structure for enhanced water level management capabilities.

A total of approximately 8,300 feet of Liverpool Ditch will be excavated. This feature will provide a continuous water source for the pump station and will additionally provide flowing side channel habitat. Excavated material will be used in raising the cross dike and perimeter levee. The resulting flowing side channel habitat will also provide significant benefits for fish.

Anticipated Impacts on Refuge Purposes:

As a result of the project, waterfowl and fish habitat will be improved and increased, which should subsequently result in increased waterfowl and fish populations. This will be a direct benefit toward maintaining and accomplishing refuge purposes.

Justification:

The proposed project will contribute to refuge objectives.

Determination:

The proposed project is compatible with the purpose for which the refuge was established.

Determined by: Andrew C. French 01-11-91
Project Leader Date

Reviewed by: [signature] 1.11.91
Wildlife Associate Manager Date

Concurred by: [signature] 1-11-91
Regional Director Date

United States Department of the Interior

Fish and Wildlife Service
Rock Island Field Office (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

TAKE PRIDE IN AMERICA

In Reply Refer to:

COM: 309/793-5800
FTS: 782-5800

March 19, 1991

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

Dear Colonel Brown:

This constitutes our Fish and Wildlife Coordination Act report on the Chautauqua National Wildlife Refuge (NWR) Habitat Rehabilitation and Enhancement Project (HREP), Illinois River, Mason County, Illinois. The project is a component of the Upper Mississippi River System Environmental Management Program authorized 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 authority for this report is contained in Section 2 of the Fish and Wildlife Coordination Act of 1958 (Public Law 85-624).

The area proposed for the Chautauqua NWR HREP project is United States property currently managed by the U.S. Fish and Wildlife Service (FWS). The property was acquired in 1936 and incorporated into the National Wildlife Refuge System. Therefore, provisions of the National Wildlife Refuge Administration Act require that a compatibility statement, finding of no significant impact and a special use permit be approved by our Regional Directory prior to construction. The project planning process dictates that our statement be completed at the same time as your final report and environmental statement. It is for this reason that we have been designated as a cooperating agency for the purposes of compliance with National Environmental Policy Act.

BACKGROUND

The goal of the Upper Mississippi River System Environmental Management Program is to implement "...numerous enhancement efforts...to preserve, protect, and restore habitat

that is deteriorating due to natural and man-induced activities." The objective of these enhancement activities is to recover some of the riparian habitat diversity that has been lost due to construction of the Mississippi and Illinois River Navigation Projects and sedimentation. The Illinois River in particular suffers from a loss of backwater terrestrial and aquatic habitats. Oxbow lakes, riverine wetlands and bottomland hardwood forests have become scarce along the waterway.

PROJECT DESCRIPTION

The Chautauqua NWR HREP project is located within the boundaries of the Chautauqua National Wildlife Refuge. The area currently consists primarily of non-forest wetland and bottomland hardwoods. Prior to Federal acquisition the tracts were part of a levee and drainage district. The outer levee still serves as a water level control structure for interior habitats. The FWS manages the area primarily for migrating waterfowl. Water level manipulations are utilized as much as possible, to encourage moist soil plant growth to improve habitat conditions for migrating birds. These manipulations are dependent on the stage of the river, and structural inadequacies and failures currently make habitat management activities difficult and only marginally effective.

The proposed project would involve repairing the cross dike between the upper and lower pools, raising the elevation of the outer levee from a two-year to a 10-year level of protection installing a pump system to provide effective water level management capabilities to both pools, and replacing the water level control structure on the south end of the lower pool. The objective is to improve habitat condition principally for diving ducks in the upper pool and dabbling ducks in the lower pool. In addition, a portion of the Liverpool Channel would also be dredged to improve fish habitat conditions in this area of the Illinois River.

METHODOLOGY

In order to quantify the existing habitat conditions and the impacts of the proposed features on the Chautauqua NWR HREP project area a habitat evaluation was performed at the site. The methodology selected was the Wildlife Habitat Appraisal Guide (WHAG) procedures developed by the Missouri Department of Conservation and the U.S.D.A. Soil Conservation Service. A list of variables for each habitat type are measured on site and from these an estimation of existing habitat values, measured in habitat units, can be made for several wildlife species. Once existing habitat values are determined, the variables affected by proposed project features are re-evaluated to calculate impacts to the selected evaluation species resulting from project implementation.

For project planning and impact analysis purposes, project life was established as 50 years. In order to provide a standard of comparison for the 50-year analysis, target year

conditions were established at years 0 (existing conditions), 1, 5, 10, 25 and 50, and average annual habitat units were calculated for each evaluation species, based on expected habitat conditions over the evaluation period.

Mallard (*Anas platyrhynchos*) and diving ducks, a multi-species guild consisting of canvasback (*Aythya valisineria*), redhead (*Aythya americana*), lesser scaup (*Aythya affina*), greater scaup (*Aythya marila*), ring-necked duck (*Aythya collaris*), common goldeneye (*Bucephala clangula*), and bufflehead (*Bucephala albeola*) were selected as the primary species of concern for this project, in keeping with established refuge goals. Wood duck (*Aix sponsa*) and green-backed heron (*Butorides striatus*) were also selected as evaluation species for the same reason. In addition, channel catfish (*Ictalurus punctatus*), walleye (*Stizostedion vitreum*), and largemouth bass (*Micropterus salmoides*) were selected as evaluation species to determine the impacts of proposed project features on aquatic /fisheries habitat values within and adjacent to the refuge.

EXISTING FISH AND WILDLIFE RESOURCES

Existing aquatic and terrestrial resources at the Chautauqua NWR project site are summarized in the following table.

Table 1 - Chautauqua National Wildlife Refuge, Havana, IL
Existing Aquatic and Terrestrial Resources

HABITAT	ACRES
Aquatic (Deep water)	0
Non-forested Wetland (Shallow water-vegetated and open)	
Upper Pool	997
Lower Pool	2250
Liverpool Channel	70
Total Non-forested Wetland	3317
Bottomland Hardwood Wetland	
Upper Pool	103
Upper Levee	31
Cross-Dike	23
Lower Pool	340
Lower Levee	64
Liverpool Island	402
Total Bottomland Hardwood Wetland	923
Grassland	0
TOTAL ACRES IN PROJECT AREA	4240

Historically, Lake Chautauqua, which is now divided into an upper and lower pool by a cross dike, provided a diverse and productive fishery. Over the past 50 years, however, the fishery has declined for a number of reasons. The combination of water level manipulations to manage that area for waterfowl, unpredictable and periodic flooding from the adjacent river, and increased sedimentation over the last 20 years have all affected aquatic plant growth, water quality and depths, reducing fisheries values. At present, the most common fish species utilizing the area include carp (*Cyprinus carpio*), freshwater drum (*Aplodinotus grunniens*), buffalo (*Ictiobus spp.*) and bullhead (*Ictalurus spp.*). Other species, such as channel catfish, walleye, largemouth bass, and smallmouth bass (*Micropterus dolomieui*), crappie (*Pomoxis spp.*), and bluegill (*Lepomis macrohirus*) also use the area seasonally, when water conditions are favorable.

Immediately adjacent to the levee which forms Lake Chautauqua, on the riverward side, is the Liverpool Channel. This channel was created as a result of the levee construction during the early part of this century. It connects with the river just upstream of the cross-dike and forms an intermittently flowing side channel for about three miles, until it rejoins the river near the downstream end of the refuge. It currently is one of the few remaining flowing side channels on the Illinois River. Over the last 70 or so years since its construction, sedimentation has eliminated most fisheries values associated with the channel. It currently provides fish habitat only during high water periods.

The area within the levee consists of approximately 3247 acres of non-forested wetland - 997 acres in the upper pool and 2250 acres in the lower pool, separated by a cross-dike. These areas are currently managed as a single pool because shortly after its construction in 1969, a breach occurred in the cross-dike between the two pools, making independent management impossible. When river levels permit, the pools are drawn down to sill elevation to encourage aquatic plant growth within the pools. The existing sill elevation of the upper pool water level control structures is 433.5 feet National Geodetic Vertical Datum (NGVD), and the lower pool sill is at 433.0 NGVD. Average bottom elevation of both pools is about 431 NGVD, some 2.5 feet below existing sill elevation. Even when river water levels permit, pool levels can only be drawn down enough to expose about 200 acres of bottom substrate. The remaining acres rarely, if ever, dry out. This inability to completely dewater the pools leaves the bottom in an unconsolidated condition, vulnerable to resuspension by wind generated waves.

In addition, the existing levee surrounding both pools has an emergency spillway, located in the lower pool, which allows river flood waters to enter Lake Chautauqua at an elevation of 444.6 NGVD, the pools are usually flooded at least once or twice per year. Suspended sediments carried in by these flood waters greatly increase turbidity and add to the supply of flocculants susceptible to resuspension.

These factors have greatly reduced the extent of historic aquatic plant communities within the lake, reducing and limiting its value for migratory waterfowl, as well as other fish and wildlife species. Waterfowl use on the refuge has declined significantly since

waterfowl censuses began on the refuge in the 1940's. Peak annual numbers of waterfowl using the refuge have dropped from over 600,000 ducks in 1954, to approximately 200,000 in the 1970's and were only about 56,000 in 1989.

Aside from waterfowl, great blue herons (*Ardea herodias*), greenbacked herons, great egrets (*Casmerodius albus*) and blackcrowned night herons (*Nycticorax nycticorax*) are among the more common avian species found on the refuge. White-tailed deer (*Odocoileus virginianns*), squirrels (*Sciurus spp.*), skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), red fox (*Vulpes vulpes*), muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and mink (*Mustela vison*) are also common.

The bald eagle (*Haliaeetus leucocephalus*) and the Indiana bat (*Myotis sodalis*) are the only federally listed threatened or endangered species that would be expected to utilize habitats on Chautauqua NWR. There are no bald eagle nesting sites on the refuge, but they do winter on the area, generally arriving in October and staying until the ice melts in spring. Habitat conditions on and around the refuge appear suitable for Indiana bats and some tree removal will be required to complete the proposed project. However, the amount of cleaning required will have no impact on potential bat habitat.

FUTURE WITHOUT THE PROJECT

WHAG model results based on our assumptions for future trends indicate that habitat conditions on Chautauqua NWR will decline for most evaluation species over the next 50 years. Table 2 summarizes future without project (Alternative A) habitat unit (HU's) changes for each evaluation species over the 50-year evaluation period.

TABLE 2 - CHAUTAUQUA NATIONAL WILDLIFE REFUGE EMP - FUTURE WITHOUT PROJECT (ALTERNATIVE A) HABITAT CHANGES

	UPPER POOL			LOWER POOL			LIVERPOOL CHANNEL		
	TARGET YEAR HU's		PERCENT CHANGE	TARGET YEAR HU's		PERCENT CHANGE	TARGET YEAR HU's		PERCENT CHANGE
EVALUATION SPECIES	TY 0	TY 50		TY 0	TY 50		TY 0	TY 50	
MALLARD	347.4	472.4	36%	540	832.5	54%	112.2	100.5	-10
DIVING DUCKS	350	270	-23%	787.5	607.5	-23%	NE	NE	NE
WOOD DUCK	89.1	86.5	-3%	NE	NE	NE	202	213.1	5%
GREEN-BACKED HERON	768.5	849.2	8%	1440	1552.5	8%	157.1	193	23%
CHANNEL CATFISH	100	100	0%	225	225	0%	0.7	0.7	0%
WALLEYE	100	100	0%	225	225	0%	0.7	0.7	0%
LARGEMOUTH BASS	100	100	0%	225	225	0%	0.7	0.7	0%

NE - NOT EVALUATED
PERCENT CHANGE - POSITIVE NUMBER INDICATES NET INCREASE IN HABITAT VALUES, NEGATIVE NUMBER INDICATES NET DECREASE IN HABITAT VALUES
HU'S - HABITAT UNITS

Habitat Units are a reflection of habitat suitability (value) for a particular species multiplied by habitat available for that species. The changes in HU's over the evaluation period are a function of changes in the habitat suitability for each species (assuming acreages remain constant over time). This is the case in both refuge pools. In the Liverpool Channel area, bottomland hardwood wetland acreage will increase through succession so changes in HU's are related to changes in both parameters.

Mallard habitat conditions within the refuge will improve over the 50-year timeframe, primarily as a result of continuing sedimentation, which will lead to more shallow emergent marsh. Habitat conditions within the Liverpool Channel will deteriorate to some degree, primarily as a result of continuing sedimentation, and succession from shallow non-forested wetland to bottomland hardwood wetland.

Diving duck habitat conditions within the refuge will decline, as continuing sedimentation will result in the lake succeeding to more shallow emergent marsh that is less attractive to those species. Habitat conditions for divers were not evaluated in Liverpool Channel, primarily because the area is not suitable as diving duck habitat in its current condition. Also, the proposed project features would result in insignificant impacts to these species in this area.

Wood duck habitat conditions will deteriorate slightly in the upper pool, as a result of continuing sedimentation and its effects on the forested wetlands. Habitat conditions in the Liverpool Channel will improve as a result of the succession of approximately 28 acres of non-forested wetland in the area to bottomland hardwood wetland. Habitat conditions for wood ducks were not evaluated in the lower pool because proposed project features will not affect bottomland hardwoods in that area. Changes in habitat conditions similar to those in the upper pool can be expected in the lower pool over the same period.

Habitat conditions for green-backed herons will improve throughout the refuge and Liverpool Channel area, primarily as a result of the succession of both the non-forested wetland and bottomland hardwood wetland habitats. Continuing sedimentation will lead to more shallow emergent marsh, natural woodland succession will make both habitat types more attractive to herons.

The existing aquatic model is not sensitive enough to detect any changes in habitat conditions for the three fish species evaluated. However, it is apparent that aquatic habitat conditions will continue to decline over the 50-year period, as sedimentation reduces average water depths, and shallow open water areas convert to more vegetated marsh.

FUTURE WITH THE PROJECT

Four structural increments were analyzed over the 50-year project life. The first increment (Alternative B1) includes the repair of the cross dike between the upper and lower pools and the construction of a pumping station at the cross-dike to facilitate water level management of the pool. In order to facilitate the repair of the cross dike, approximately 21 acres of forested levee (bottomland hardwood wetland) will be converted to grassland. For analysis purposes it was assumed that this conversion would be permanent. Approximately 2200 feet of channel within the Liverpool Channel will need to be dredged to allow effective use of the proposed pumping station. Dredged material obtained from the channel will be used to repair the cross dike. In addition, approximately 8800 feet of channel will be excavated in the upper pool to provide the capability to fully dewater the pool. Material excavated from this channel will be side-cast in the pool to form approximately six acres of small islands that would be managed as grassland habitats. Neither the future grassland habitat on the levee nor the islands were evaluated, as the current WHAG grassland model does not contain variables to measure values for breeding waterfowl. The islands were indirectly evaluated, however, through their beneficial effects on the production of aquatic vegetation within the pool. The islands will serve to some degree as breakwaters to reduce wind-induced turbidity, thus improving conditions for plant growth.

After completion of the improvements in this increment, the upper pool will be managed on an approximately 10-year cycle. Following is a summary of the proposed management cycle.

YEAR 1 - dewater pool to consolidate bottom substrate

YEAR 2 - reflood and maintain water depth of six to eight inches to promote aquatic vegetation growth

YEAR 3 - increase water depth to three or four feet. Attempt stocking yellow perch fingerlings or broodstock, and largemouth bass fingerlings. Raise water after migration and maintain winter pool average depth of five to six feet.

For WHAG analysis purposes the cycle was assumed to be 10 years. Actual management will be based upon habitat conditions, and may differ from the proposed plan depending on those conditions, and responses to management activities.

The second increment (Alternative B2) includes Alternative B1, plus the construction of a new outlet/water level control structure on the south end of the lower pool. Two channels, totalling approximately 7500 feet in length, will also be excavated within the lower pool to provide the capability to fully dewater that pool. One of the two channels will run upstream to the pumping station, and the other will run downstream to the new outlet water level control structure to be constructed at the south end of the pool.

Dredged material obtained from these channels will be side-cast along the channels in an alternating fashion, creating several elevated areas approximately one to two feet higher than the surrounding ground. These raised areas will be managed as part of the moist soil unit, and were evaluated as such.

The third increment (Alternative C) involves the construction of several barrier islands within the upper pool. In contrast to the islands to be constructed in Alternative B1, the purpose of these islands is to reduce fetch, and thus the ability of wind generated waves to resuspend bottom sediments. This would result in reduced turbidity that would encourage the growth of aquatic plants within the pool. Three parallel islands would be constructed perpendicular to the prevailing winds, using materials dredged from immediately adjacent to the islands. These islands were evaluated as a completely separate feature to obtain an indication of their true capability to reduce sedimentation resuspension and promote aquatic vegetation growth. The islands would be managed as grassland habitat, and were not evaluated as habitat using the model.

The last increment (Alternative D) includes the excavation of 6750 feet of the Liverpool Channel to improve fisheries habitat conditions along this reach of the Illinois River. Excavation will begin at the upstream end of the Liverpool Channel to a point some 4550 feet downstream of the cross-dike. At that point a new channel would be excavated through Liverpool Island, reconnecting the excavated portion of Liverpool Channel with the main channel of the Illinois River. Approximately 14.8 acres of bottomland hardwood wetland would be converted to some other habitat type to accomplish this increment. Some 4.3 acres of hardwoods on the levee would be converted to grassland to facilitate dredging of the Liverpool Channel. An additional 4.3 acres would be converted to aquatic habitat during the construction of the new connecting channel (3.6 acres), approximately 0.7 will be excavated to provide a deep backwater area for fish wintering habitat. In addition, approximately 6.2 acres will be cleared on the island as a dredge material disposal site. This area was assumed to revert to bottomland hardwood wetland over time and was evaluated as such. Table 3 summarizes the acreages of each habitat type for each increment evaluated.

Table 3 - Chautauqua National Wildlife Refuge, Havana, IL

PLAN	B1	B2	C	D
ALTERNATIVE PLAN HABITAT ACREAGES				
AQUATIC	10	0	13	6.6
NON-FORESTED WETLAND	981	2250	984	0
BOTTOMLAND HARDWOOD WETLAND	103	300	103	374
BOTTOMLAND HARDWOOD LEVEE	33	64	54	0
GRASSLAND	27	0	0	4.3

TABLE 4 - CHAUTAUQUA NATIONAL WILDLIFE REFUGE EMP - WHAG ANALYSIS SUMMARY

	ALTERNATIVE B1			ALTERNATIVE B2			ALTERNATIVE C			ALTERNATIVE D			
EVALUATION SPECIES	WITHOUT	WITH	PERCENT CHANGE	WITHOUT	WITH	PERCENT CHANGE	WITHOUT	WITH	PERCENT CHANGE	WITHOUT	WITH	PERCENT CHANGE	
MALLARD	412	618	50%	679	1498	121%	412	442	7%	109	124	14%	AAHU'S
DIVING DUCKS	310	731	136%	698	788	13%	310	333	7%	NE	NE	NE	AAHU'S
WOOD DUCK	88	82	-7%	NE	NE	NE	88	88	0%	212	240	13%	AAHU'S
GREEN-BACKED HERON	819	837	2%	1501	1039	-31%	819	896	9%	178	275	54%	AAHU'S
CHANNEL CATFISH	100	194	94%	225	225	0%	NE	NE	NE	1	5	400%	AAHU'S
WALLEYE	110	213	94%	225	225	0%	NE	NE	NE	1	5	400%	AAHU'S
LARGEMOUTH BASS	110	281	155%	225	225	0%	NE	NE	NE	1	6	500%	AAHU'S

ALTERNATIVES
A - NO ACTION
B1 - UPPER POOL WATER LEVEL CONTROL
B2 - LOWER POOL WATER LEVEL CONTROL
C - UPPER POOL BARRIER ISLANDS
C - LIVERPOOL DITCH CLEANOUT - UPPER END

WITHOUT COLUMNS FOR ALL ALTERNATIVES B1 - D = ALTERNATIVE A
NE - NOT EVALUATED
AAHU - AVERAGE ANNUAL HABITAT UNIT
PERCENT CHANGE - POSITIVE NUMBER INDICATES INCREASE IN HABITAT UNITS, NEGATIVE NUMBER INDICATES DECREASE IN HABITAT UNITS

A-20

Figures 1 through 5 summarize the percent change in average annual habitat units (AAHU's) from without project conditions for each increment and evaluation species.

Alternative B1 (Upper Pool Water Level Control) will provide a 50 percent increase from without project conditions in AAHU's for mallards, and diving duck values will be more than doubled. These increases are the result of water level management capabilities, and the effects these capabilities will have on bottom substrate consolidation, sediment resuspension, and ultimately on aquatic vegetation growth within the pool. Wood duck values will be reduced slightly - by seven percent, as a result of the loss of bottomland hardwood wetland along the levees. Heron values will remain essentially the same. Whag model results indicate an increase in AAHU's of two percent.

Alternative B2 (Lower Pool Water Control) provide a 121 percent increase from without project conditions in AAHU's for mallards, and a modest (13 percent) increase in benefits for diving ducks. Wood ducks were not evaluated in this increment, as the proposed features would not affect habitat values for this species. In comparison to the other species, this increment will result in a reduction of heron AAHU's of almost a third (31 percent). These changes in habitat values are the result of improved water level management capabilities within this pool. The objective of the management plan will be to provide emergent aquatic vegetation for waterfowl during the migratory seasons. These same capabilities will cause the decline in heron habitat values as a result of the loss of shallow emergent marsh habitat throughout the summer months, when the marsh is drawn down to stimulate moist soil plant growth.

Alternative C (Upper Pool Barrier Islands) results in very little AAHU improvement for any evaluation species. Mallard and diving duck benefits are both improved by only a modest seven percent. Wood duck values remain the same and heron values are improved by nine percent. These changes are a reflection of a slight improvement in aquatic plant growth in the wind shadow of these islands. By the same token, however, they are also limited by the inability of the islands to reduce sediment resuspension to the degree necessary to significantly improve habitat conditions.

Alternative D (Liverpool Channel Cleanout) is primarily a fisheries habitat improvement increment, but would also impact habitat used by three of the four terrestrial evaluation species. This alternative will result in a 14 percent improvement in mallard habitat values, a 13 percent increase in wood duck habitat values and a 54 percent increase in heron habitat values over without project conditions. Diving duck habitat was not evaluated as the area has very low, if any, current values, and proposed project features would result in insignificant impacts related to this species. These increases are the result of improvements in wetland habitat characteristics, primarily water conditions, aquatic plant growth, and bottomland hardwood wetland conditions, for each of these species over the project evaluation period.

FIGURE 1 – CHAUTAUQUA NWR HREP
ALTERNATIVE B1 – UPPER POOL WATER CONTROL

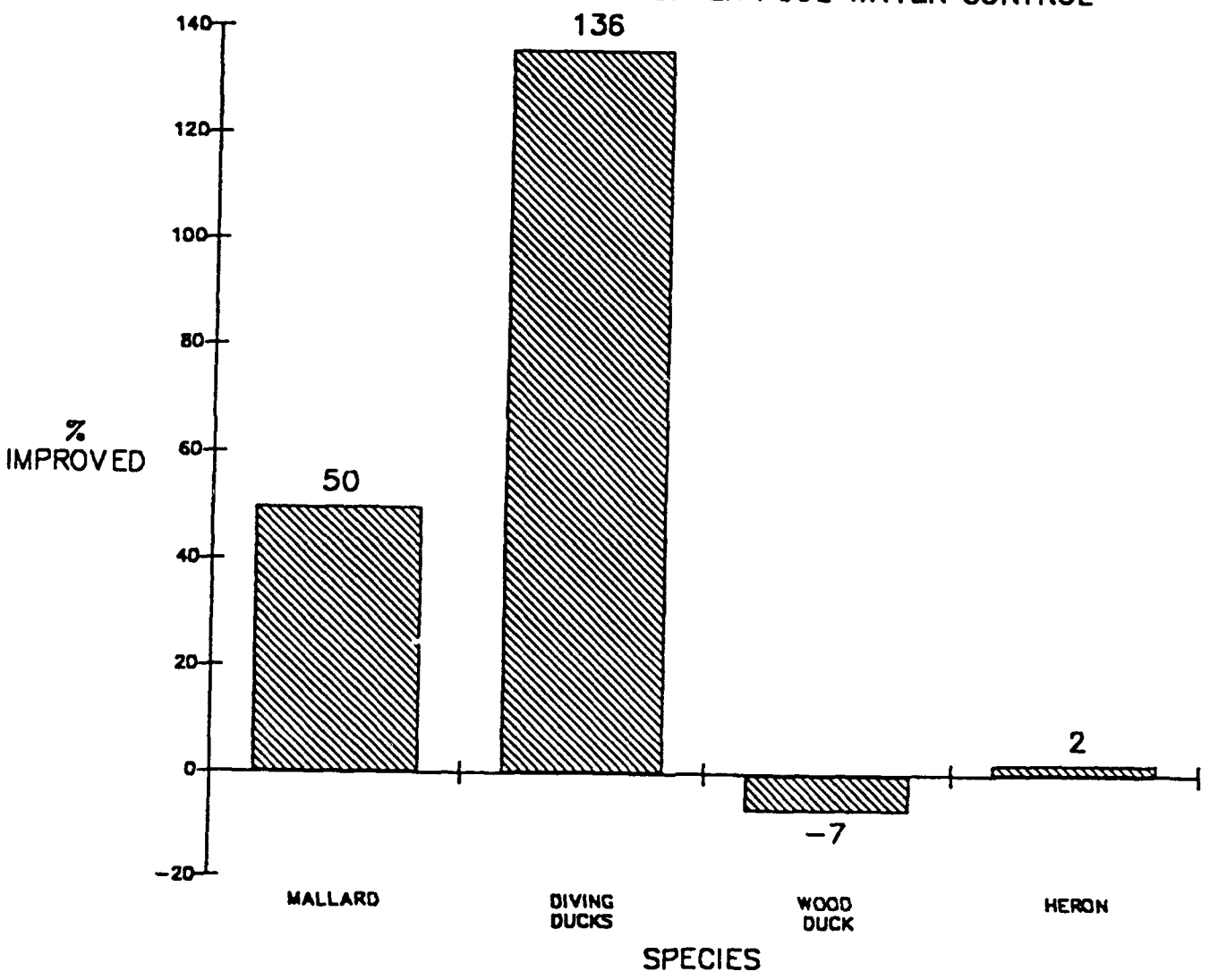

FIGURE 2 – CHAUTAUQUA NWR HREP
ALTERNATIVE B2 – LOWER POOL WATER CONTROL

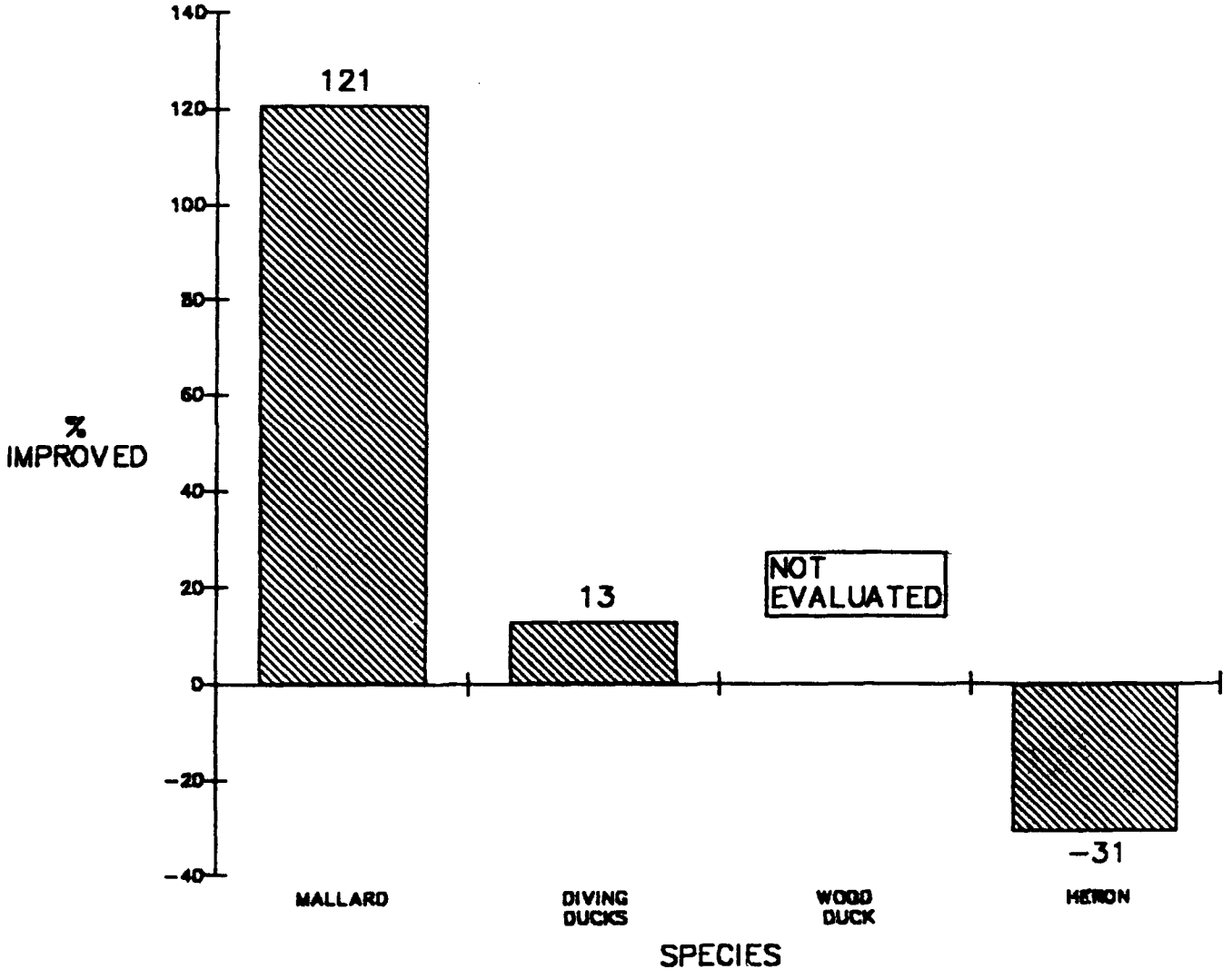

FIGURE 3 – CHAUTAUQUA NWR HREP
ALTERNATIVE C – UPPER POOL BARRIER ISLANDS

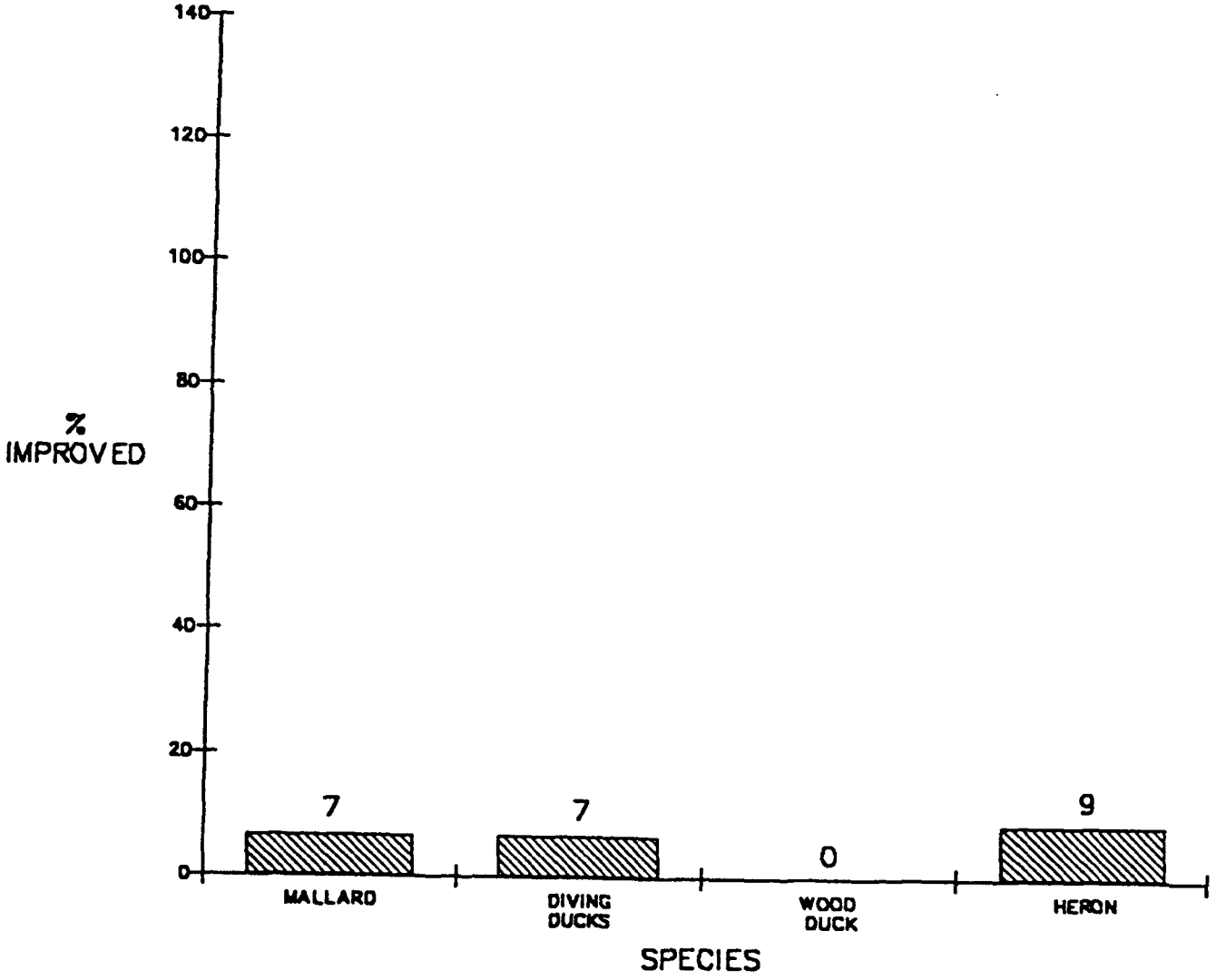

FIGURE 4 – CHAUTAUQUA NWR HREP
ALTERNATIVE D – LIVERPOOL CHANNEL CLEANOUT

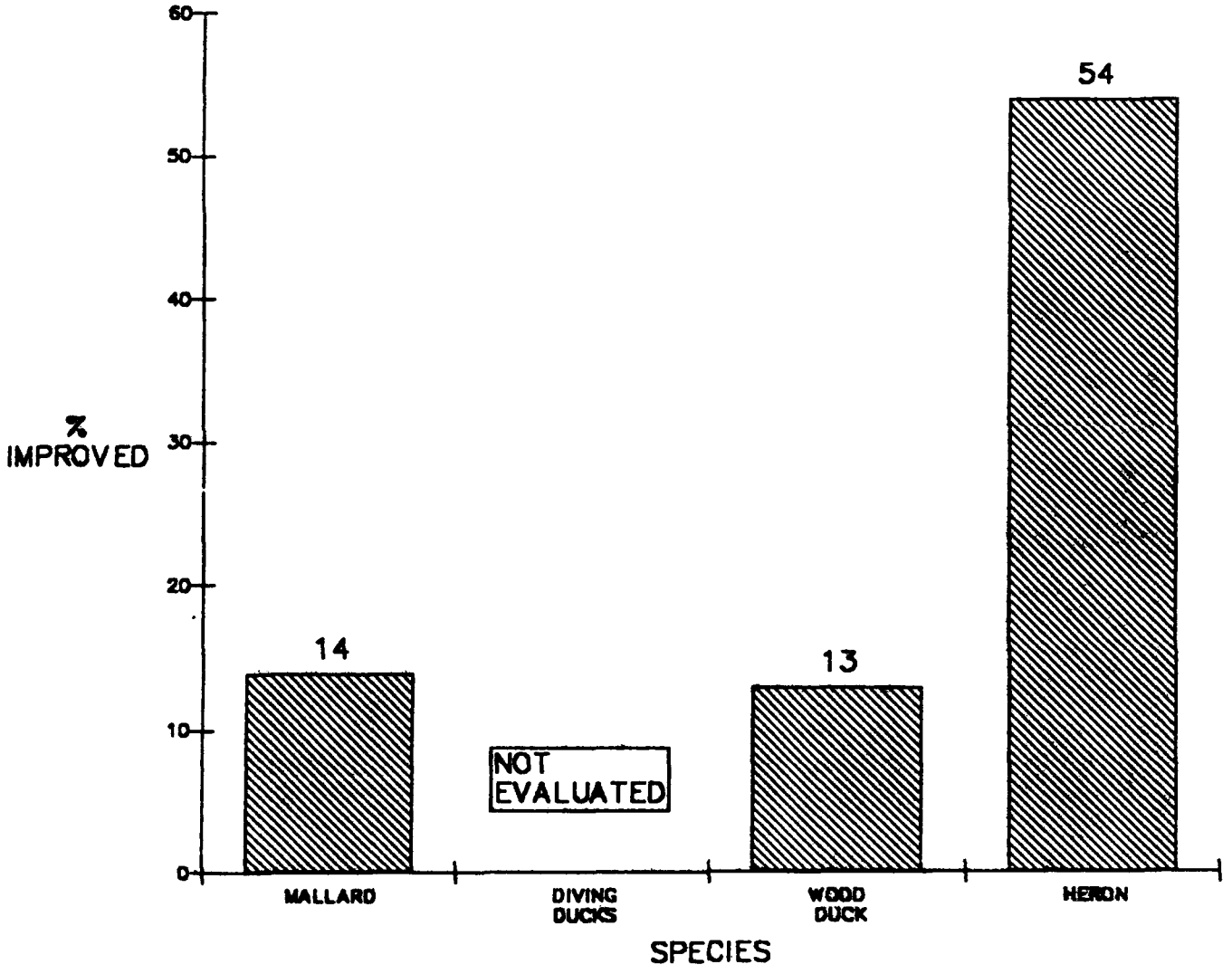

FIGURE 5 – CHAUTAUQUA NWR HREP
FISHERIES HABITAT IMPROVEMENTS

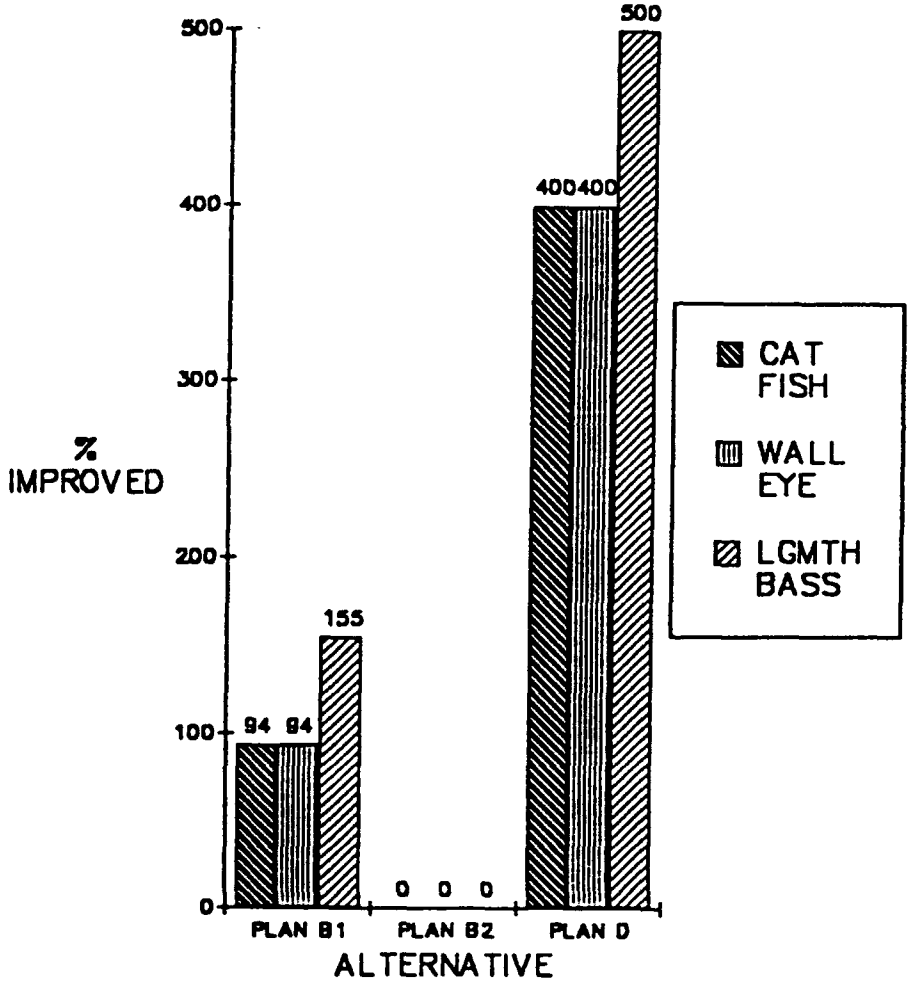

Figure 5 displays the changes in AAHU's over without project conditions for each of the evaluation fish species and project increment. Alternative B1 results in a 94 percent increase in AAHU's for the channel catfish and walleye, and a 155 percent increase for the largemouth bass. These improvements are the result of the capabilities to maintain desirable water levels, improve water quality and provide improved aquatic vegetation conditions, which are attractive to various fish species. What is not clearly displayed in the results of this analysis are the loss of values that will occur during the years the upper pool is dewatered and held at depths unattractive for use by these fish species. There will be two or three years when fisheries values will be very low as a result of the proposed water management activities. The improvements indicated in Figure 5 are obtained during the remaining years of the management cycle and are averaged over the entire cycle.

Alternative B2 indicates habitat values over the period of analysis for these three species will remain unchanged. The aquatic model indicates habitat conditions in the lower pool are already minimal because of problems with low water conditions and dissolved oxygen levels. The numerical value placed on this area by the model is the lowest value possible. Under with-project conditions this value remains the lowest possible, as these conditions are exacerbated. Hence, the model indicates no change in habitat conditions. In reality, the value of the lower pool as habitat for these species will be significantly reduced, because the pool will be dewatered annually as part of the management of the area as a moist soil unit for waterfowl. It will only provide habitat during the periods in which it is flooded, and then it may be too shallow to provide quality habitat.

Alternative C was not specifically evaluated, as it was not considered to be a viable increment from a waterfowl management standpoint. Alternative D would provide a four-fold increase in AAHU's for both the channel catfish and the walleye, and a five-fold increase in values for the largemouth bass. These increases are primarily the result of the development of useable habitat. In its current condition, Liverpool Channel's bottom elevation is such that the habitat is a series of isolated shallow pools except during high water conditions. Excavating the channel will create a significant amount of new habitat previously unavailable to these species. Benefits will probably be even larger than model results indicate, as the current model cannot evaluate the effects of habitat improvements on waters outside the project area. Certainly these proposed improvements will have beneficial effects on the fishery over a much larger reach of the river than just that within the project.

CONCLUSIONS AND RECOMMENDATIONS

Water level control capabilities would provide the potential for significant improvements in habitat conditions within Chautauqua NWR for mallards and diving ducks. Wood duck habitat values would be reduced slightly, due to the loss of bottomland hardwoods along the levee, and heron habitat values would be reduced in the lower pool because of

the loss of shallow marsh associated with the management of that area as a moist soil unit.

Fisheries habitat conditions would be improved significantly in the upper pool when water levels are held at sufficient levels, but during the periods when the pool is drawn down to consolidate bottom materials the area would be unusable. The lower pool would also have reduced values for fish, as a result of more consistent and complete dewatering for moist soil management purposes.

According to the WHAG models, the addition of barrier islands would not result in any significant improvements for any evaluation species. The excavation of the upper portion of the Liverpool Channel would result in significant improvements to the fisheries in this area of the Illinois River, by providing high quality flowing side channel habitat as well as access to back water winter habitat. This increment would also provide improvements in conditions for the mallard, wood duck, and heron.

Based on the results of the foregoing analysis, we recommend that the Chautauqua NWR HREP project include water level control in both pools and excavation of the upper portion of Liverpool Channel. This proposed project will result in a net increase in wetland and aquatic values in the Illinois River. If you have any questions regarding these comments, please do not hesitate to contact me.

Sincerely,

Richard C. Nelson
Field Supervisor

cc: Chautauqua NWR (Miller)
FA (Surprenant)
Mark Twain NWR (Mattsson)
RD (AFWE)
RD (ARW)
ILDOC (Sallee)

CD:sjg

Illinois Historic
Preservation Agency
Old State Capitol Springfield, Illinois 62701 (217) 782-4836
Suite 4-900 State of Illinois Center 100 W. Randolph Chicago, IL 60601 (312) 814-1409

217/785-4997

MASON COUNTY
Lake Chautauqua Habitat
Rehabilitation and Enhancement Project
Alternative levee rehabilitation and boat ramp

IHPA LOG #910104255TRW (89103001)
Corps of Engineers-Rock Island
Acres: 32.0 Sites: 0

March 20, 1991

Mr. Matthias A. Kerschbaum
United States Department of the Interior
Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Dear Sir:

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,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

WH:TRW:bb1017A/74

c: CoE-RI

State of Illinois
DEPARTMENT OF AGRICULTURE
Division of Natural Resources
State Fairgrounds, P.O. Box 19281, Springfield, IL 62794-9281, 217/782-6297

Bureau of Farmland Protection Bureau of Soil Conservation

April 16, 1991

Colonel John R. Brown, District Engineer
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
with Integrated Environmental Assessment (R-7PR)

Lake Chautauqua Rehabilitation and Enhancement
LaGrange Pool, Illinois Waterway, River Miles 124-128
Mason County, Illinois

Dear Colonel Brown:

The Illinois Department of Agriculture has reviewed the Lake Chautauqua Rehabilitation and Enhancement Assessment for its potential impact to agricultural land and submits the following comments.

The boundaries of the project area are approximately the same as those of the refuge. The proposed project includes raising approximately 3.8 miles of existing levee and cross dike to a 10-year level of protection; modifying an existing radial gate structure; providing a pump station with 41,000 gpm capacity; providing gated gravity outlets for the upper and lower lakes; providing drainage channels to the pump station and gravity outlets; providing a boat ramp for upper lake management purposes; excavating a selected reach of side channel; and constructing a side channel entrance closure structure.

All project features are located on lands owned by the Department of the Interior, USFWS. Because the project will utilize government property and prime farmland will not be affected, the Illinois Department of Agriculture does not object to its implementation.

Sincerely,

Teresa J. Savko

Teresa J. Savko
Bureau of Farmland Protection

TJS:mdg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

MAY 09 1991

5ME-16JCK

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

Dear Colonel Brown:

In accordance with the National Environmental Policy Act and Section 309 of the Clean Air Act, we have reviewed the Definite Project Report with integrated Environmental Assessment (EA) for the Lake Chautauqua Rehabilitation and Enhancement Project in Mason County, Illinois. The purpose of the project is to reduce the sediment load that is threatening the integrity of the fishery and waterfowl of the Lake Chautauqua deep water habitat.

Lake Chautauqua is a 3250 acre floodplain lake and wetland complex along the Illinois River between river miles 124 and 128. The lake is formed by a 9-mile long perimeter levee and is divided into an upper and lower lake by a cross dike. The U.S. Fish and Wildlife Service presently operates the lake for migratory waterfowl as part of the Chautauqua National Wildlife Refuge.

Lake Chautauqua was historically part of a highly productive freshwater ecosystem, but conversion of wetlands to farmland and increased sedimentation resulting from agriculture activities have significantly degraded the aquatic habitat. The Lake Chautauqua project site provides opportunity to restore and enhance habitat for fisheries and waterfowl.

Four alternatives were assessed for the proposed project in addition to the no action alternative. These alternatives are entitled water control, construction of barrier islands, side channel excavation, and sediment reduction. The water control alternative involves raising the cross dike and levee, modifying the radial gate structure, construction of a pump station, construction of a gravity outlet for the upper lake, construction of a stoplog structure in the lower lake, excavation of drainage channels in the lower lake, and construction of a replacement boat ramp. The barrier islands alternative consists of constructing earthen embankments to function as breakwaters to diminish wave impacts. Side channel excavation consists of excavating sediments to provide usable flowing side channel habitat. The sediment reduction alternative involves raising the levee to the 50-year flood event. The EA recommends the incorporation of the water control alternative and the side channel excavation alternative for the rehabilitation and enhancement project, concluding that these actions will result in a net increase in wetland and aquatic values for Lake Chautauqua.

Corps of Engineers' response:

O - This is a fairly accurate description of the project

The EA states that there are 892 acres of bottomland hardwoods and 3320 acres of shallow open water habitat in the Lake Chautauqua area. The water control alternatives would convert 21 acres of bottomland hardwoods to grassland along the levee. An additional 30 acres of bottomland hardwoods would be converted to various habitat types for the side channel excavation.

The EA does not mention compensatory mitigation for the project. According to the Missouri Habitat Appraisal Guide (MHAG) method of analysis of habitat quantification, which fine tunes the U.S. Fish and Wildlife Habitat Evaluation Procedures (HEP) to more efficiently input field data, net environmental benefits for fish and wildlife are expected to result. The evaluation appears to favor waterfowl and fish species. Forested wetlands provide habitat for a variety of upland species, including deer and bat species, so these species should also be factored into the study. The study should be conducted without being biased towards the desired species whose habitat would be most favorably influenced by the project's implementation.

Despite the net MHAG benefits due to the project, you may wish to consider compensatory mitigation for the impacted forested wetlands. The EA is not clear whether natural succession of bottomland forest will occur with the project in place. There may be opportunity for compensatory mitigation on areas of the refuge that have been farmed or otherwise degraded, and these opportunities should be explored. Our guidance for bottomland hardwood mitigation is that compensation be done on a minimal ratio of 3:1 of wetlands created to those lost. This ratio is necessary to help ensure long-term survival of the newly restored wetlands. The compensation should be outlined in a mitigation plan, and included in the Final Definite Project Report with EA.

We are concerned with impacts to the hydrology of the area. The sediment and water control structures will influence the hydrology of the forested floodplain adjacent to Lake Chautauqua. This alteration of water regime may have an adverse impact on the 800+ acres of bottomland hardwoods not directly impacted by the project. This impact should be assessed and discussed in the Final EA.

Water quality should benefit from the project. Decreased sedimentation and wave action should reduce turbidity and introduction of riverine constituents to the lake substrate. However, there are a couple of potential water quality impacts that should be assessed. The dredging will result in temporary increased turbidity due to stirred up sediments, and these sediments may be contaminated. Tests have shown that the Illinois River south of Seneca, Illinois, has PCB concentrations of 1 part per million, and this and other pollution sources may have contributed to lake sediment deposits. The sediments should be tested to assure that the dredged material is uncontaminated. If the sediments contain contaminants, they should not be used to construct islands or side casted to the levee or another location; they will need to be disposed of properly to assure no adverse environmental impacts. If it is still planned to use contaminated sediments for levee construction, then bioassays should be conducted to determine impact upon aquatic species and wildlife that would use the levee.

Corps of Engineers' response:

1. The overall habitat evaluation for the project indicates a net gain of habitat quality over the 50-year project life (net gain of habitat units). Based on this predicted improvement, no mitigation should be necessary. Admittedly, the evaluation species selected do not represent the full range of species present in the Lake Chautauqua Refuge. These species were selected because changes in their habitat will best indicate how the project goals and objectives would be met. The primary goal of Chautauqua Refuge (which is also mandated by law) is enhancement of migratory waterfowl, so, naturally, these species received primary consideration. This does not mean, however, that other species were not considered. The green-backed heron, beaver, northern parula, prothonotary warbler, king rail and the target species (except for the green-backed heron). In addition, the number of species models available in WHAG is limited. Several species of interest could not be evaluated on an equal basis with the target species because individual models have not been developed.

2. MITIGATION OF FORESTED WETLANDS
The DPR indicates that approximately 48.6 acres of woodland will be impacted by the project. Except for the 14.2 acres impacted on Liverpool Island, all of this acreage occurs on the tops and side slopes of the refuge levees. All of this acreage is second growth, which has developed since the levee was built in the early 1900's. Cottonwood, silver maple, green ash, and mulberry account for more than 80% of tree cover. Valuable mast-producing species such as pin oak are virtually absent. Proper maintenance of the levees in past years would normally have prevented this second growth forest from becoming established. Impacts to more valuable, pre-levee bottomland forest in the Melz Slough area will be avoided by transporting borrow from outside the slough. There is no specific mitigation for the 14.2 acres cleared on Liverpool Island. The net increase in wetland and aquatic habitat benefits offsets this loss. Although not specifically intended as mitigation, the refuge has an ongoing forestry program to increase bottomland forest acreage on refuge lands.

3. Impacts to the local water regime have been considered for bottomland forest, located within and outside the leveed area. As discussed under the "Bottomland Hardwoods" subsection in the Natural Resource Impacts discussion, there is a minimal chance of impacts occurring to hardwoods in the Melz Slough Area. Outside of the leveed refuge portion, there is no change in water level regime anticipated.

4. In order to evaluate the water quality impacts of proposed HREP projects, a testing protocol has been established which first quantifies a variety of parameters which are reasonably expected to be present within the project site. If evidence of contamination is found, additional testing is performed to determine bioavailability and the potential for impacts to the

Sediments that are to be dredge should be tested for chemical contamination. Three core samples should be taken at the dredging site. Core depth should extend two foot below project depth to characterize material in the event of over-dredging and to characterize the material exposed by the dredging event. Each core sample should be divided into three foot sections, from bottom to top, with each subsample undergoing analysis for the following constituents:

Total Solids	Chlorinated Hydrocarbons
Volatile Solids	-alpha BHC
Chemical Oxygen Demand	-beta BHC
Percent Moisture	-delta BHC
Cyanide	-gamma BHC
Metals	-Chlordane
-Arsenic	-DDD
-Cadmium	-DDE
-Chromium	-DDT
-Copper	-Dieldrin
-Lead	-Endrin
-Mercury	-Heptachlor
-Nickel	-PCBs
-Selenium	Total Phosphate
-Zinc	Total Organic Carbon
-Manganese	Ammonia Nitrogen

The results of the sample tests should be made available to our Agency for review.

The final EA should assess and discuss secondary water quality impacts of the completed project. These impacts include increased recreational use and potential for increased agricultural activities. Impacts due to motor boating and marina development may result in increased turbidity, and the release of hydrocarbons into the lake. Increased agricultural activity may pose a water quality impact of runoff of toxins such as pesticides and fertilizers. The potential for any of these activities should be discussed for the Lake Chautauqua Rehabilitation and Enhancement Project.

Once completed, the project should provide a benefit to the waterfowl and fishery habitat of Lake Chautauqua. The project can further benefit waterfowl by provided nesting habitat through the planting of native vegetation on the islands and dike/levee. Such vegetation could include prairie grasses, which are becoming increasingly rare with the degradation of prairie remnants. We support the project provided that the aforementioned concerns are adequately assessed.

Corps of Engineers' response:

environment. Sediment quality testing was performed at 8 locations representative of the project site (two in upper Lake Chautauqua, two in lower Lake Chautauqua, two in Liverpool Ditch and two in Meyers Ditch) on February 20, 1990. Samples were taken with a 36-inch core sampler. Each sample was analyzed individually for a number of physical and chemical parameters. In addition, elutriate samples were prepared and analyzed from each sediment sample. A description of the test protocols utilized, a complete list of the parameters which were analyzed, and a tabular presentation of the results can be found in Technical Appendix G of the Definite Project Report.

The results of this screening procedure revealed that while the sediment is composed of very fine-grained material and contained notable concentrations of several contaminants, the elutriate test produced only isolated violations of the Illinois General Use Water Quality Standards. The exception to this was ammonia nitrogen which exhibited concentrations which would probably violate the un-ionized ammonia standard in the lower lake, Liverpool Ditch and Meyer's Ditch. It is likely, however, that the impacts will be short-term and limited to a reasonably small mixing zone.

5. Any secondary water quality impacts that are expected to occur are discussed in the 404(b)(1) Water Quality Evaluation of the main report. Recreational use of the upper lake will probably increase as the quality of the fishery resource improves; however, since this is a national wildlife refuge, there are no plans to construct any marina facilities, etc., to accommodate any increase. Any impacts to water quality from increased recreational activity (i.e., boating) are considered negligible.

There will be no change in agricultural activity as a result of the project; hence, no change in agricultural-related water quality.

6. Where possible, the refuge will plant vegetation on levees and other areas that are of benefit to local wildlife.

Thank you for the opportunity to review the Definite Project Report with integrated Environmental Assessment (EA) for the Lake Chautauqua Rehabilitation and Enhancement Project. If you have any questions regarding our comments, please contact Milo Anderson of my staff at 312 886-2967.

Sincerely yours,

Thomas L. Jackson, Acting Chief
Environmental Review Branch

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

[redacted]

BRENT MANNING, DIRECTOR

May 13, 1991

Mr. James H. Blanchar, P.E.
Chief, Operations Division
Department of the Army
Rock Island District, Corps of Engineers
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Mr. Blanchar:

The Department of Conservation has reviewed the project(s) listed below and has no objections to permit issuance:

Application No.	Applicant
20914Z	U.S. Army Corps of Engineers

Sincerely,

Robert W. Schanzle
Permit Program Manager
Division of Planning

RWS:slf

United States Department of the Interior

OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL AFFAIRS
230 S. DEARBORN, SUITE 3422
CHICAGO, ILLINOIS 60604

TAKE PRIDE IN AMERICA

ER 91/361

May 22, 1991

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

Dear Colonel Brown:

The Department of the Interior (Department) has reviewed the Definite Project Report with Integrated Environmental Assessment for Lake Chautauqua, Illinois, Habitat Rehabilitation and Enhancement Project. The Department has no objections to the proposed project.

We appreciate the opportunity to provide comments.

Sincerely,

Sheila Minor Huff
Regional Environmental Officer

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-0610

U.S. Army Corps of Engineers (Mason County)
Lake Chautauqua HREP (Illinois River)
Log # C - 804-90 -- (CoE Appl. 209142 #)

June 13, 1991

Mr. James H. Blanchar, P.E.
Chief, Operations Division
Rock Island District
Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Dear Mr. Blanchar:

This Agency received a request on September 6, 1990, from the U.S. Army Corps of Engineers, Rock Island District requesting necessary comments for environmental consideration concerning the Lake Chautauqua Habitat Rehabilitation and Enhancement Project (HREP). The proposed project will consist of raising the existing perimeter levee and cross dike, adding new drainage channels in the south lake, modifications and additions to the water level control structures, construction of a new boat ramp, and excavation of the Liverpool side channel. The project is located at approximate Illinois River Miles 124 to 128, Sections 4-10, T22N, R8W in Mason County, Illinois. 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 towards this Agency.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 92-217), 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 Regulations;

b. water pollution as 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 the waters of the State unless a permit has been issued by this Agency. Any back filling 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.

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 contain dredge spoil generated by the excavation of the Liverpool Ditch and the new cut from the Ditch to the Illinois River. A containment plan for these areas shall be submitted to the Illinois Environmental Protection Agency for review and approval.

7. This certification becomes effective when the Department of the Army, Corps of Engineers, includes the above conditions #1 through 6 as conditions of the requested permit issued pursuant to Section 404 of PL. 92-500.

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:JCH:let/1713q, 73-74

cc: IEPA, DWPC, Records Unit
DWPC, Field Operations Section, Region 3
IDOT, Division of Water Resources, Springfield
USEPA, Region V
U.S. Army Corps of Engineers, Rock Island District

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

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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:

CENCR-PD-E

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS

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

JUNE 1991

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128
MASON COUNTY, ILLINOIS

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MASON COUNTY, ILLINOIS

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

SECTION 1 - PROJECT DESCRIPTION

LOCATION

Lake Chautauqua is a 4,500-acre National Wildlife Refuge located between Illinois River Miles (RM) 124 and 128 in Mason County, Illinois. The refuge is managed by the U.S. Fish and Wildlife Service (USFWS).

GENERAL DESCRIPTION

Lake Chautauqua is managed primarily for nesting and migratory waterfowl. Water levels are artificially managed on approximately 3,400 acres of lake to provide optimum habitat for migratory waterfowl. This management goal has become increasingly difficult to realize for the past several years because of flooding from the Illinois River and an inability to properly maintain optimum water levels in the lake. Poor water level management capability allows floodwaters to eliminate desirable aquatic plants used by waterfowl. Sediments carried along with the floodwaters from the Illinois River have transformed to lake bottom into a fluffy, colloidal substrate which discourages rooted aquatic plants. Wind-generated waves also resuspend sediments and elevate turbidity levels and decrease light penetration.

Physical limitations, as well, limit the refuge's water control capability. There are no pumping facilities to accomplish lake drawdown or to maintain desired lake levels. Lake Chautauqua is divided into an upper lake and a lower lake by a cross dike constructed in 1969. That cross dike was breached by high water shortly afterward which prevented independent management of each lake. High water levels outside the refuge levee frequently prohibit water level management. Sill elevations of the existing water control structures also are 2 feet above the lake bottom, which reduces the amount of refuge acreage that can be dewatered.

A secondary objective of the refuge is to increase the amount of deep water and side channel habitat for fish on refuge lands. Sedimentation has resulted in a loss of more than 10 feet of depth in the Liverpool side channel. At a flat pool (LaGrange Pool) of 429.0 feet National Geodetic Vertical Datum (NGVD), there is less than 6 inches of water or less in the channel.

The proposed project will reverse the adverse effects of sedimentation by providing improved water level control in both the upper and lower lakes and greater water depth in Liverpool Channel. This will be accomplished by: (1) repairing the cross dike; (2) raising the northern perimeter levee to a 10-year level of protection and constructing a pump station and drainage channels that can control water levels in either lake; (3) constructing a new water control structure in the lower lake with a sill elevation of 429.0 NGVD; and (4) mechanically excavating Liverpool Channel.

The cross dike will be constructed first using mechanical equipment. Borrow material will originate from the new pump station access channel immediately adjacent to the levee. Following repair of the cross dike and construction of the pump station, the upper lake will be dewatered to allow for construction of the drainage channel. Excavated material will be alternately sidecast along the channel to form 6.1 acres of barrier islands. Drainage channels in the lower lake probably will be constructed by mechanical excavation. Excavated material again will be sidecast along the channel, but will not be emergent at most water levels. Approximately 8,400 feet of Liverpool Channel and Liverpool Island will be excavated down to elevation 419.4 NGVD (30-foot bottom width) to provide improved fishery habitat. Material will be placed on the refuge levee and adjacent bottomland hardwoods.

AUTHORITY AND PURPOSE

Authority for this project is contained in Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The purpose of Section 1103 is "to ensure the coordinated development and enhancement of the Upper Mississippi River (UMR)."

GENERAL DESCRIPTION OF THE DREDGED AND FILL MATERIAL

General Characteristics of Material - Grain size analysis was conducted by the Geotechnical Branch, U.S. Army Corps of Engineers. Bulk sediment samples were taken from seven locations within the project area. Sediments were all extremely fine grained. Seven out of eight samples had greater than 95 percent of all material passing a No. 230 sieve (less than 0.062 um). The remaining sample passed 86 percent through a No. 230 sieve.

Quantity of Material - The following quantities of dredged material will be generated at the following sites within the project area:

TABLE B-1

Summary of Fill Activities for Lake Chautauqua

Quantity (cy)	Source	Discharge Site
173,250	Liverpool Channel	Cross Dike
7,700	Near Liverpool Lake	Near Liverpool Lake
25,600	Upper Lake	Cross Dike
72,200	Upper Lake	Upper Lake
27,800	Lower Lake	Lower Lake
306,550	TOTAL	

DESCRIPTION OF THE PROPOSED DISCHARGE SITES

Material excavated from Liverpool Channel will be placed on the refuge levee and near Liverpool Lake. Material will be placed along the levee slope, from the toe to crown, reaching an elevation of approximately 446.0 NGVD. Material excavated from the new cut from Liverpool Ditch to the main river mechanically will be placed adjacent to the newly excavated channel. The unconfined placement on Liverpool Island and the refuge levee will require 6.9 acres and 7.8 acres, respectively. The entire 14.7 acres is bottom land forest of varying stages of succession. Cottonwood and silver maple are dominant, but hackberry and mulberry are also common. All of the proposed discharge sites lie at or below the 2-year flood elevation, and ground cover tends to be poison ivy and stinging nettles.

Upper Lake Chautauqua dredging of an 8,800-foot-long, 6-foot-deep drainage channel will result in placement of material on the cross dike and in the lake itself. A total of 6.1 acres of dredged material islands will be constructed from sidecast material. These barrier islands will have an elevation of 437.0 NGVD compared to the existing bottom elevation of 431.0 NGVD. These islands will provide two indirect benefits: (1) They will provide some variation in bottom contours in an otherwise extremely uniform bottom landscape (this also should promote some diversity in wetland vegetation where none now exists); and (2) the islands and invading woody vegetation should provide some wind and wave shadow effect that also will promote establishment of wetland plants.

To facilitate draw down of lower Lake Chautauqua, 7,500 feet of a 2-foot-deep drainage channel will be dredged, resulting in the filling of 8.1 acres of lake bottom. Material will be sidecast onto the adjacent lake bottom in the configuration of alternating submerged islands. These submerged islands will not extend above an elevation of about 433.0 NGVD.

The existing lake bottom is similar to the upper lake. Aquatic vegetation varies from year to year according to water levels and wind. Patches of American lotus, pond lily, and duck potato are sometimes present. Submergent vegetation is practically nonexistent.

DESCRIPTION OF PLACEMENT METHOD

All dredging will be accomplished by mechanical means such as dragline or backhoe.

SECTION 2 - FACTUAL DETERMINATIONS

PHYSICAL SUBSTRATE DETERMINATIONS

For the most part, substrate compositions impacted by discharge are the same or nearly the same as the dredged material. This is particularly true of excavated material placed in the upper and lower lakes where silt will be placed on silt. Only the elevation will change. In the upper lake, this increase in elevation is anticipated to benefit aquatic vegetation.

The existing cross dike is constructed of sand from an adjacent upland location. Cross dike repair will result in a conversion of sandy "soils" to one composed of fine-grained sediments. This will ultimately cause a change in vegetation. The increased nutrients present in silt likely will cause an increase in vegetation biomass (i.e., increased ground cover) and also enhance the growth of any woody shrubs and trees that become established.

Placement of fill material from Liverpool Ditch on the adjacent levee and bottom land forest will not cause any noticeable change in substrate composition. The levee elevation will remain the same, except for some low spots below elevation 446.0 NGVD that will be leveled. The elevation of 6.2 acres of bottom land adjacent to Liverpool Lake will increase to a maximum of 446.0 NGVD.

WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

WATER

Salinity - Not applicable.

Water Chemistry - No change anticipated.

Clarity - The barrier islands, created as a result of fill placement from channel excavation in the upper lake, should increase water clarity by decreasing wind/wave-generated resuspended sediments.

Color - No change anticipated.

Taste - Not applicable.

Dissolved Gas Levels - Dredging may create a temporary increase in oxygen demand by exposing new sediments. However, no adverse effects are anticipated from this.

Nutrients - No effect anticipated.

Eutrophication - No effect anticipated.

CURRENT PATTERNS AND CIRCULATION

Current patterns and flow repair of the cross dike will prevent exchange of water between the upper and lower lakes as intended. Barrier islands will interrupt the flow of surface waters in the upper lake.

Velocity - No change in velocities from fill activities.

Stratification - Not applicable due to shallow depth of lakes.

Hydrologic Regime - Fill activities will have no effect on natural flooding in or adjacent to the refuge. Repair of the cross dike will decrease the frequency of flooding in the upper lake.

NORMAL WATER LEVEL FLUCTUATIONS

Fill will have no effect on normal water level fluctuations. It will, however, allow increased capability to artificially manipulate water levels in both lakes.

SALINITY GRADIENTS

Not applicable.

ACTIONS TAKEN TO MINIMIZE IMPACTS

None.

SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

EXPECTED CHANGES IN SUSPENDED PARTICULATES AND TURBIDITY LEVELS IN VICINITY OF PLACEMENT SITE

Construction will cause a temporary increase in turbidity levels in both the lakes, Liverpool Channel, and downstream of Liverpool Channel. Due to the turbid conditions that already exist in the lake, no adverse impacts are anticipated to aquatic resources.

EFFECTS ON CHEMICAL AND PHYSICAL PROPERTIES OF THE WATER COLUMN

Light Penetration - Temporary decrease during construction. Significant increase anticipated in both lakes following construction.

Dissolved Oxygen - Dissolved oxygen levels in the upper lake and Liverpool Channel may increase during winter months when ice cover is present.

Toxic Metals and Organics - Sediment elutriate testing performed for this project indicate that copper, iron, manganese, and ammonia nitrogen concentrations may increase during construction. These parameters are not expected to cause toxicity problems for the existing biota.

Pathogens - No change anticipated.

Aesthetics - Improved water quality should improve lake aesthetics.

EFFECTS ON BIOTA

Primary Production - Any adverse of increased turbidity during construction on primary productivity will be negligible.

Suspension/Filter Feeders - Negligible effects are anticipated.

Sight Feeders - Negligible effects anticipated.

ACTIONS TAKEN TO MINIMIZE IMPACTS

None.

CONTAMINANT DETERMINATIONS

Bulk sediment analyses were conducted on samples collected on February 20, 1990. Copper, iron, and manganese were considered to have elevated concentrations. Although ammonia nitrogen concentrations as high as 1 mg/l have been observed, it is unlikely that construction will result in violation of State standards given a minimal mixing zone.

AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

Effects on Plankton - Plankton productivity should improve as a result of the project.

Effects on Benthos - Existing benthic fauna is sparse due to poor substrate conditions. The project should improve both the diversity and productivity of lake benthos.

Effect on Nekton - All nektonic organism populations such as fish and aquatic invertebrates should benefit from improved water quality.

Effects on Aquatic Food Web - Improved water quality (i.e., decreased suspended sediments in particular) should benefit the entire food chain of both aquatic and semi-aquatic organisms around the refuge.

Effects on Special Aquatic Sites - The proposed project is located on a national wildlife refuge. Almost all of the project area is either palustrine emergent or forested wetland. The proposed project will significantly improve the short- and long-term productivity of the wetland. The proposed project has the full support of the USFWS and the State of Illinois. Without the project, there will be a continuing erosion of wetland values in the project area from sedimentation.

Threatened and Endangered Species - The American bald eagle is the only federally endangered species known to use to the refuge. Eagles regularly use the refuge during the winter months for feeding and roosting. The project is anticipated to have no effect on eagles.

Other Wildlife - Lake Chautauqua also is used regularly by wading birds such as great blue herons and furbearers such as muskrat. More stable water levels will benefit these species. Migrating shorebirds also will use the isolated mudflats when water levels permit.

Actions to Minimize Impacts - None.

PROPOSED PLACEMENT SITE DETERMINATIONS

Mixing Zone Determination - The use of mechanical dredging equipment will minimize the amount of sediment resuspended during construction. Sediments resuspended from channel dredging within the refuge should remain within a few hundred feet of the excavation site. Lack of any distinguishable current should limit any dispersion of the plume to that caused by wind-generated waves. Wind-generated waves also will resuspend existing bottom sediments so that the plume would quickly become indistinguishable from ambient conditions.

Dredging of Liverpool Channel could create a plume of sediment that would enter the main river channel if water elevations are high enough. The closer the water elevation is to flat pool (429.0 NGVD), the smaller this plume is likely to be since the channel's existing bottom elevation is about 431.0 NGVD. The high bottom elevation of the channel also promotes good vegetation growth in summer. This vegetation would help sediments to settle more quickly.

Determination of Compliance with Applicable Water Quality Standards - Concentrations for most parameters were below Illinois General Use Water Quality Standards. Copper, iron, manganese, and ammonia nitrogen exceeded the standards for some samples.

POTENTIAL EFFECTS ON HUMAN USE CHARACTERISTICS

Municipal and Private Water Supply - No effect anticipated.

Recreational and Commercial Fisheries - The quality of sportfishing in the lake is low due to poor habitat conditions. Recreational fishing may temporarily be closed during construction if the lake is dewatered. The refuge currently permits commercial fishermen to harvest rough fish from the lakes. They also will be unable to harvest during construction.

Water-Related Recreation - There is minimal water-based recreation other than sportfishing during high water. No effect is anticipated.

Aesthetics - Placement of fill will have no long-term impact on aesthetics. Clearing of portions of the levee and cross dike will remove some trees and shrubs that enhance the refuge's natural character.

Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves - The project area is managed as a Federal wildlife refuge whose primary objective is to provide habitat

for migratory waterfowl. The proposed fill activities will significantly improve the refuge's operation in meeting these goals.

DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

Any impacts from the proposed discharge will be temporary.

DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

No adverse secondary effects from the fill are anticipated.

SECTION 3 - FINDINGS OF COMPLIANCE FOR LAKE CHAUTAUQUA NATIONAL WILDLIFE REFUGE HABITAT REHABILITATION AND ENHANCEMENT PROJECT

1. No adaptations of the guidelines were made in this evaluation.

2. Alternative locations for the proposed project are not possible since the goal was to improve wetlands specific to Lake Chautauqua Refuge. Alternative non-wetland locations for placement of fill such as the refuge levee and cross dike were utilized to the maximum extent possible. Material generated from excavation of the drainage ditches could not be practicably transported to upland sites.

3. State standards for turbidity and ammonia may be temporarily exceeded within the lake during construction. Only the portion of the project occurring outside the levee (i.e., Liverpool Ditch) has the potential to affect the main channel of the Illinois River.

4. The project will not affect Federal or State-listed endangered species.

5. The project is located on the Lake Chautauqua Federal Wildlife Refuge and is in compliance with refuge guidelines.

6. The project will have no effect on public or private water supplies and will benefit recreational and commercial fisheries. No significant adverse impacts to aquatic or terrestrial wildlife will occur.

7. Appropriate measures will be utilized, when necessary, to prevent or minimize any impacts to the aquatic ecosystem.

8. On the basis of the Section 404(b)(1) guidelines, I specify that the proposed placement sites comply with the requirements of the guidelines.

_____
Date

John R. Brown
Colonel, U.S. Army
District Engineer

DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

Any impacts from the proposed discharge will be temporary.

DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

No adverse secondary effects from the fill are anticipated.

SECTION 3 - FINDINGS OF COMPLIANCE FOR LAKE CHAUTAUQUA NATIONAL WILDLIFE REFUGE HABITAT REHABILITATION AND ENHANCEMENT PROJECT

1. No adaptations of the guidelines were made in this evaluation.

2. Alternative locations for the proposed project are not possible since the goal was to improve wetlands specific to Lake Chautauqua Refuge. Alternative non-wetland locations for placement of fill such as the refuge levee and cross dike were utilized to the maximum extent possible. Material generated from excavation of the drainage ditches could not be practicably transported to upland sites.

3. State standards for turbidity and ammonia may be temporarily exceeded within the lake during construction. Only the portion of the project occurring outside the levee (i.e., Liverpool Ditch) has the potential to affect the main channel of the Illinois River.

4. The project will not affect Federal or State-listed endangered species.

5. The project is located on the Lake Chautauqua Federal Wildlife Refuge and is in compliance with refuge guidelines.

6. The project will have no effect on public or private water supplies and will benefit recreational and commercial fisheries. No significant adverse impacts to aquatic or terrestrial wildlife will occur.

7. Appropriate measures will be utilized, when necessary, to prevent or minimize any impacts to the aquatic ecosystem.

8. On the basis of the Section 404(b)(1) guidelines, I specify that the proposed placement sites comply with the requirements of the guidelines.

18 June 1991
Date

John R. Brown
Colonel, U.S. Army
District Engineer

LETTERS OF INTENT
AND MEMORANDUM OF AGREEMENT

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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:

MEMORANDUM OF AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE UNITED STATES FISH AND WILDLIFE SERVICE

SUBJECT: Enhancing Fish and Wildlife Resources of the Upper Mississippi River System at Lake Chautauqua, Illinois

I. PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the Department of the Army (DA) and the U.S. Fish and Wildlife Service (USFWS) will operate in constructing, operating, maintaining, and rehabilitating the Lake Chautauqua, Illinois, separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

The project lands of the Lake Chautauqua, Illinois, separable element are owned by the United States and are managed by the Department of the Interior, USFWS, as part of the Chautauqua National Wildlife Refuge.

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features on the Lake Chautauqua, Illinois, are 100 percent Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared, 75 percent Federal and 25 percent non-Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of improving water level management capability for approximately 3,250 acres (Upper and Lower Lake Chautauqua) and the restoration of more than 8,000 feet of flowing side channel habitat (Liverpool Ditch).

IV. RESPONSIBILITIES

A. The DA is responsible for:

1. **Construction:** Construction of the project which consists of a pump station, 2 water control structures, cross dike raise, and drainage and side channel excavation at Lake Chautauqua, Illinois.

2. **Major Rehabilitation:** The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. **Construction Management:** Subject to and using funds appropriated by the Congress of the United States, the DA will construct the Lake Chautauqua, Illinois, Fish and Wildlife Enhancement project as described in the Definite Project Report, *Lake Chautauqua Rehabilitation and Enhancement*, dated June 1991, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If the DA encounters potential delays related to construction of the project, the DA will promptly notify the USFWS of such delays.

4. **Maintenance of Records:** The DA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. The DA shall maintain such books, records, documents, and other evidence for a minimum of 3 years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the USFWS.

B. The USFWS is responsible for:

1. **Operation, Maintenance, and Repair:** Upon completion of construction as determined by the District Engineer, Rock Island, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report, *Lake Chautauqua Rehabilitation and Enhancement*, dated June 1991, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. **Non-Federal Responsibilities:** In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the USFWS shall obtain 25 percent of all costs associated with the operation, maintenance, and repair of the project from the Illinois Department of Conservation (IDOC).

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

USFWS: Regional Director
U.S. Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

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

EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY: _____
JOHN R. BROWN
Colonel, U.S. Army
District Engineer

DATE: _____

THE U.S. FISH AND WILDLIFE SERVICE

BY: _____
JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife Service

DATE: _____

APPENDIX D

COST ESTIMATE

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-7F)

LAKE CHAUTAUQUA REHABILITATION AND ENHANCEMENT
LA GRANGE POOL, ILLINOIS WATERWAY, RIVER MILES 124-128

APPENDIX D
COST ESTIMATE

D-1. GENERAL.

This appendix contains the detailed cost estimate prepared for the Lake Chautauqua Rehabilitation and Enhancement project at Illinois River miles 124-128, including Federal construction, planning, engineering and design, and construction management costs. The current working estimate prepared for this Definite Project Report 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), incorporating local wage and equipment rates, was used 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.

D-2. PRICE LEVEL.

Project element costs are based on February 1991 prices. These costs are considered fair and reasonable to a well-equipped and capable contractor and include overhead and profit. The Fully Funded Estimate (FFE) was calculated in accordance with guidance from CECW-B, dated March 3, 1990, Factors for Updating Study/Project Cost Estimates for FY 1992 Budget Submission.

D-3. CONTINGENCY DISCUSSION.

After review of project documents and discussion with personnel involved in the project, cost contingencies were developed 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 to 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 made. 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 Design Branch.

06.-.-.- Upper Lake Water Control, Pump Station. The pump station is located in a remote area. Access during construction is along the top of an existing levee which must be constructed into a temporary access road. This temporary road, which is about 3 miles long, will be used to deliver materials and supplies for the pump station construction. Parking is limited at the construction site, and it is assumed that workers will walk or be taxied to the site along the deteriorated cross dike which is 1 mile long. These factors were considered in assigning productivities for the work items. Historical data were used for pricing the pump and discharge line. Available soil borings show the station to be founded on suitable material. Piling or over-excavation of unsuitable material and extensive structural backfill are not anticipated. Dewatering is estimated at 2 months time during construction of the station and is assigned a 25-percent contingency. An overall contingency of 17.5 percent is considered to be satisfactory for the pump station construction.

06.-.-.- Northern Levee Repair. This work involves upgrading the existing levee. After clearing and grubbing operations, a dragline will excavate adjacent borrow and place it on the levee for shaping. No compaction is required other than that obtained by tracked equipment working the area. Prior to borrow operations, unsuitable topsoil will be removed and stockpiled. These routine construction activities are given a 20 percent contingency. Riprap is given a 30 percent contingency to account for unknown haul distance and unit price adjustments for difficult site access. An overall contingency of about 21 percent is considered adequate for this work.

06.-.-.- Cross Dike Repair. This work is similar to the Northern Levee Repair. An existing breach in the cross dike will be filled by dozers pushing material from the adjacent levee. The remaining fill for constructing the cross dike will be placed by dragline, excavating material from an adjacent ditch borrow. Compaction will be by dozers shaping the material. Erosion control matts will be placed to protect the embankment, which will serve as a permanent roadway to the pump station. This work requires routine construction operations, and an overall contingency of about 20 percent is considered to be adequate.

06.-.-.- Upper Lake Gravity Outlet. This gatewell type structure is similar to many others constructed. Other than uncertain dewatering expenditures and potential variance in riprap price, as discussed before, this work uses standard construction techniques. An overall contingency of 18 percent is assigned this work.

06.-.-.- Modification of Existing Radial Gate Structure. This work involves rehabilitating and modifying an existing gate structure at the upper end of the project. No unusual construction techniques or materials are anticipated. Modification of the structure includes raising the sill with reinforced concrete about 4 feet to meet project elevation requirements. The raised sill will form eight openings to be covered with new trash racks with provisions for adding stoplogs. Site preparation will include provisions for dewatering, although the sill work is about 4 feet higher than flat pool. Also included will be positioning or temporary removal of the existing radial gates for work to progress. This work and the riprap cost are assigned a 30 percent contingency. All other work, including new gate lifting machinery, is given a 20 percent contingency. An overall contingency of about 24 percent is considered to be adequate for this work.

06.-.-.- Lower Lake Water Control, Stop Log Structure. This structure is located in a remote area like the pump station, but access should be easier. No major foundation problems are expected, but a 25 percent contingency is used for the structural backfill to account for type and quantity of fill needed. Dewatering has a 25 percent contingency to allow for an increase in amount or duration needed. An overall 17 percent contingency is considered satisfactory for this structure.

06.0.5.B Lower Lake Excavation. This work involves excavating and sidecasting material. Discussion with the project engineer indicates this work will be done by floating plant. Estimated equipment includes a dragline working from portable barges. A 25 percent contingency is used to account for differing site conditions and unexpected difficulties in overland mobilization of portable barges.

06.-.-.- Boat Ramp Replacement. A 25 percent contingency is used for this work to account for unexpected costs in replacing an existing single lane boat ramp and parking lot. Historical costs were used in evaluating the cost of this work.

06.-.-.- Side Channel Excavation. This work requires long boom equipment. Previous and recent contacts with contractors having such equipment show an interest by them to bid this work. The unit price is estimated based on using 180-foot boom equipment with a 6-cubic-yard clamshell bucket working from a spudded barge 24 hours a day. A 15 percent contingency is used to allow for part-time use of land-based equipment for any needed material handling or shaping. The rockfill and riprap placement has a 15 percent contingency to account for material price and haul distance. The unit prices for these items assumes barge delivery.

The average contingency for the project's construction is 18.9 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 construction plans and specifications. This cost also includes engineering support during construction,

preparation of as-built drawings, and operation and maintenance manuals. The design effort for the construction 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 is studies and analyses of project report, plans and specifications, and conferences of construction staff to become familiar with design requirements; biddability, contractibility, 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 construction phase to determine suitability and compliance with plans and specifications; negotiate with the contractor on all contract modifications, including preparation of all contract documents required therefor; 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 Chautauqua Lake Rehabilitation and Enhancement EMP project, the estimated cost of construction management is $245,000 for a construction contract with a year and a half duration and an estimated value of $3.7 million.

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VI - Operations and Maintenance Instructions

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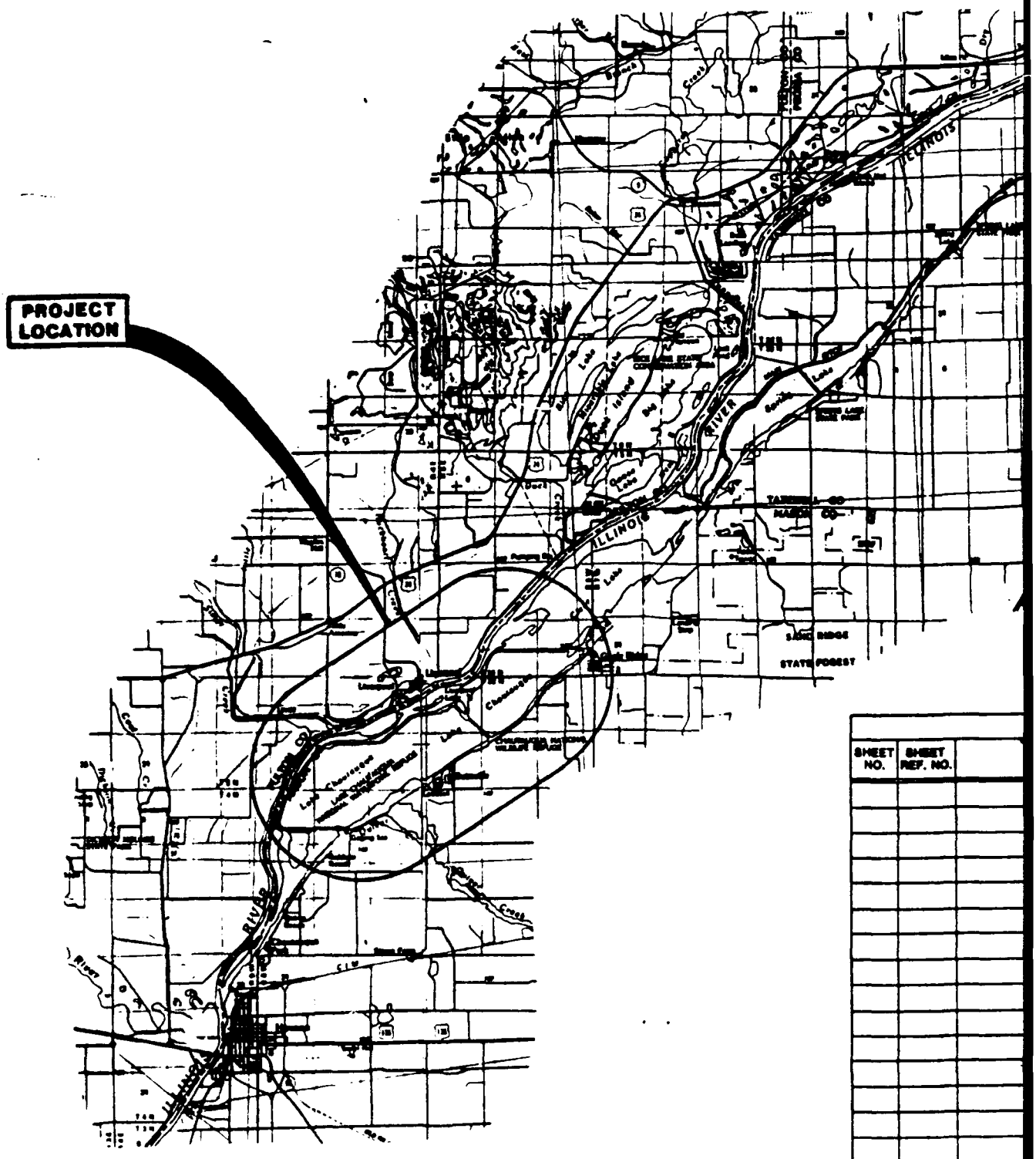
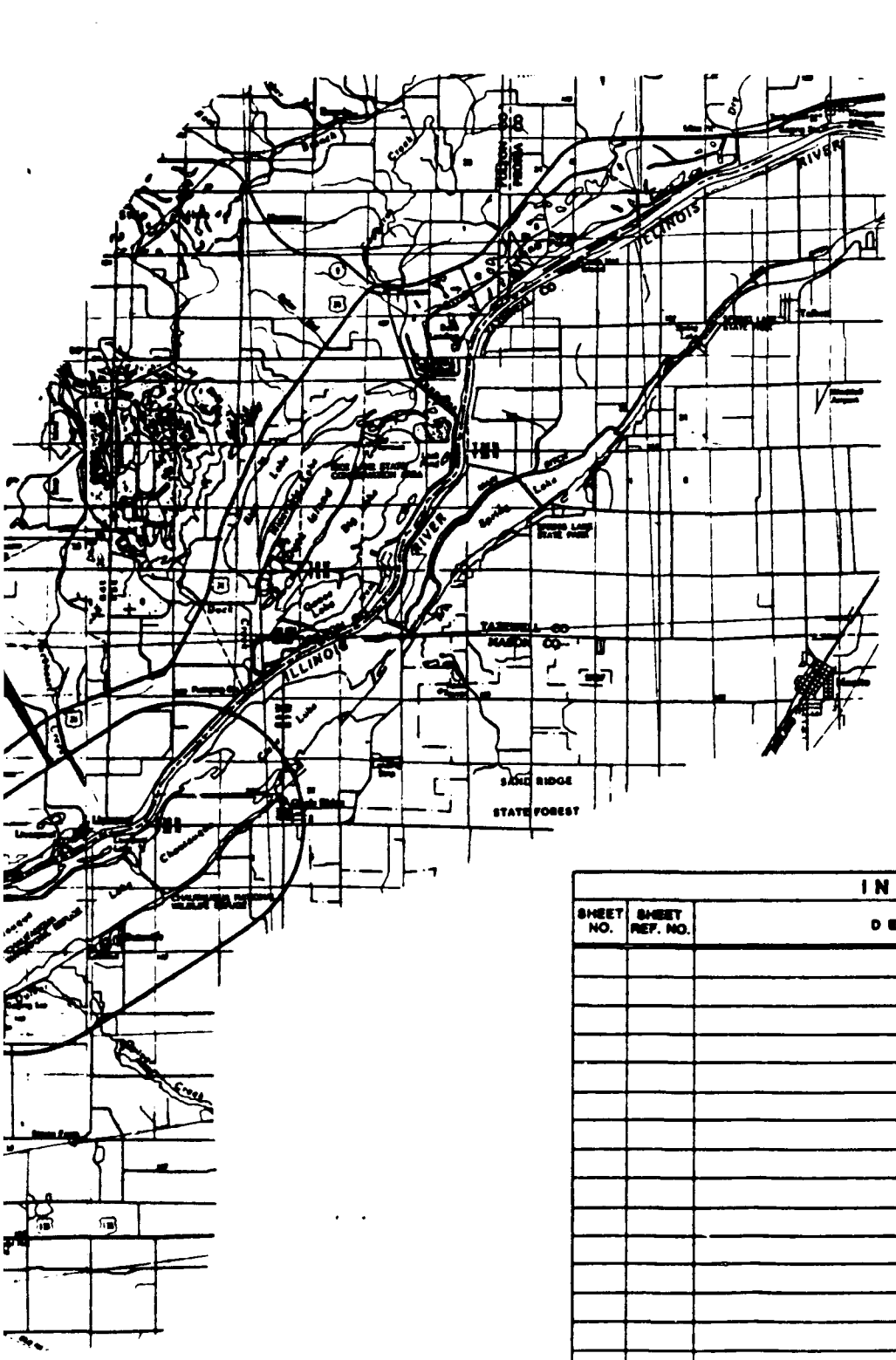


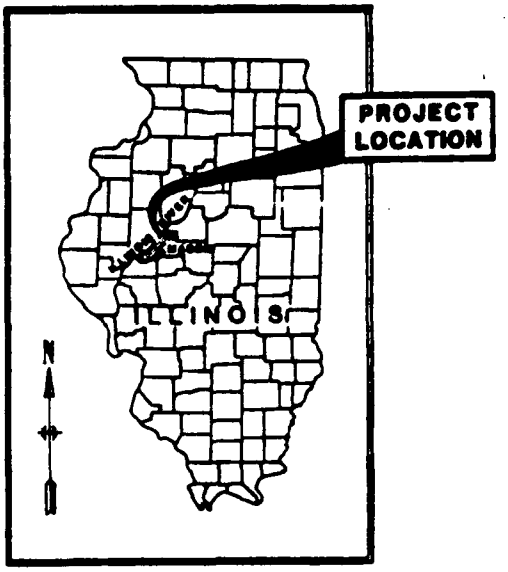
LOCATION PLAN

SHEET NO.	SHEET REF. NO.	



AN

INDEX		
SHEET NO.	SHEET REF. NO.	DESCRIPTION



VICINITY MAP

INDEX
DESCRIPTION

Revisions			
Symbol	Description	Date	Approved

SIGNATURES APPEARING BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL CHANGES IN THIS SET AS INDICATED ON EACH INDIVIDUAL TITLE BLOCK

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

Prepared by:
U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
Submitted by:
Chief, Design Br.
Chief, Engineering Div.
Chief, Construction Div.
Recommended by:
Chief, Engineering Div.
Approved by:
Col, Corps of Engineers, District Engineer

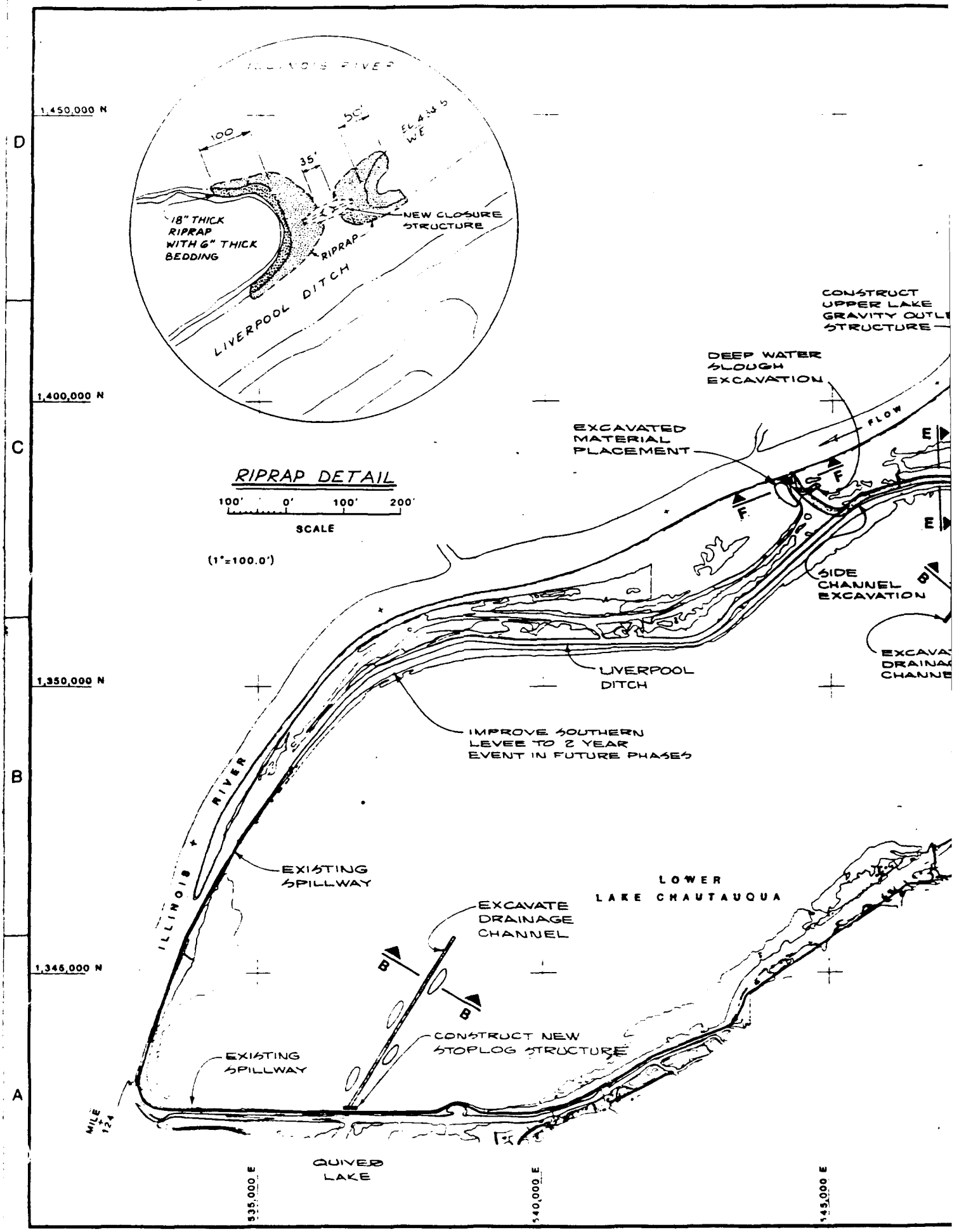
Designed by:
Drawn by: D.J.L.
Checked by:
Reviewed by:
Approved by:

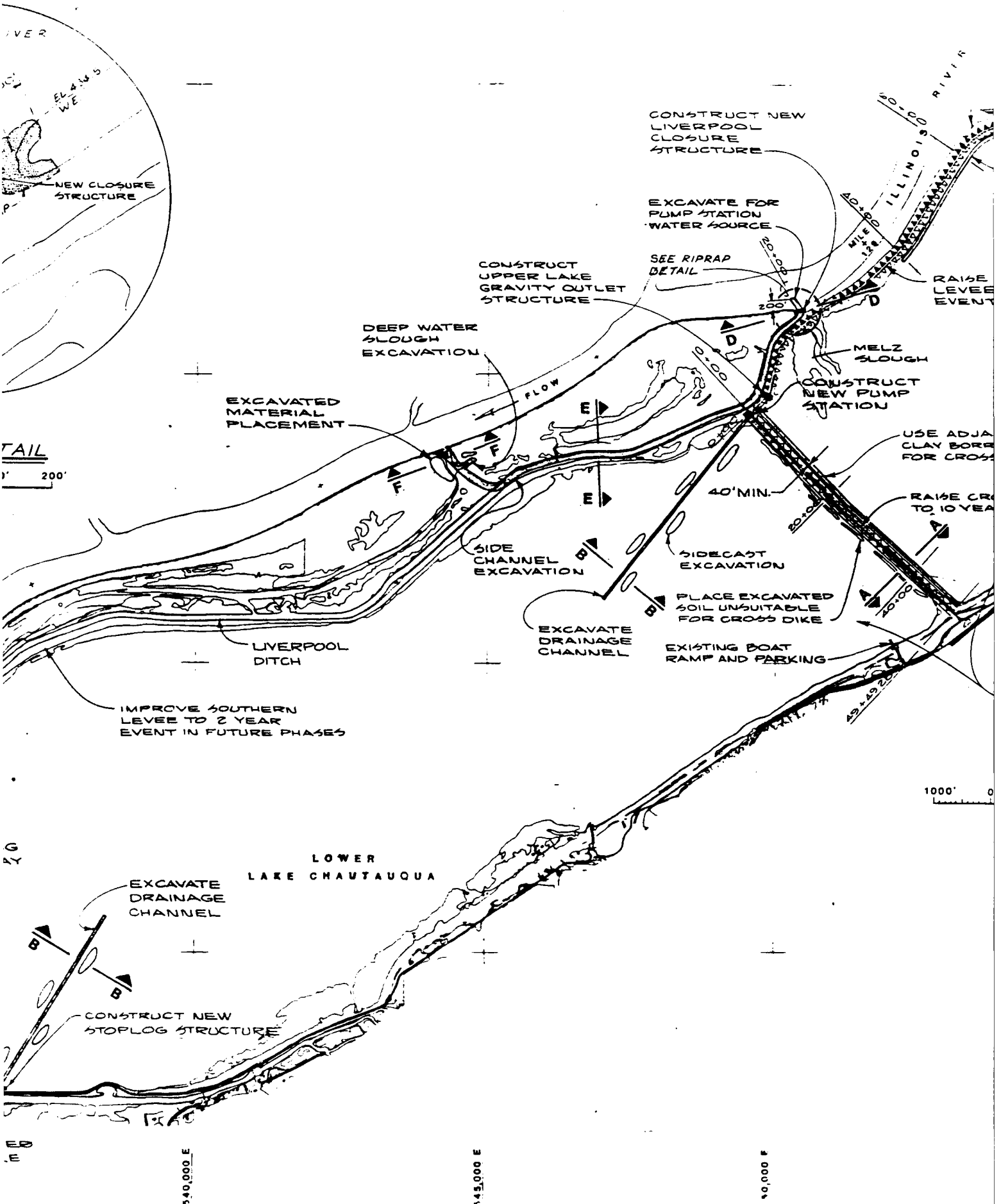
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 134 - MILE 120.5
LAKE CHAUTAUQUA

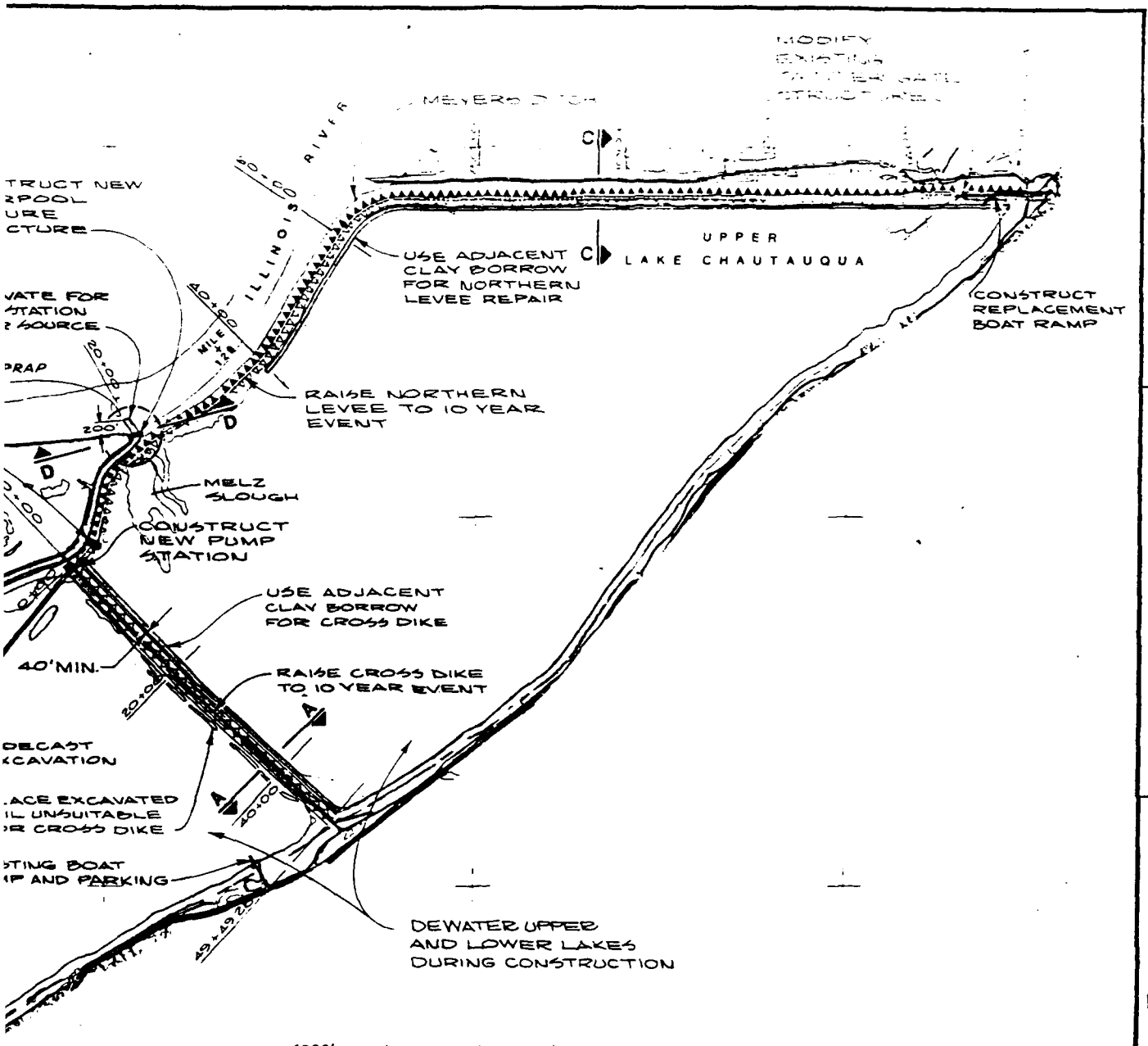
VICINITY MAP, LOCATION PLAN AND INDEX

Scale:
Date:
Drawing Code:
Sheet reference numbers:
X-1
Sheet _ of _

PLATE 1


5
4
D
C
B
A
1,450,000 N
1,400,000 N
1,350,000 N
1,346,000 N
100'
50'
35'
EL 444.5 W.E.
18" THICK RIPRAP WITH 6" THICK BEDDING
RIPRAP
NEW CLOSURE STRUCTURE
LIVERPOOL DITCH
RIPRAP DETAIL
100' 0' 100' 200'
SCALE
(1"=100.0')
CONSTRUCT UPPER LAKE GRAVITY OUTLET STRUCTURE
DEEP WATER SLOUGH EXCAVATION
FLOW
EXCAVATED MATERIAL PLACEMENT
E
F
G
SIDE CHANNEL EXCAVATION
B
LIVERPOOL DITCH
IMPROVE SOUTHERN LEVEE TO 2 YEAR EVENT IN FUTURE PHASES
ILLINOIS RIVER
EXISTING SPILLWAY
LOWER LAKE CHAUTAUQUA
EXCAVATE DRAINAGE CHANNEL
CONSTRUCT NEW STOPLOG STRUCTURE
EXISTING SPILLWAY
MILE 124
QUIVER LAKE
535,000 E
540,000 E
545,000 E


NEW CLOSURE STRUCTURE
CONSTRUCT NEW LIVERPOOL CLOSURE STRUCTURE
EXCAVATE FOR PUMP STATION WATER SOURCE
SEE RIPRAP DETAIL
CONSTRUCT UPPER LAKE GRAVITY OUTLET STRUCTURE
DEEP WATER SLOUGH EXCAVATION
EXCAVATED MATERIAL PLACEMENT
FLOW
MELZ SLOUGH
CONSTRUCT NEW PUMP STATION
40'MIN.
SIDE CHANNEL EXCAVATION
SIDECAST EXCAVATION
PLACE EXCAVATED SOIL UNSUITABLE FOR CROSS DIKE
EXCAVATE DRAINAGE CHANNEL
LIVERPOOL DITCH
EXISTING BOAT RAMP AND PARKING
IMPROVE SOUTHERN LEVEE TO 2 YEAR EVENT IN FUTURE PHASES
LOWER LAKE CHAUTAUQUA
EXCAVATE DRAINAGE CHANNEL
CONSTRUCT NEW STOPLOG STRUCTURE
ILLINOIS RIVER
MILE 136.8
200'
1000'
140,000 E
145,000 E



Revisions			
Symbol	Descriptions	Date	Approved

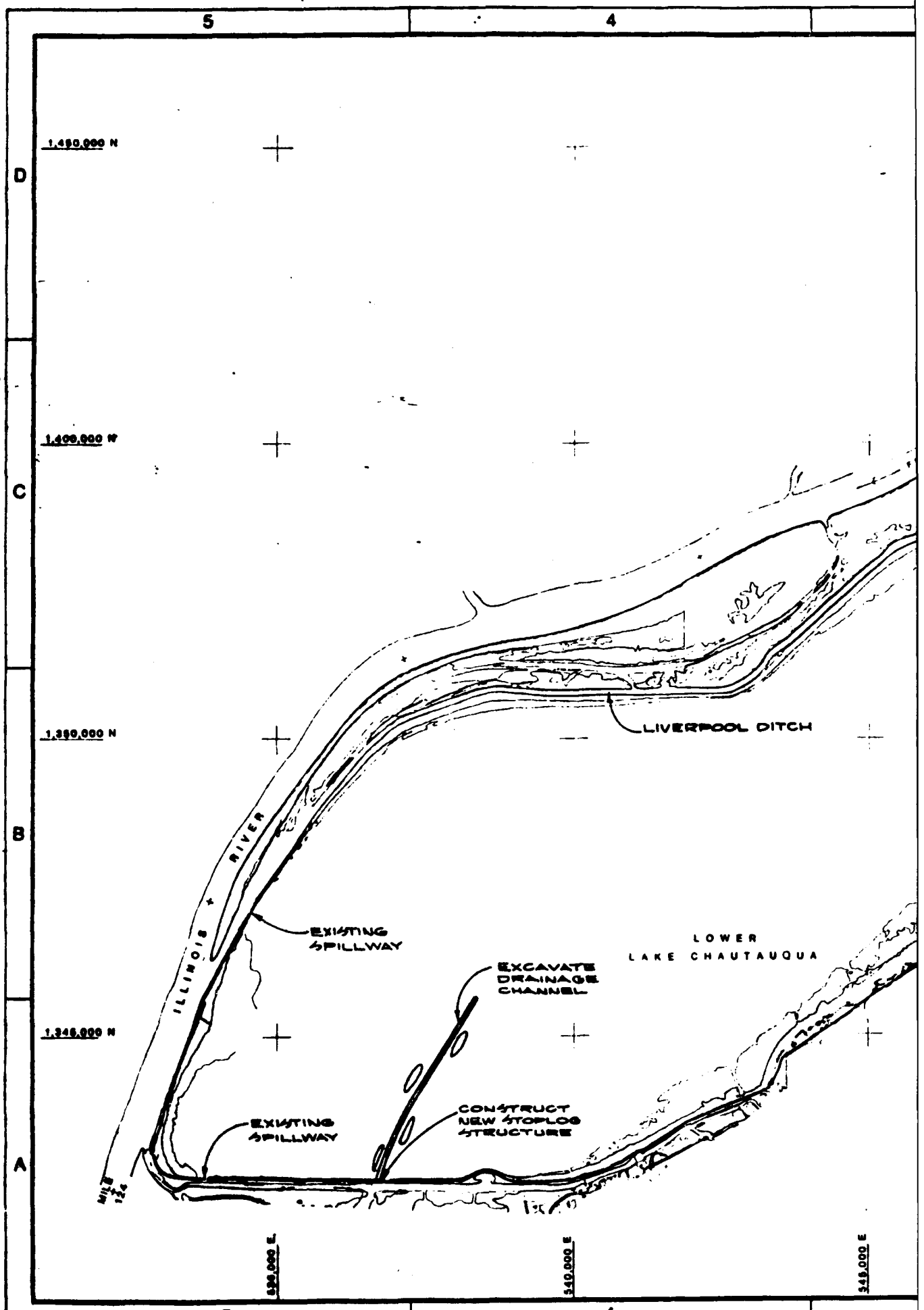
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

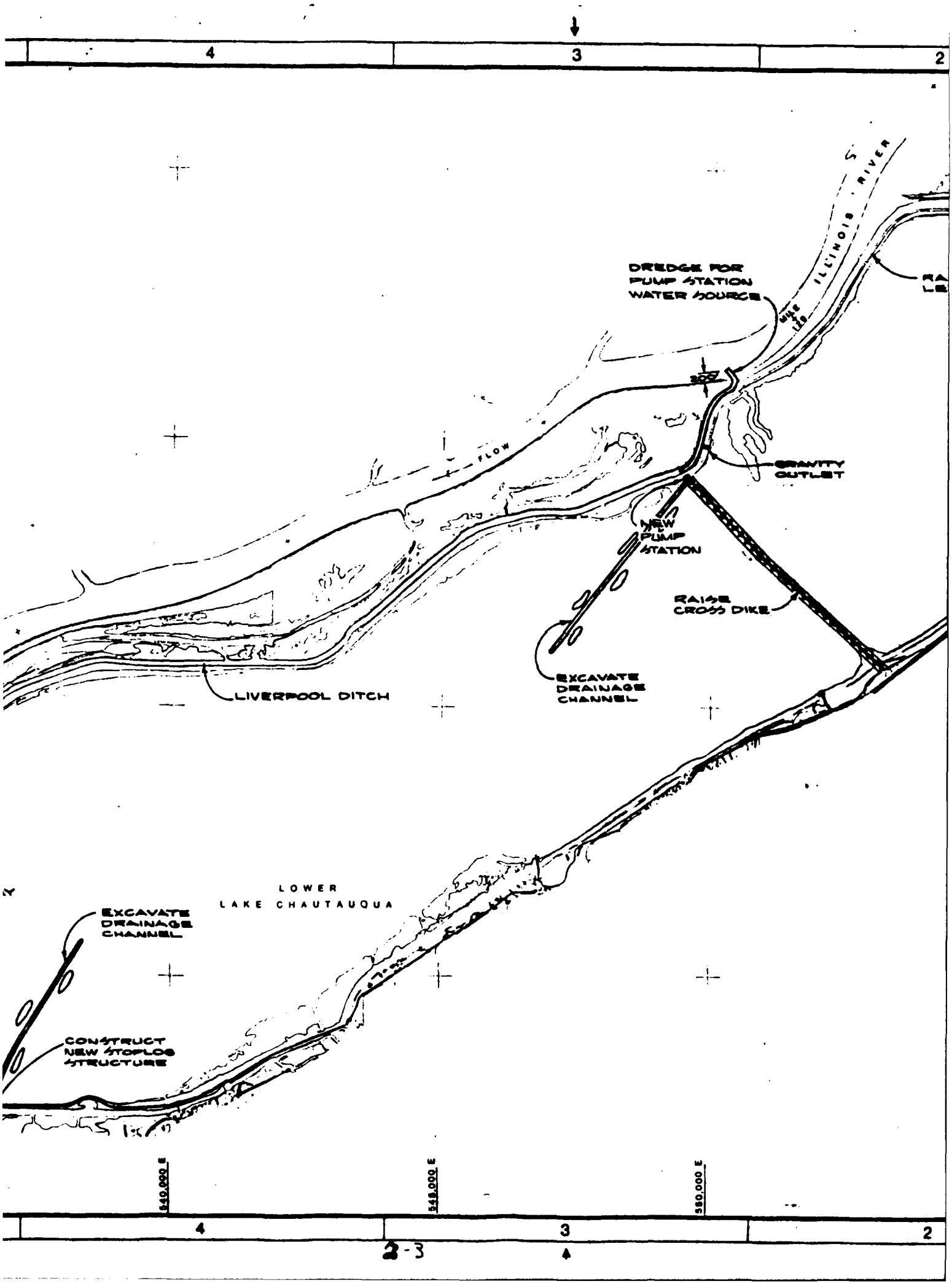
Designed by:
Drawn by: blv
Checked by:
Reviewed by:
Approved by:

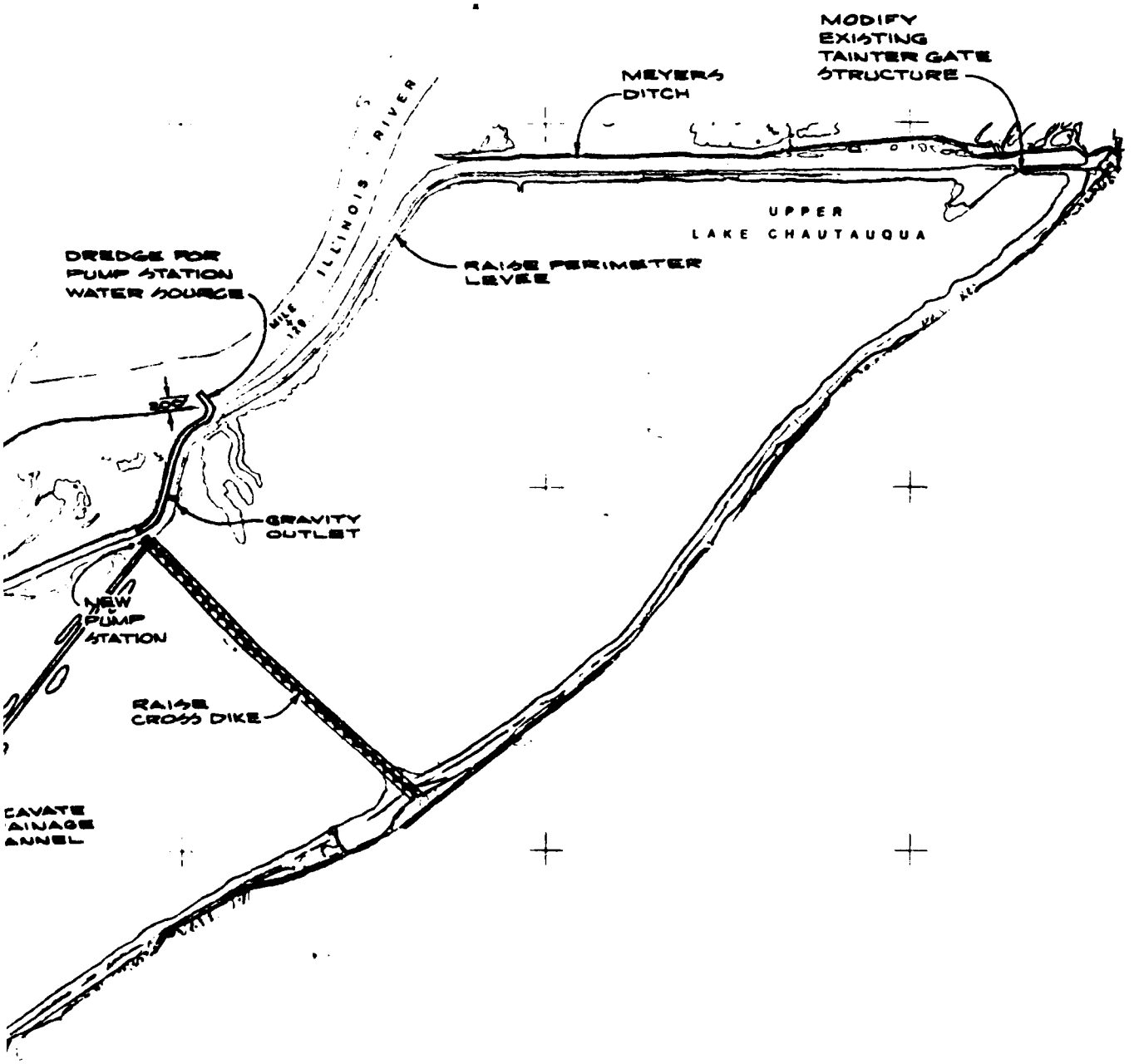
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

RECOMMENDED PLAN
WATER CONTROL
DEWATER UPPER AND LOWER LAKES

Scale: 1" = 1000'
Date:
Drawing Code:
Sheet reference number:
Sheet _ of _


5
4
D
C
B
A
1,450,000 N
1,400,000 N
1,350,000 N
1,348,000 N
LIVERPOOL DITCH
ILLINOIS RIVER
EXISTING SPILLWAY
EXCAVATE DRAINAGE CHANNEL
LOWER LAKE CHAUTAUQUA
CONSTRUCT NEW STOPLOG STRUCTURE
EXISTING SPILLWAY
MILE 124
340,000 E
345,000 E
5
4


4
3
2
DREDGE FOR PUMP STATION WATER SOURCE
ILLINOIS RIVER
FLOW
GRAVITY OUTLET
NEW PUMP STATION
RAISE CROSS DIKE
EXCAVATE DRAINAGE CHANNEL
LIVERPOOL DITCH
LOWER LAKE CHAUTAUQUA
EXCAVATE DRAINAGE CHANNEL
CONSTRUCT NEW STOPLOG STRUCTURE
540,000 E
560,000 E
4
3
2



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U.S. ARMY ENGINEER DISTRICT
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ROCK ISLAND, ILLINOIS

Designed by:
Drawn by: blv
Checked by:
Reviewed by:
Approved by:

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 – MILE 129.5
LAKE CHAUTAUQUA

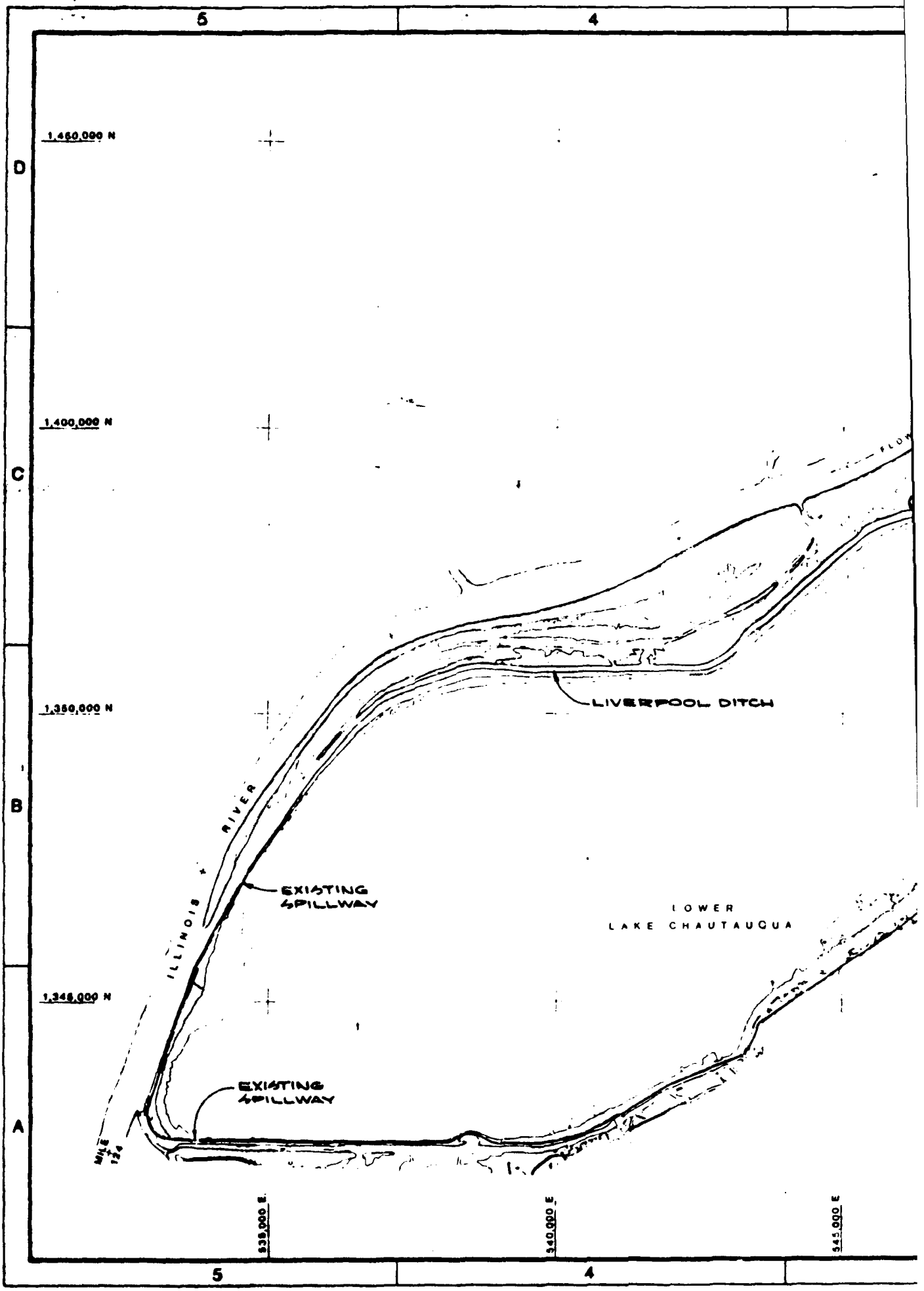
ALTERNATIVE PLAN B

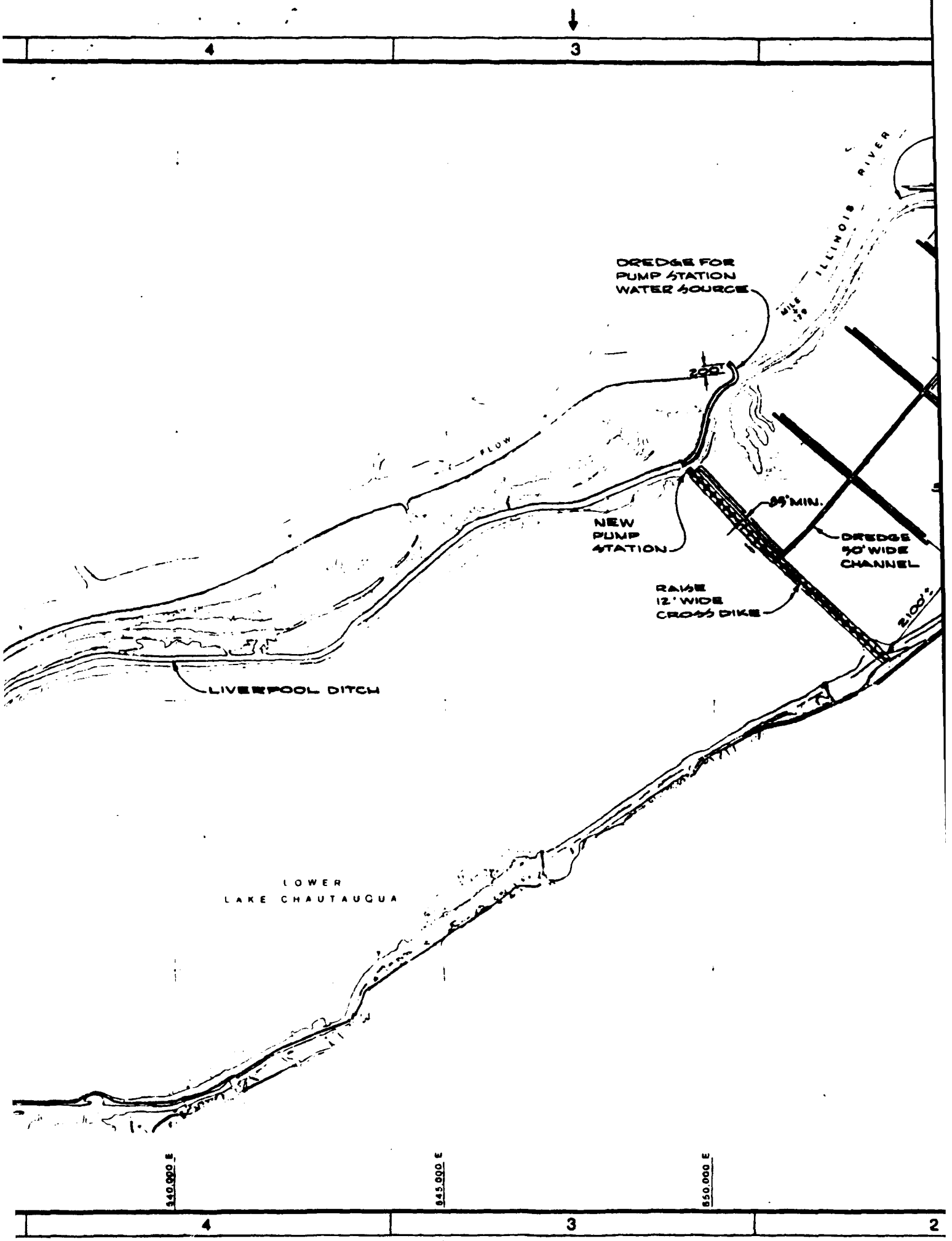
WATER CONTROL

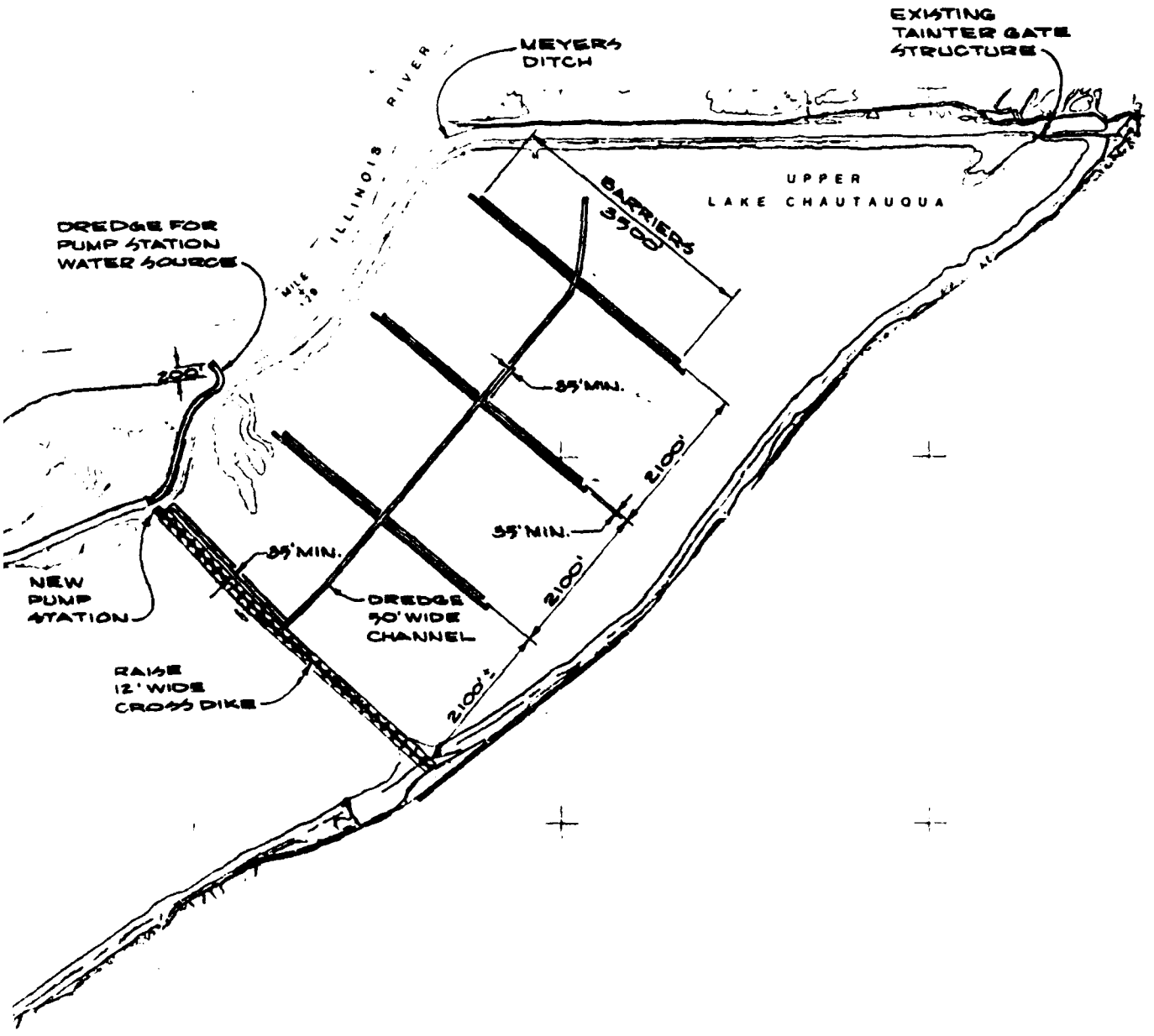
Scale: 1"=1000'
Date:
Drawing Code:
Sheet reference numbers:
Sheet _ of _

550,000 E

555,000 E


5
4
D
C
B
A
1,450,000 N
1,400,000 N
1,350,000 N
1,348,000 N
LIVERPOOL DITCH
ILLINOIS RIVER
EXISTING SPILLWAY
EXISTING SPILLWAY
LOWER
LAKE CHAUTAUQUA
MILE 124
338,000 E
340,000 E
345,000 E


4
3
DREDGE FOR
PUMP STATION
WATER SOURCE
ILLINOIS RIVER
250'
FLOW
89' MIN.
NEW
PUMP
STATION
DREDGE
90' WIDE
CHANNEL
RAISE
12' WIDE
CROSS DIKE
2100'
LIVERPOOL DITCH
LOWER
LAKE CHAUTAUQUA
840,000 E
845,000 E
850,000 E
4
3
2



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

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Drawn by
. blv

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Approved by

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

ALTERNATIVE C
BARRIER ISLAND

Scales: 1"=1000'

Sheet reference numbers

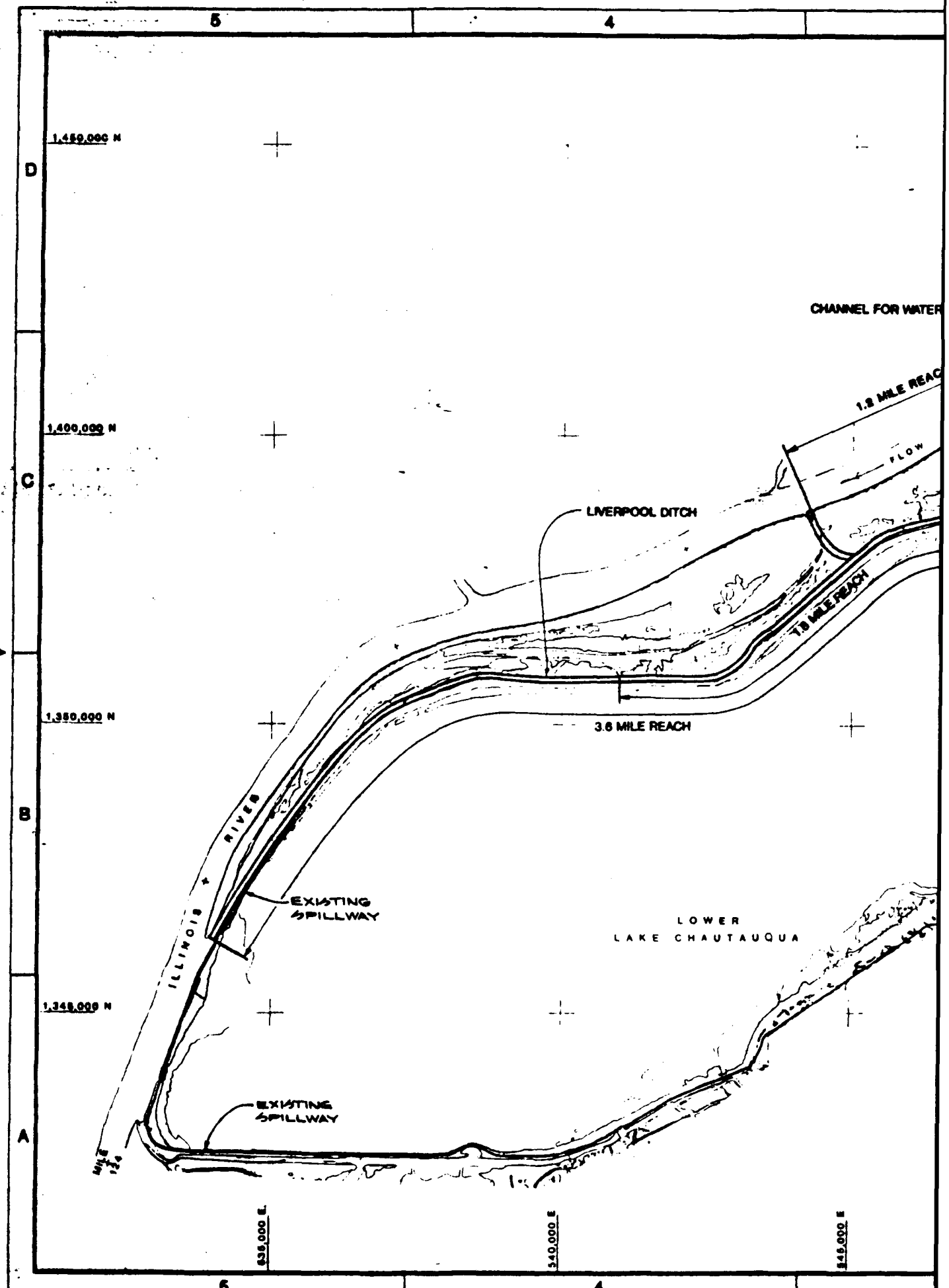
Sheet

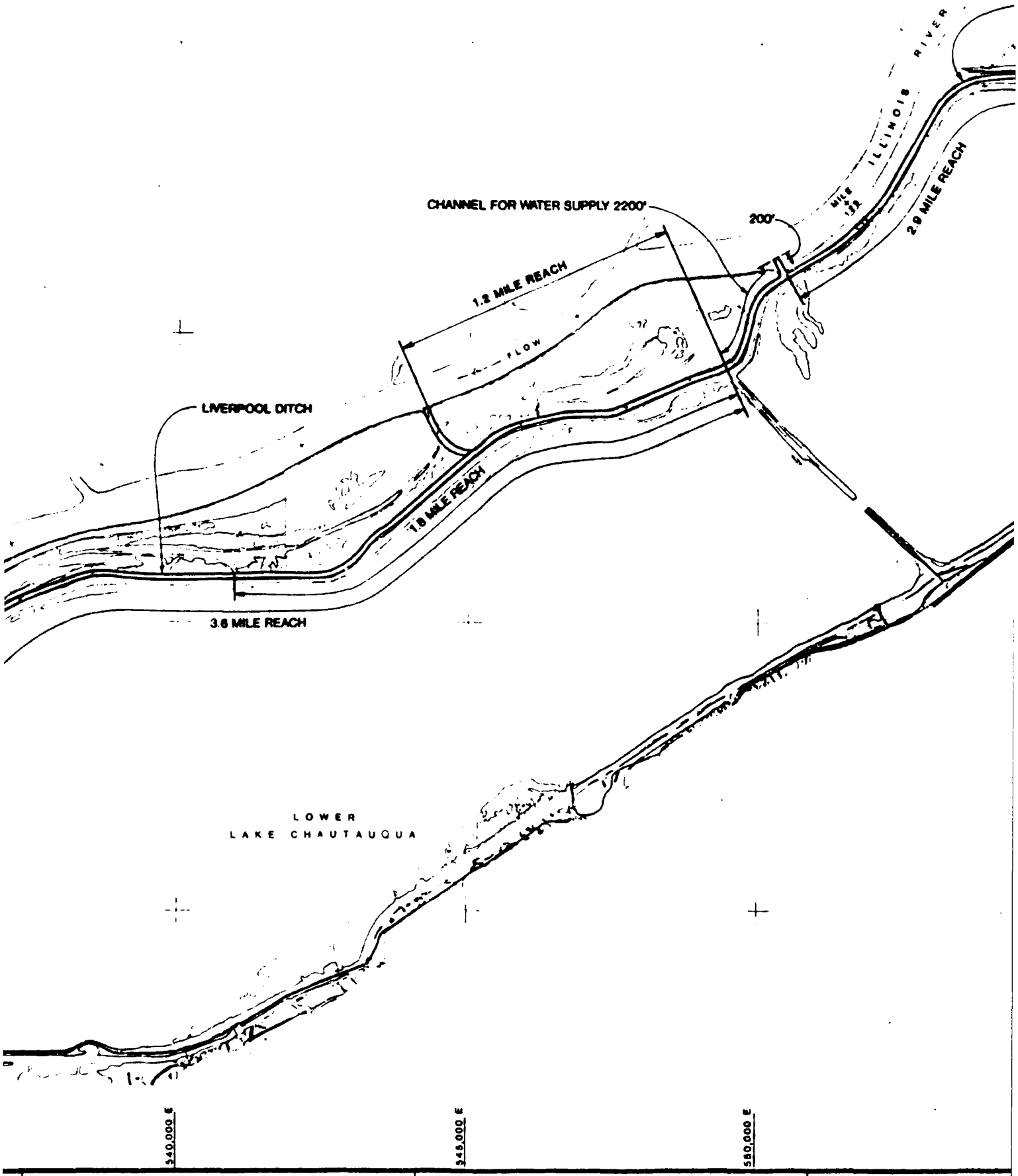
Drawing Code

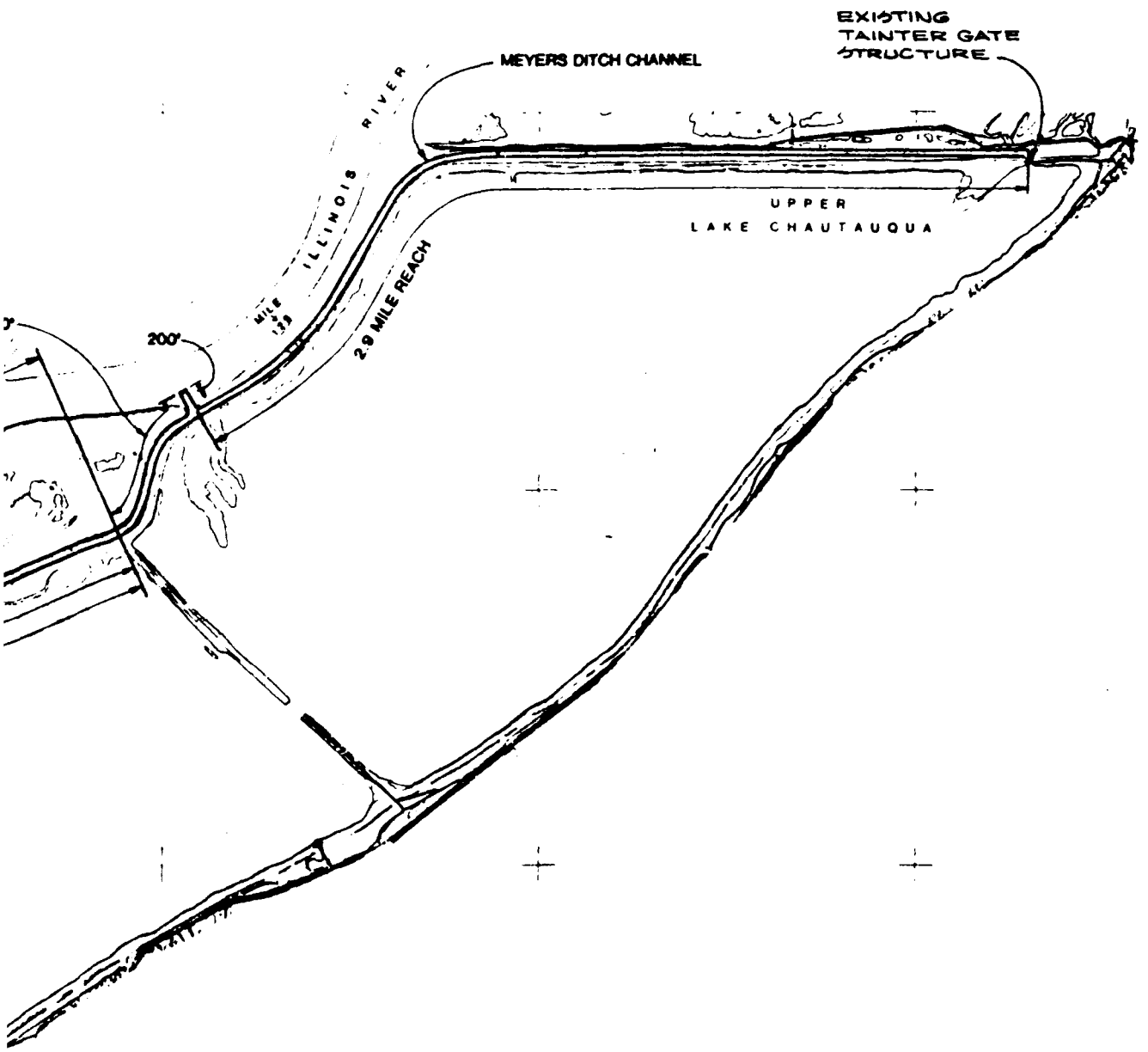
Sheet _ of _

550 000 E

555 000 E


5
4
1,450,000 N
1,400,000 N
1,350,000 N
1,348,000 N
D
C
B
A
CHANNEL FOR WATER
1.8 MILE REAC
FLOW
LIVERPOOL DITCH
1.8 MILE REACH
3.6 MILE REACH
ILLINOIS RIVER
EXISTING SPILLWAY
LOWER
LAKE CHAUTAUQUA
EXISTING SPILLWAY
835,000 E.
840,000 E
845,000 E


CHANNEL FOR WATER SUPPLY 2200'
200'
1.2 MILE REACH
FLOW
LIVERPOOL DITCH
1.8 MILE REACH
3.6 MILE REACH
ILLINOIS RIVER
MILE 132
2.8 MILE REACH
LOWER
LAKE CHAUTAUQUA
340,000 E
360,000 E
380,000 E



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CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by

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ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 134 - MILE 129.8
LAKE CHAUTAUQUA

ALTERNATIVE D
SIDE CHANNEL EXCAVATION

Scale 1"=1000'

Date

Drawing Code

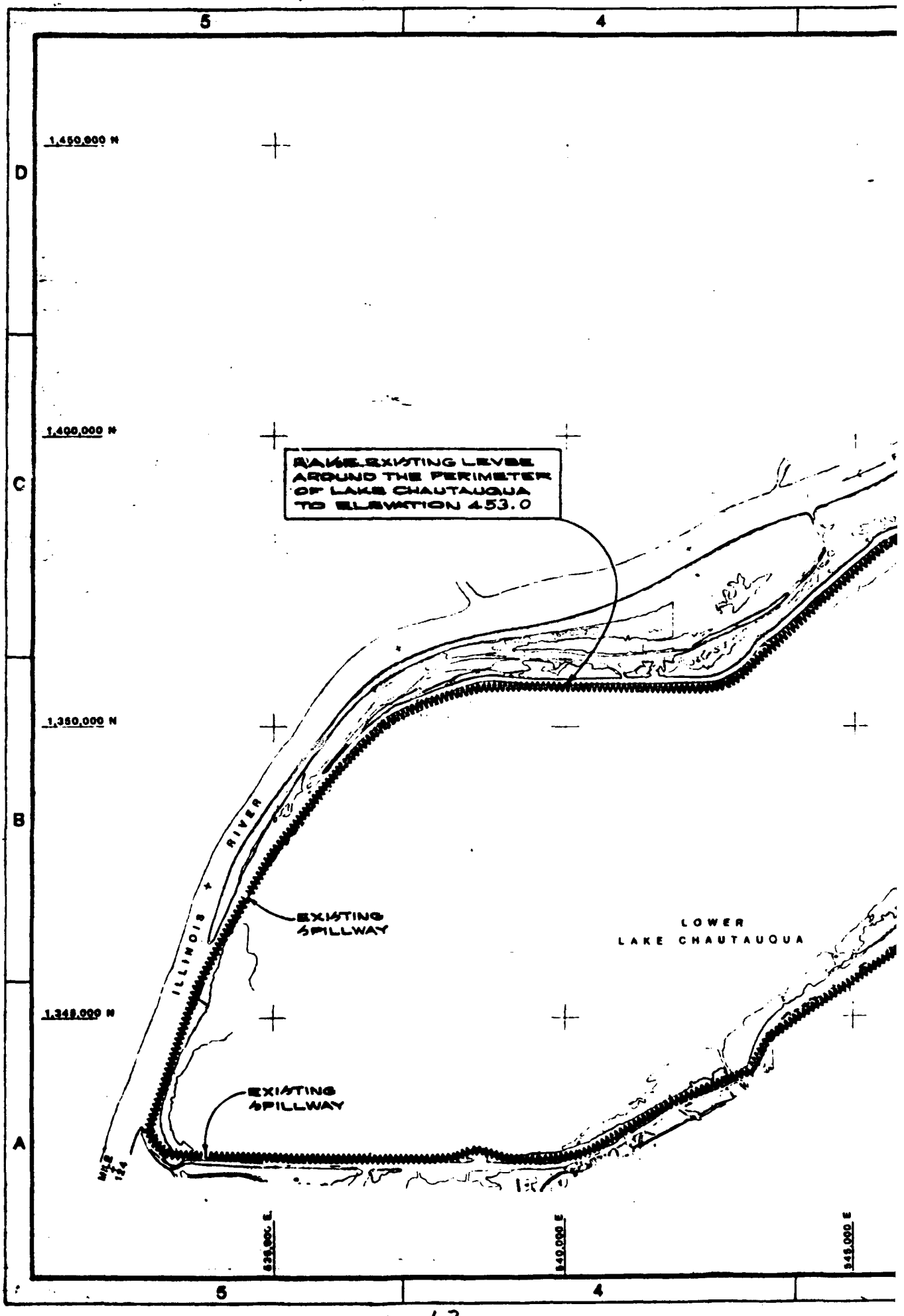
Sheet reference number

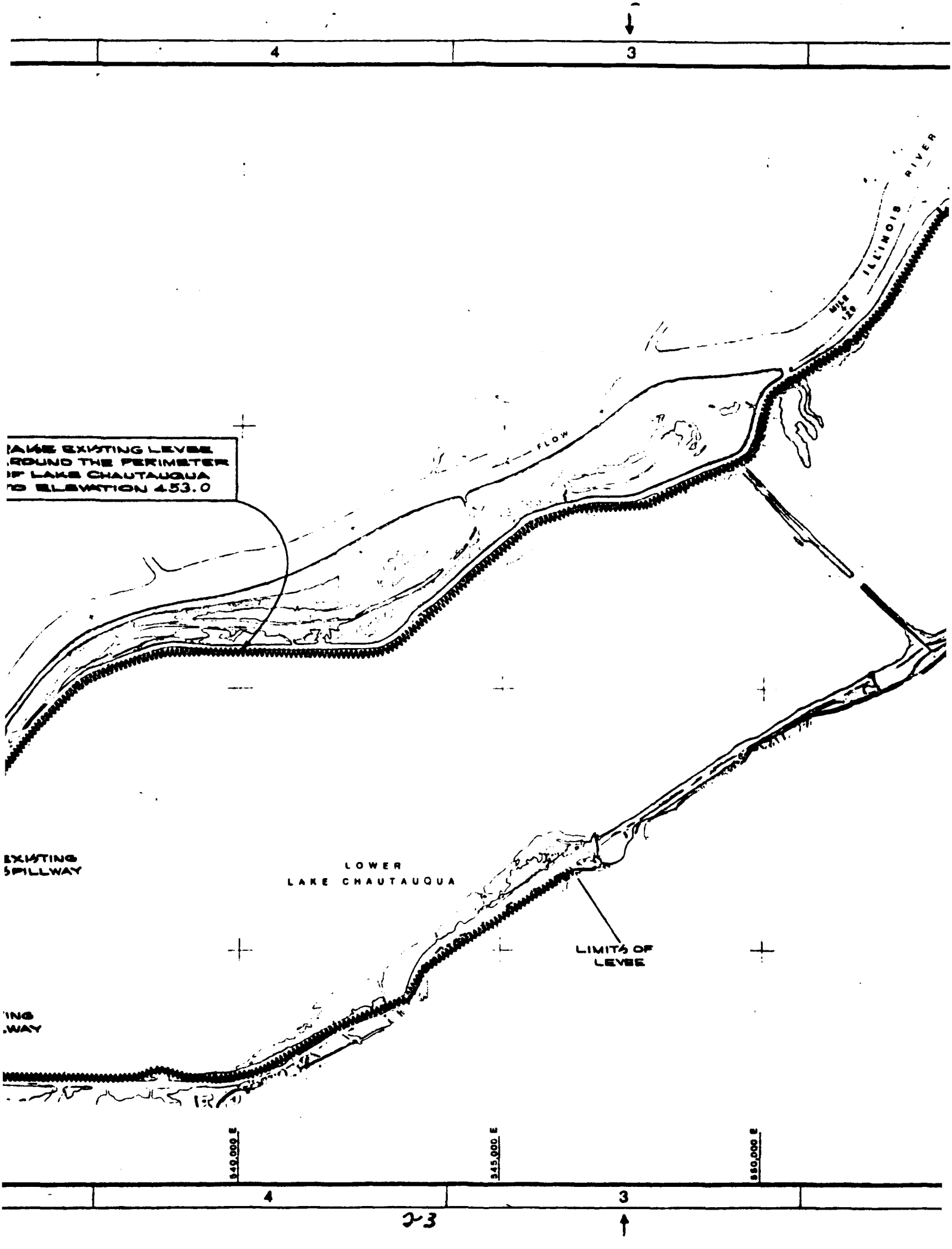
Sheet _ of _

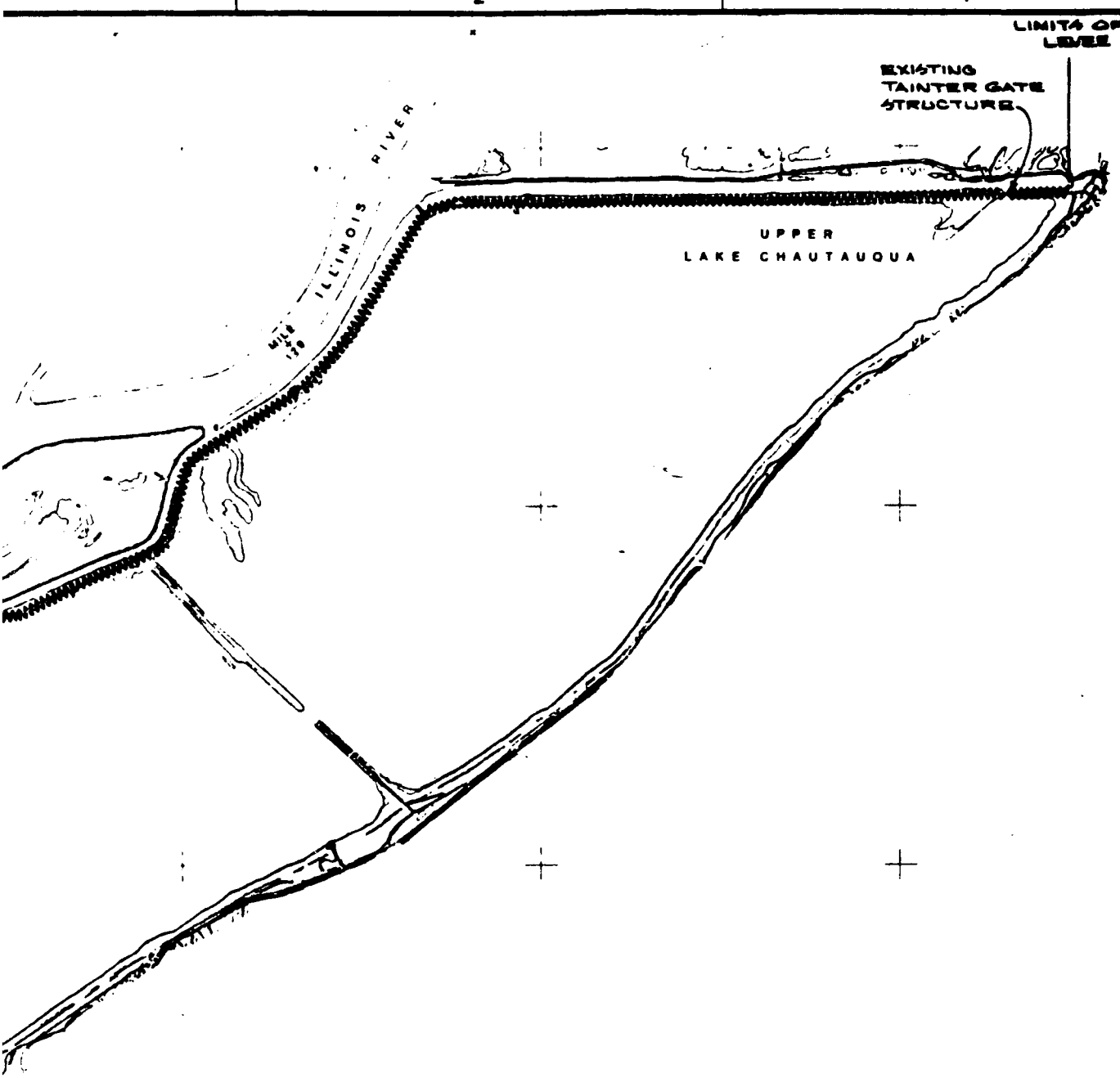
580,000 E

650,000 E

PLATE 5


5
4
1,450,000 N
1,400,000 N
1,350,000 N
1,348,000 N
D
C
B
A
RAISE EXISTING LEVEE AROUND THE PERIMETER OF LAKE CHAUTAUQUA TO ELEVATION 453.0
ILLINOIS RIVER
EXISTING SPILLWAY
EXISTING SPILLWAY
LOWER LAKE CHAUTAUQUA
MILE 124
439,000 E
440,000 E
441,000 E
5
4


4
3
ILLINOIS RIVER
FLOW
LOWER
LAKE CHAUTAUQUA
LIMITS OF
LEVEE
EXISTING
SPILLWAY
940,000 E
945,000 E
950,000 E
4
3



Revisions			
Symbol	Descriptions	Date	Approved

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

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Drawn by btv

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Reviewed by

Approved by

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

ALTERNATIVE E
SEDIMENTATION REDUCTION

Scale 1" = 1000'

Date

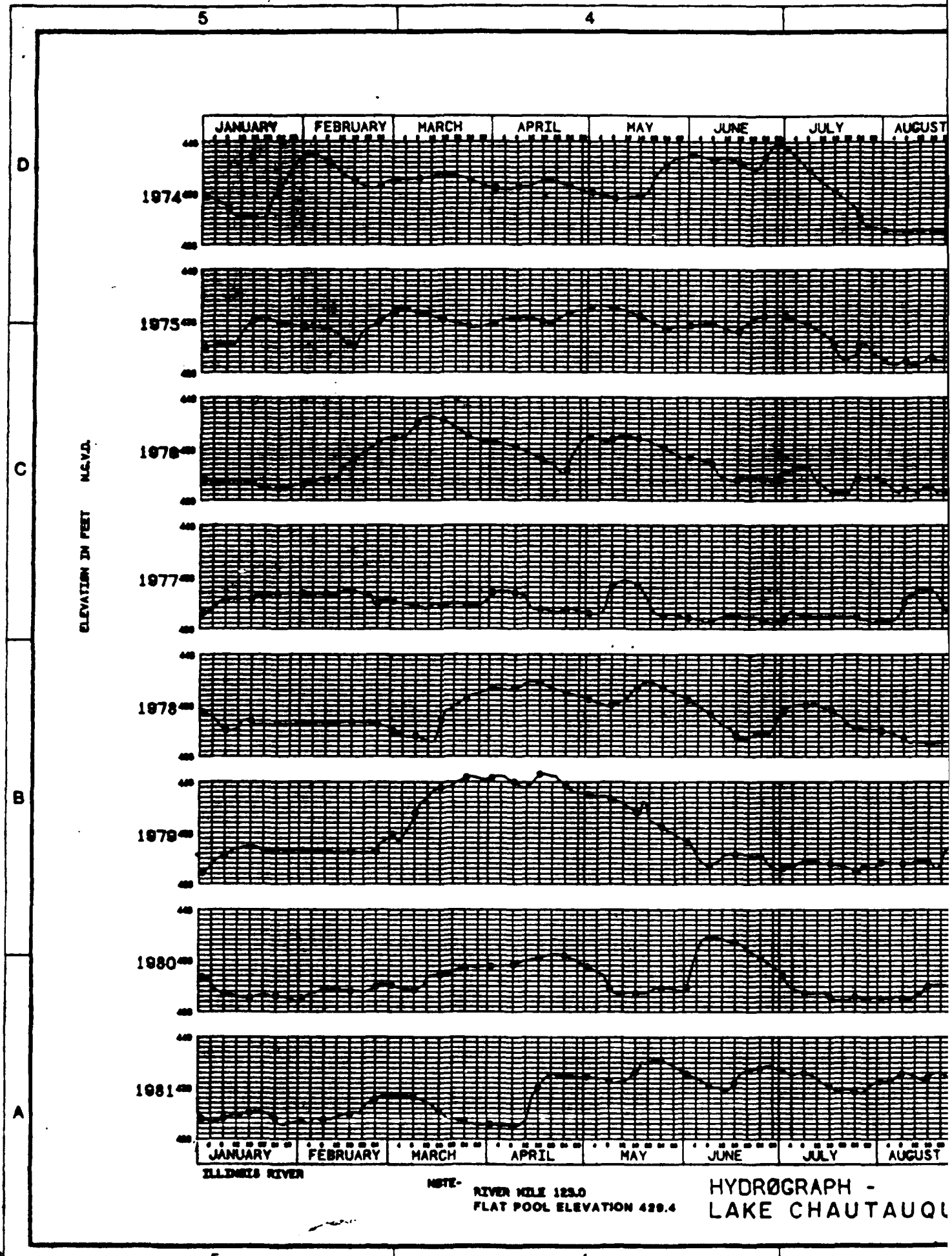
Drawing Code

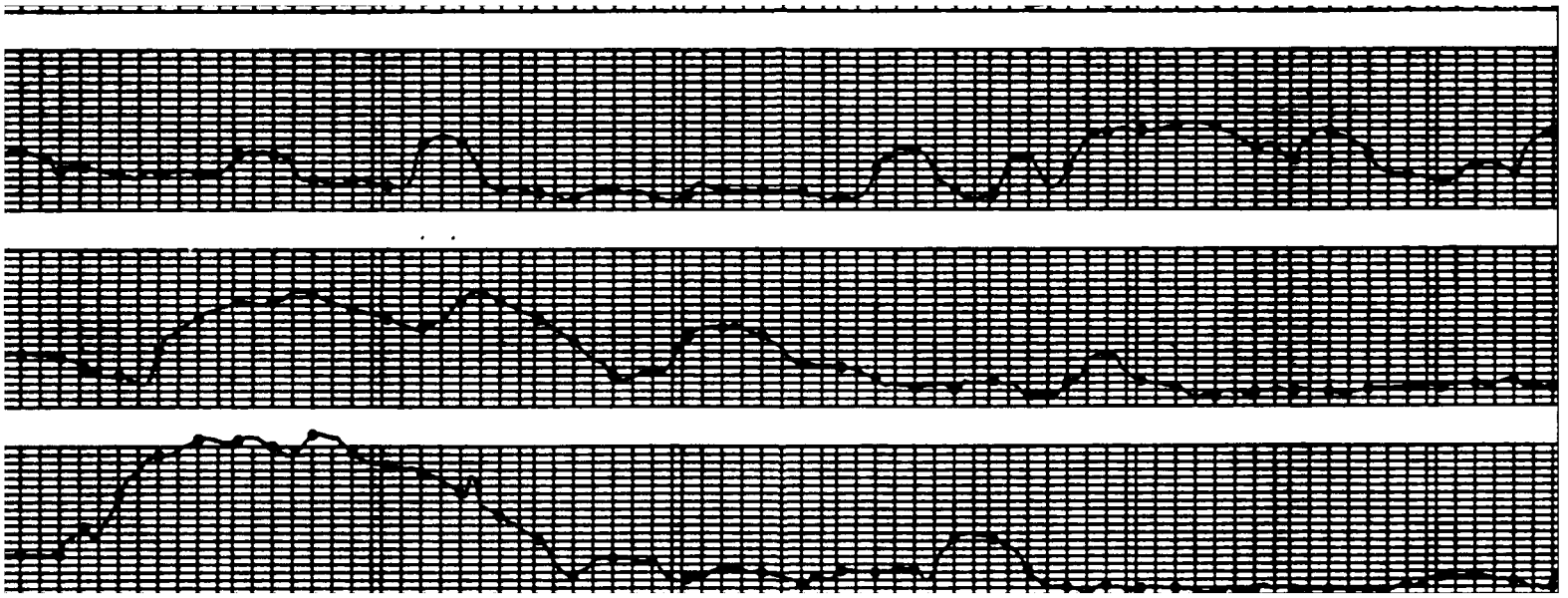
Sheet reference numbers

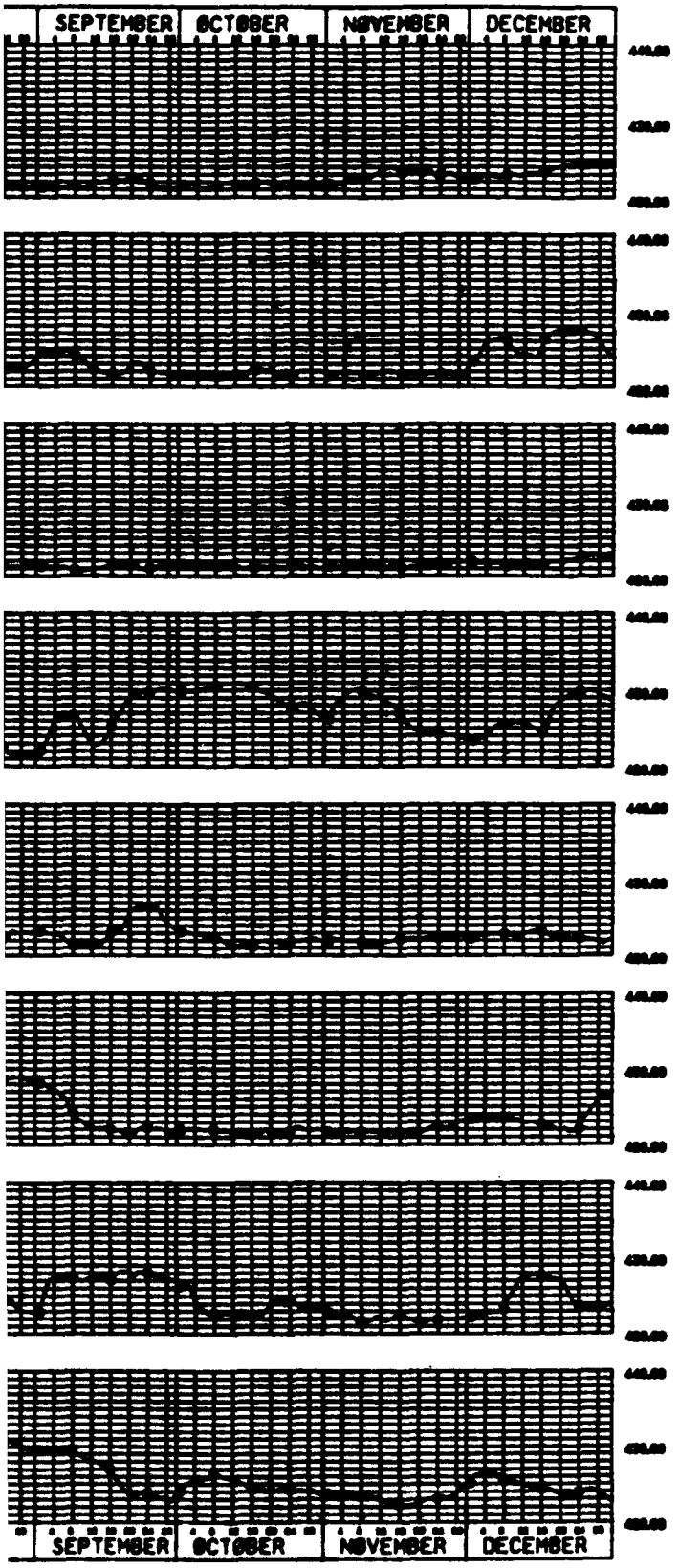
Sheet _ of _

550,000 E

555,000 E


5
4
D
C
B
A
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
1974
1975
1976
1977
1978
1979
1980
1981
ELEVATION IN FEET N.G.V.D.
ILLINOIS RIVER
NOTE- RIVER MILE 123.0
FLAT POOL ELEVATION 429.4
HYDROGRAPH -
LAKE CHAUTAUQ





A EMP

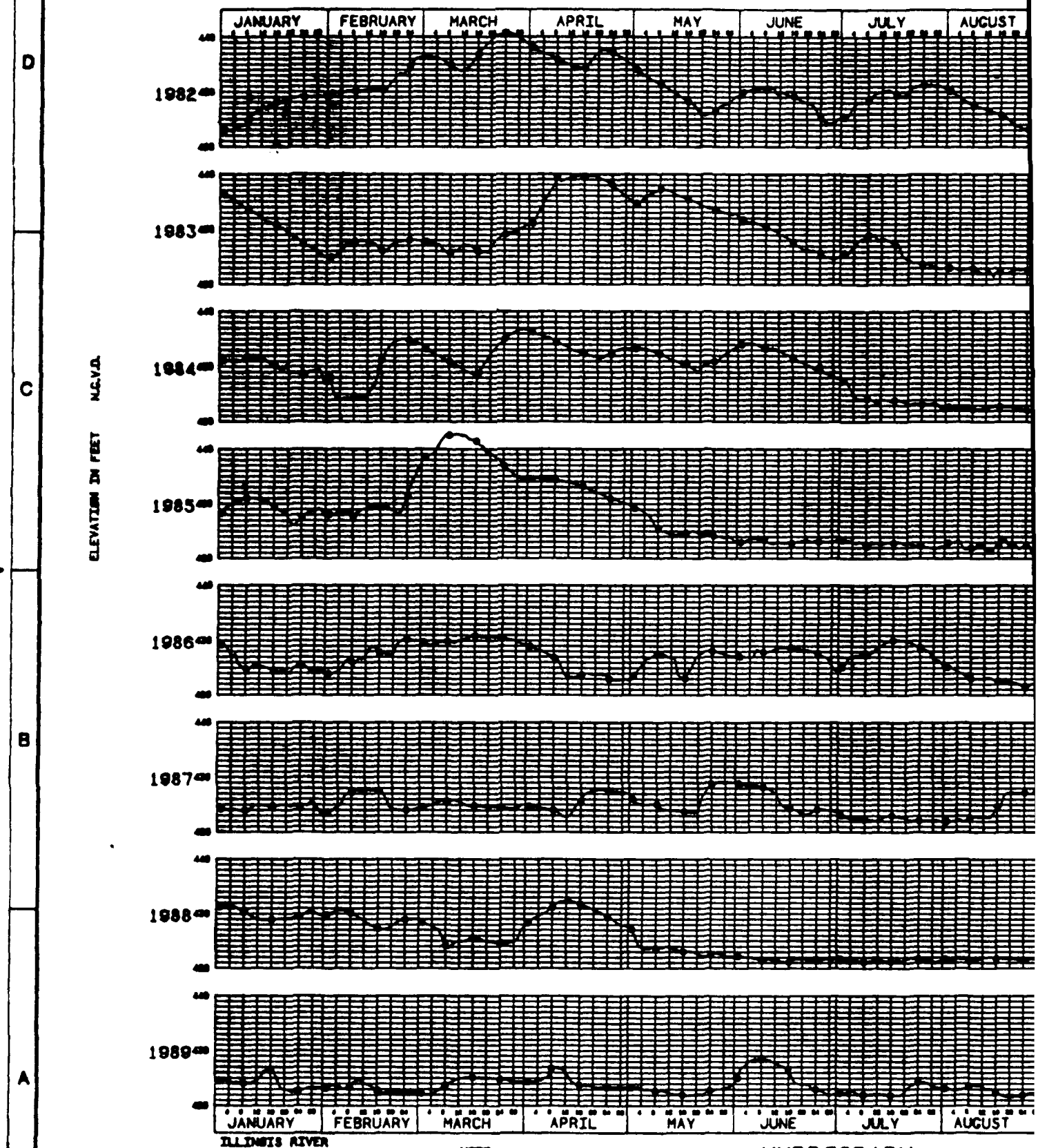
Revisions			
Symbol	Description	Date	Approved

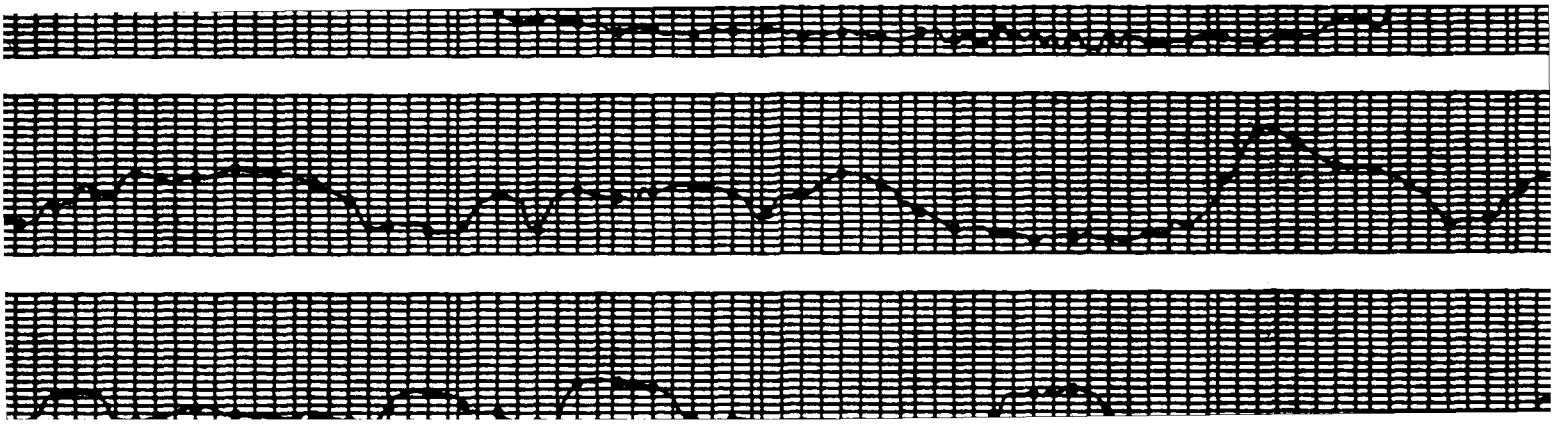
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

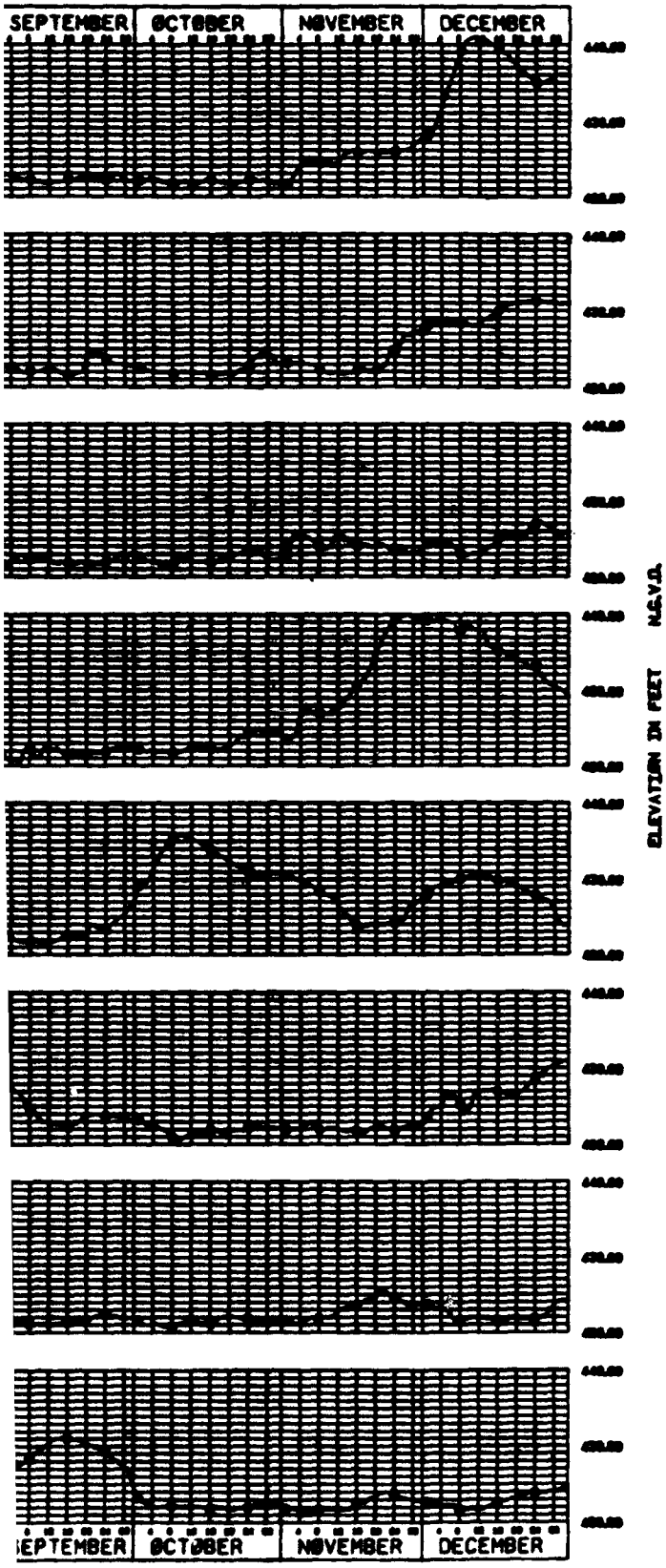
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 134 - MILE 120.6
LAKE CHAUTAUQUA

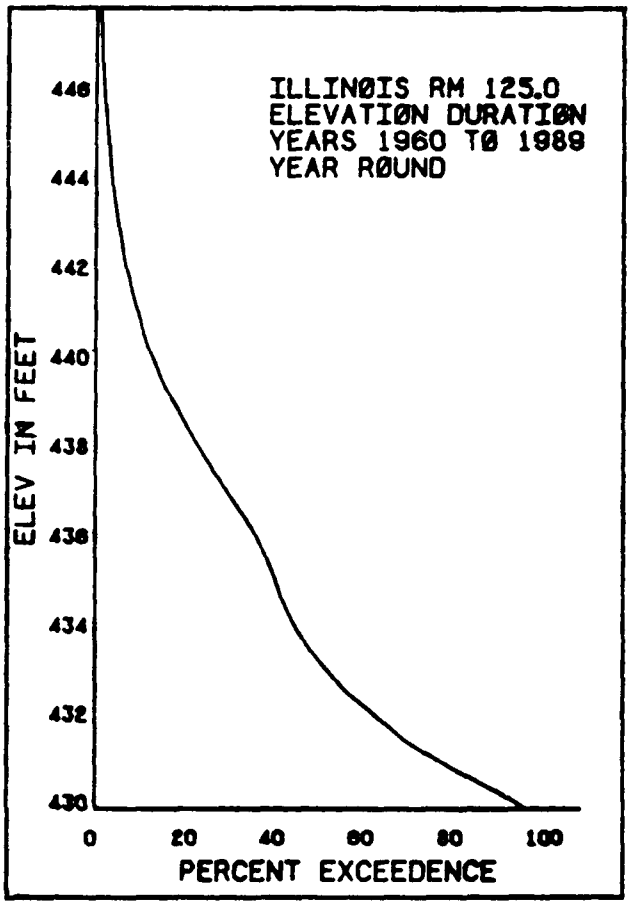
HYDRAULIC DATA I

Designed by
Drawn by
Checked by
Reviewed by
Approved by
Scale
Date
Drawing Code
Sheet reference number
Sheet _ of _


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
1982
1983
1984
1985
1986
1987
1988
1989
ELEVATION IN FEET N.G.V.D.
ILLINOIS RIVER
NOTE- RIVER MILE 125.0
FLAT POOL ELEVATION 428.4
HYDROGRAPH -
LAKE CHAUTAUQU







Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

HYDRAULIC DATA II

Developed by
Drawn by
Checked by
Reviewed by
Approved by
Date
Sheet reference numbers
Sheet _ of _

EMP


D
C
B
A
5
4
3
LC-90-5
LC
LC-90-7
LC-90-8
LC-90-9
LC-90-10
LC-90-11
LC-90-12
LC-90-14


LC-89-15
LC-90-3
LC-90-2
LC-90-4
90-5
LC-90-6
LC-90-7
LC-90-8
90-9
LC-90-10
LC-90-11
C-90-12
)0 14

BORING LOCATIONS

PLATE C

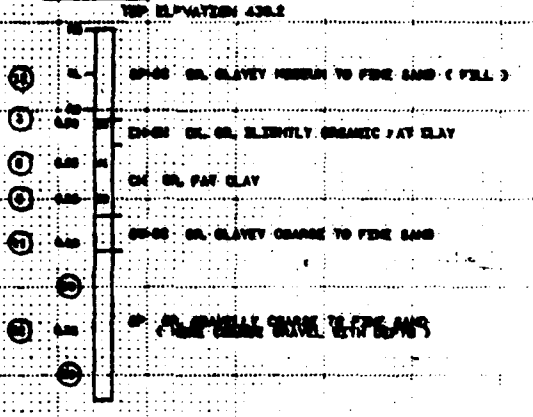
5 4

D C B A

ELEVATION

LC-89-1

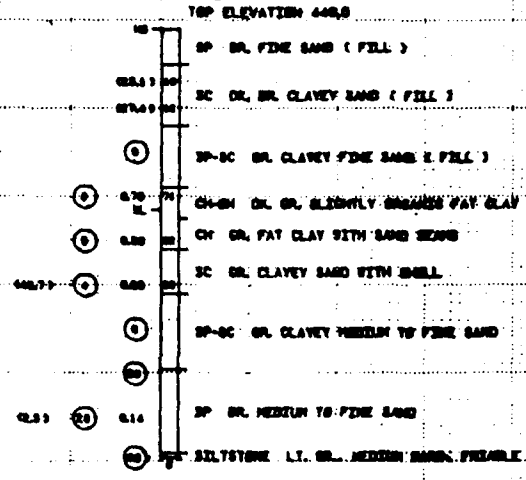
TOP ELEVATION 438.2



SEE PLAN SHEET FOR LOCATION OF BORING
23 MAY 1989

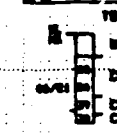
LC-89-2

TOP ELEVATION 440.8



SEE PLAN SHEET FOR LOCATION OF BORING
24 MAY 1989

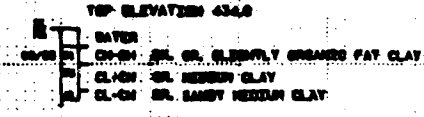
LC-89-3



SEE PLAN SHEET FOR LOCATION OF BOR
6 JULY 1989

LC-89-6

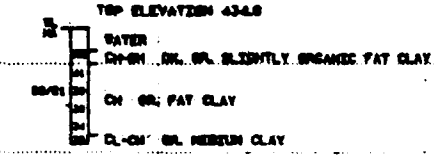
TOP ELEVATION 434.0



SEE PLAN SHEET FOR LOCATION OF BORING
7 JULY 1989

LC-89-7

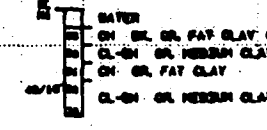
TOP ELEVATION 434.0



SEE PLAN SHEET FOR LOCATION OF BORING
7 JULY 1989

LC-89-8

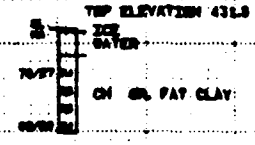
TOP ELEVATION 434.0



SEE PLAN SHEET FOR LOCATION OF BORING
7 JULY 1989

LC-89-12

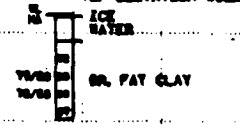
TOP ELEVATION 431.8



STA 00+00
MEVERS DITCH
15 DECEMBER 1989

LC-89-13

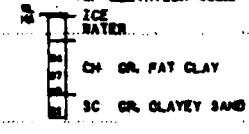
TOP ELEVATION 432.2



STA 40+00
MEVERS DITCH
20 DECEMBER 1989

LC-89-14

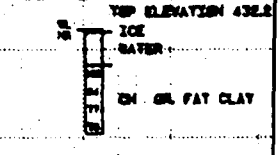
TOP ELEVATION 432.2



STA 60+50
MEVERS DITCH
20 DECEMBER 1989

LC-89-15

TOP ELEVATION 432.2

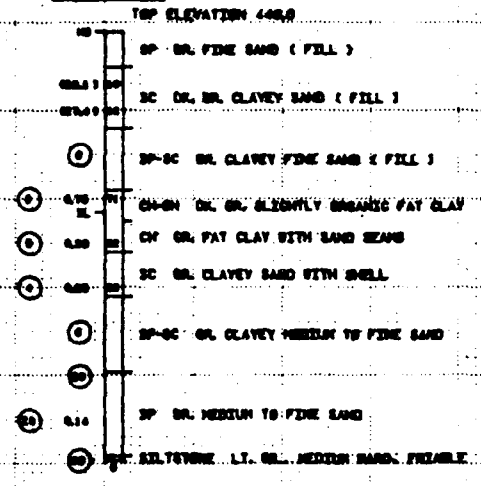


STA 80+00
MEVERS DITCH
20 DECEMBER 1989

5 4

LC-89-2

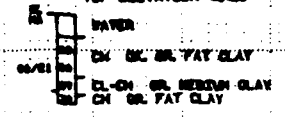
TOP ELEVATION 448.0



SEE PLAN SHEET FOR
LOCATION OF BORING
24 MAY 1989

LC-89-3

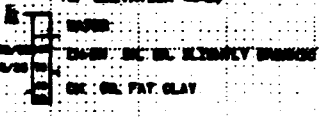
TOP ELEVATION 434.0



SEE PLAN SHEET FOR
LOCATION OF BORING
6 JULY 1989

LC-89-4

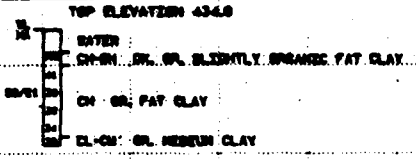
TOP ELEVATION 434.0



SEE PLAN SHEET FOR
LOCATION OF BORING
6 JULY 1989

LC-89-7

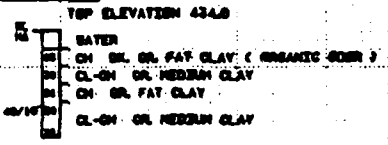
TOP ELEVATION 434.0



SEE PLAN SHEET FOR
LOCATION OF BORING
7 JULY 1989

LC-89-8

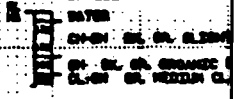
TOP ELEVATION 434.0



SEE PLAN SHEET FOR
LOCATION OF BORING
7 JULY 1989

LC-89-9

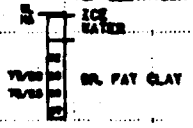
TOP ELEVATION 434.0



SEE PLAN SHEET FOR
LOCATION OF BORING
7 JULY 1989

LC-89-13

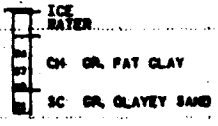
TOP ELEVATION 430.2



STA 49+00
NEVERS DITCH
20 DECEMBER 1989

LC-89-14

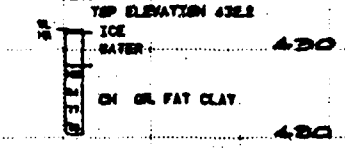
TOP ELEVATION 430.2



STA 50+50
NEVERS DITCH
20 DECEMBER 1989

LC-89-15

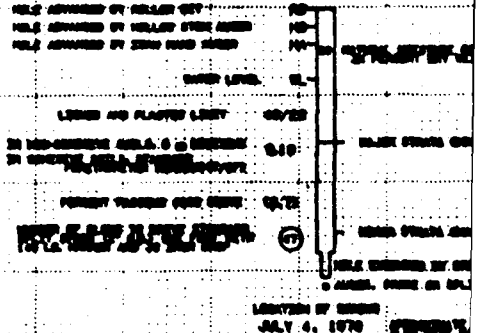
TOP ELEVATION 430.2



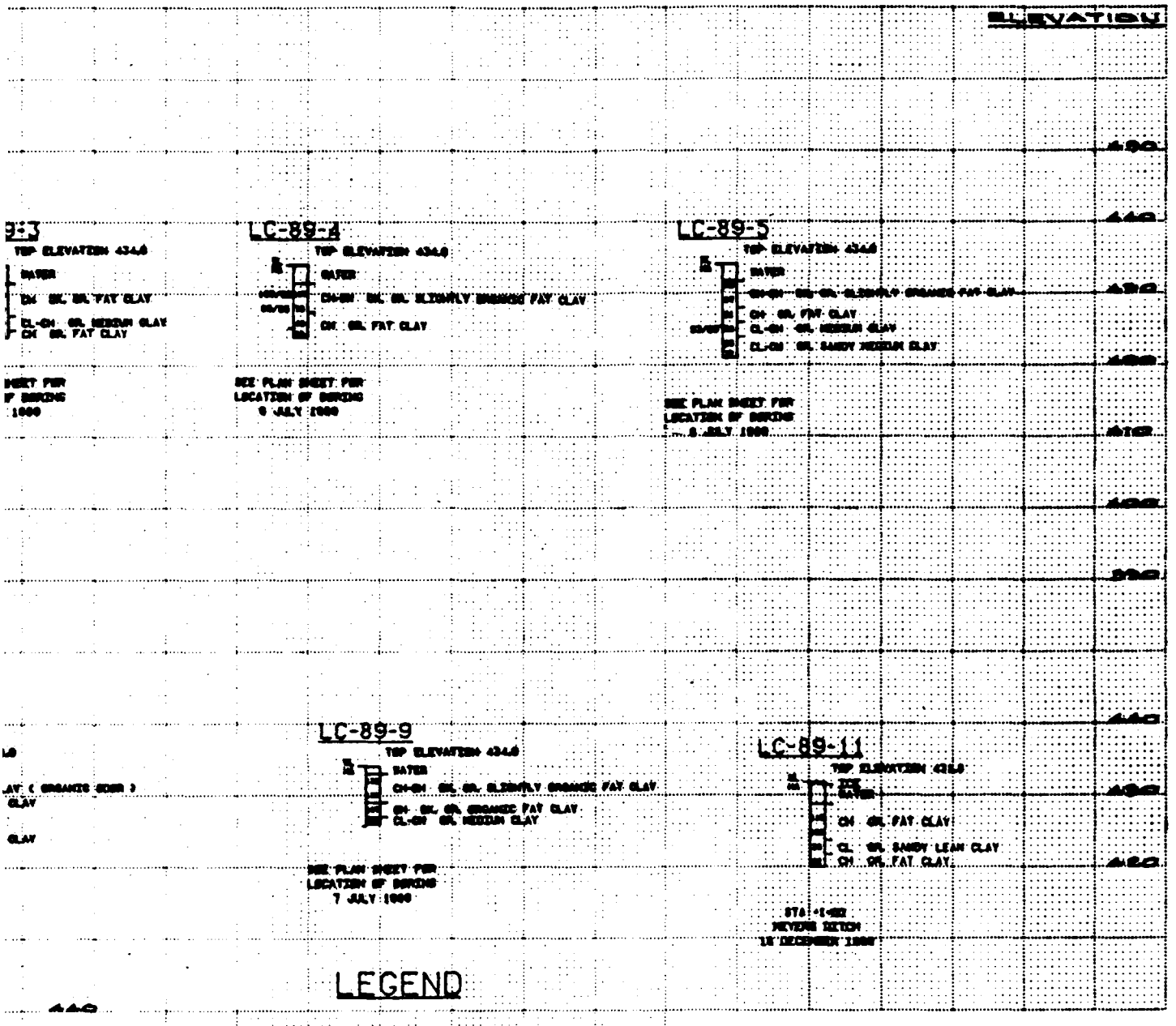
STA 52+50
NEVERS DITCH
20 DECEMBER 1989

LEGEND

BORING NUMBER



LOCATION OF BORING
JULY 4, 1989



Revisions			
Symbol	Description	Date	Approved

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

Designed by:
Drawn by: DIV
Checked by:
Reviewed by:
Approved by:

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 120.5
LAKE CHAUTAUQUA

BORING LOGS I

Scale
Date
Drawing number
Sheet of

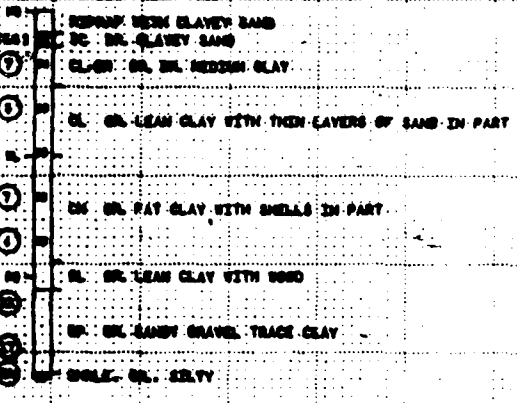
5 4 3

D C B A

ELEVATION

LC-90-1

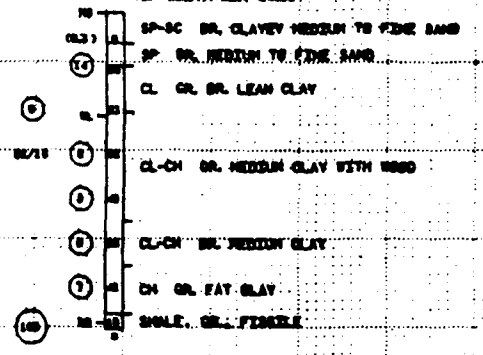
TOP ELEVATION 438.7



LOCATION OF INLET/OUTLET STRUCTURE
(SEE PLAN SHEET)
02 JANUARY 1990

LC-90-2

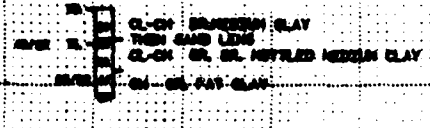
TOP ELEVATION 448.8



STA 144+55
LOCATION OF PUMP STATION
23 JANUARY 1990

LC-90-6

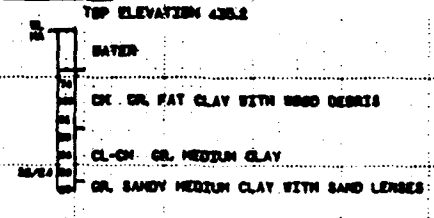
TOP ELEVATION 438.8



STA 135+00
(TOP OF LEVEE)
21 FEBRUARY 1990

LC-90-7

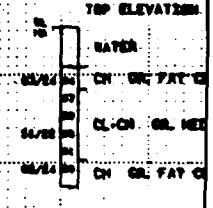
TOP ELEVATION 438.8



STA 202+00
LIVERPOOL DITCH
22 FEBRUARY 1990

LC-90-8

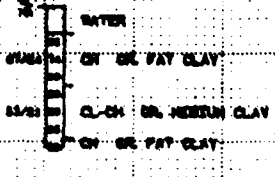
TOP ELEVATION



STA 222+00
LIVERPOOL DITCH
22 FEBRUARY 1990

LC-90-12

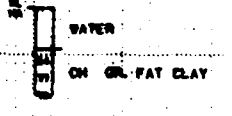
TOP ELEVATION 433.1



STA 282+00
LIVERPOOL DITCH
22 FEBRUARY 1990

LC-90-13

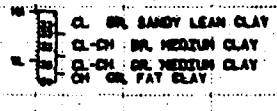
TOP ELEVATION 433.1



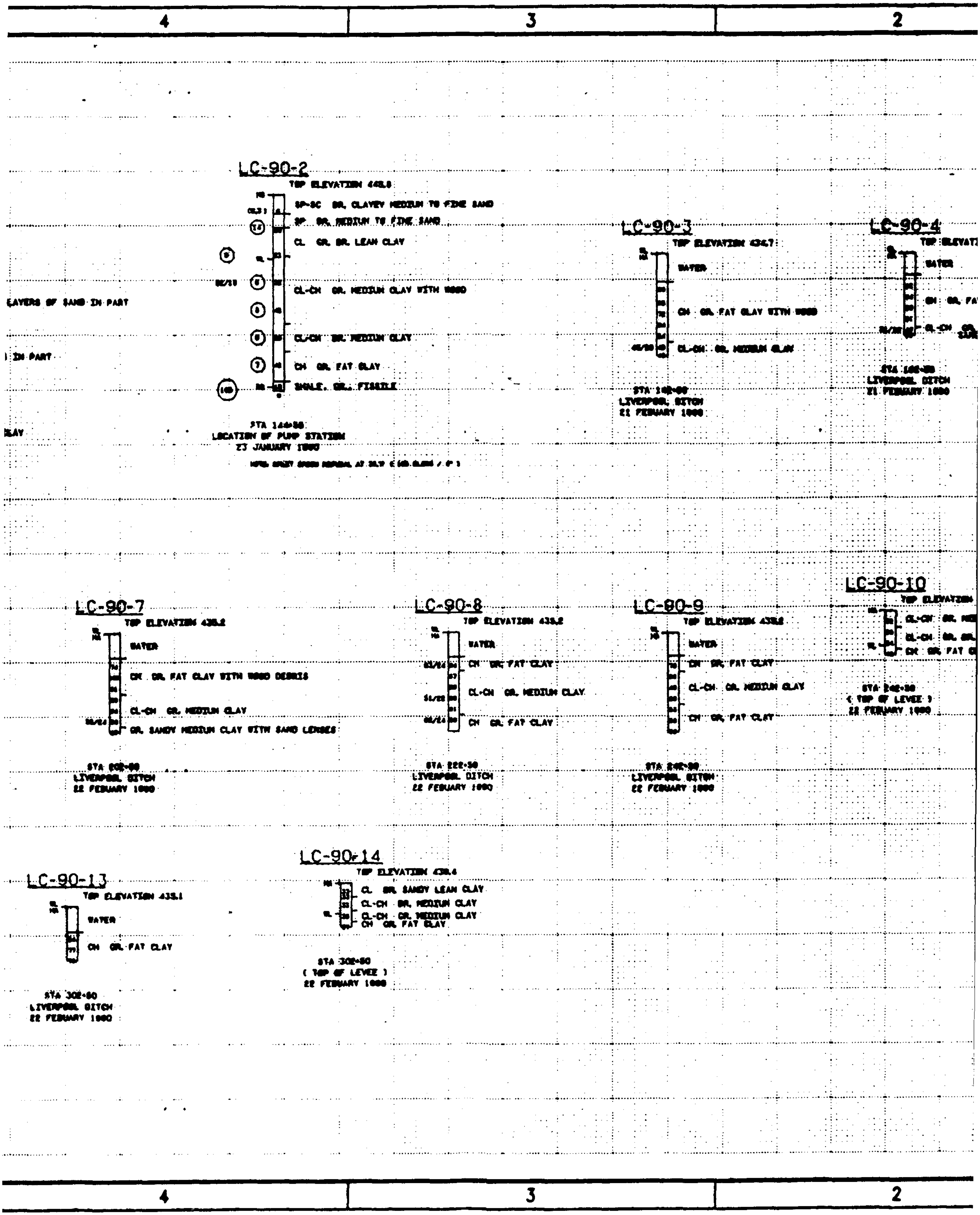
STA 302+00
LIVERPOOL DITCH
22 FEBRUARY 1990

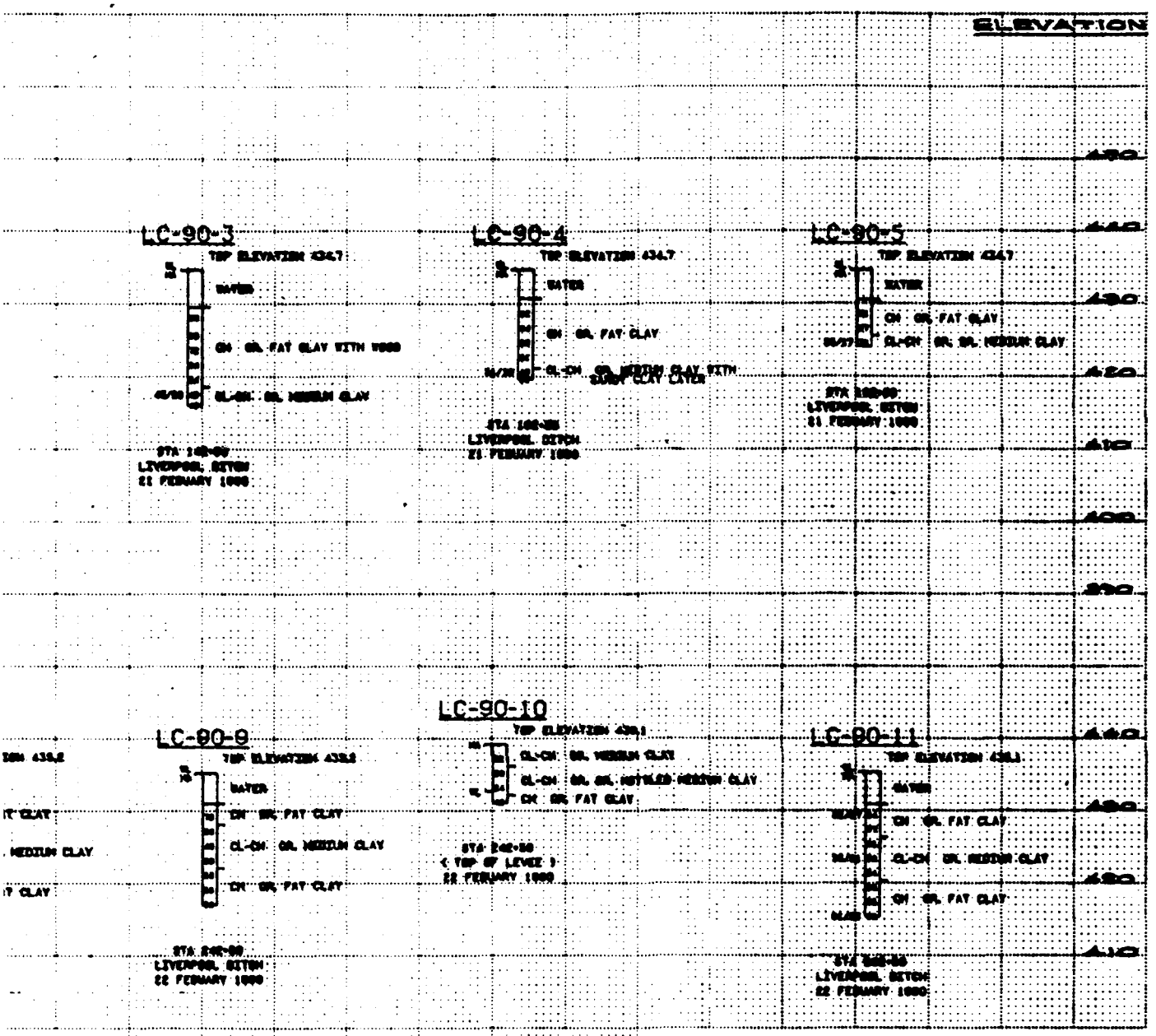
LC-90-14

TOP ELEVATION 438.4



STA 302+00
(TOP OF LEVEE)
22 FEBRUARY 1990


LC-90-2
TOP ELEVATION 443.8
SP-SC GR. CLAYEY MEDIUM TO FINE SAND
SP GR. MEDIUM TO FINE SAND
CL GR. BR. LEAN CLAY
CL-CH GR. MEDIUM CLAY WITH WOOD
CL-CH BR. MEDIUM CLAY
CH GR. FAT CLAY
SHALE, GR., FISSILE
STA 144+50
LOCATION OF PUMP STATION
23 JANUARY 1990
LAYERS OF SAND IN PART
LC-90-3
WATER
CH GR. FAT CLAY WITH WOOD
CL-CH GR. MEDIUM CLAY
LIVERPOOL DITCH
21 FEBUARY 1990
LC-90-4
WATER
LIVERPOOL DITCH
21 FEBUARY 1990
LC-90-7
TOP ELEVATION 435.2
WATER
CH GR. FAT CLAY WITH WOOD DEBRIS
CL-CH GR. MEDIUM CLAY
GR. SANDY MEDIUM CLAY WITH SAND LENSES
LIVERPOOL DITCH
22 FEBUARY 1990
LC-90-8
TOP ELEVATION 435.2
WATER
CH GR. FAT CLAY
CL-CH GR. MEDIUM CLAY
CH GR. FAT CLAY
STA 222+50
LIVERPOOL DITCH
22 FEBUARY 1990
LC-90-9
WATER
CH GR. FAT CLAY
CL-CH GR. MEDIUM CLAY
CH GR. FAT CLAY
LIVERPOOL DITCH
22 FEBUARY 1990
LC-90-10
TOP ELEVATION
(TOP OF LEVEE)
22 FEBUARY 1990
LC-90-13
TOP ELEVATION 435.1
WATER
CH GR. FAT CLAY
STA 302+50
LIVERPOOL DITCH
22 FEBUARY 1990
LC-90-14
TOP ELEVATION 438.4
CL BR. SANDY LEAN CLAY
CL-CH BR. MEDIUM CLAY
CL-CH GR. MEDIUM CLAY
CH GR. FAT CLAY
STA 302+50
(TOP OF LEVEE)
22 FEBUARY 1990



Revisions			
Symbol	Description	Date	Approved

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

Designed by:
Drawn by: blv
Checked by:
Reviewed by:
Approved by:

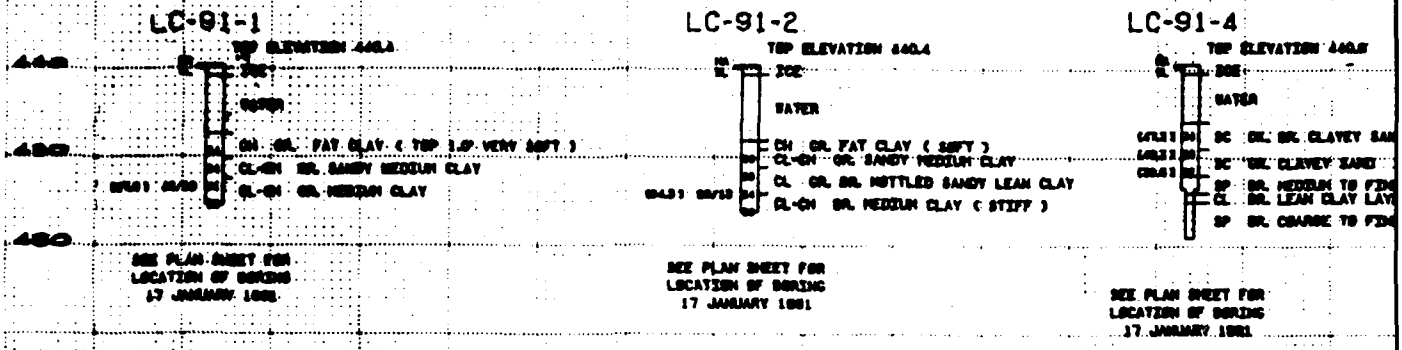
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 130.5
LAKE CHAUTAUQUA

BORING LOGS II

Scale:
Drawing Code:
Sheet reference number:
Sheet of

PLATE 11

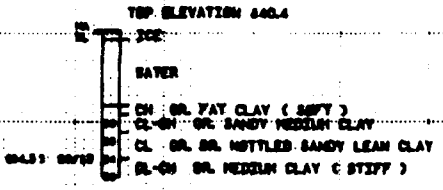
ELEVATION


LC-91-1
TOP ELEVATION 440.8
TOP SOIL
WATER
CH GR. FAT CLAY (TOP 1.0' VERY SOFT)
CL-CH GR. SANDY MEDIUM CLAY
CL-CH GR. MEDIUM CLAY
440
480
SEE PLAN SHEET FOR LOCATION OF BORING 17 JANUARY 1991
LC-91-2
TOP ELEVATION 440.4
TOP SOIL
WATER
CH GR. FAT CLAY (SOFT)
CL-CH GR. SANDY MEDIUM CLAY
CL GR. BR. MOTTLED SANDY LEAN CLAY
CL-CH BR. MEDIUM CLAY (STIFF)
SEE PLAN SHEET FOR LOCATION OF BORING 17 JANUARY 1991
LC-91-4
TOP ELEVATION 440.8
TOP SOIL
WATER
SC BR. CLAYEY SAND
SC BR. CLAYEY SAND
SP BR. MEDIUM TO FINE
CL BR. LEAN CLAY LAYE
SP BR. COARSE TO FINE
SEE PLAN SHEET FOR LOCATION OF BORING 17 JANUARY 1991

P 1.0' VERY SOFT)
N CLAY

LC-91-2

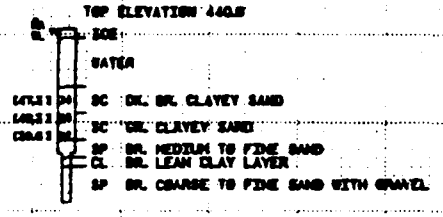
TOP ELEVATION 640.4



SEE PLAN SHEET FOR
LOCATION OF BORING
17 JANUARY 1991

LC-91-4

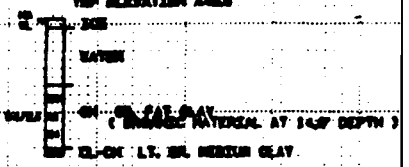
TOP ELEVATION 640.8



SEE PLAN SHEET FOR
LOCATION OF BORING
17 JANUARY 1991

LC-91-5

TOP ELEVATION 640.0



SEE PLAN SHEET FOR
LOCATION OF BORING
17 JANUARY 1991

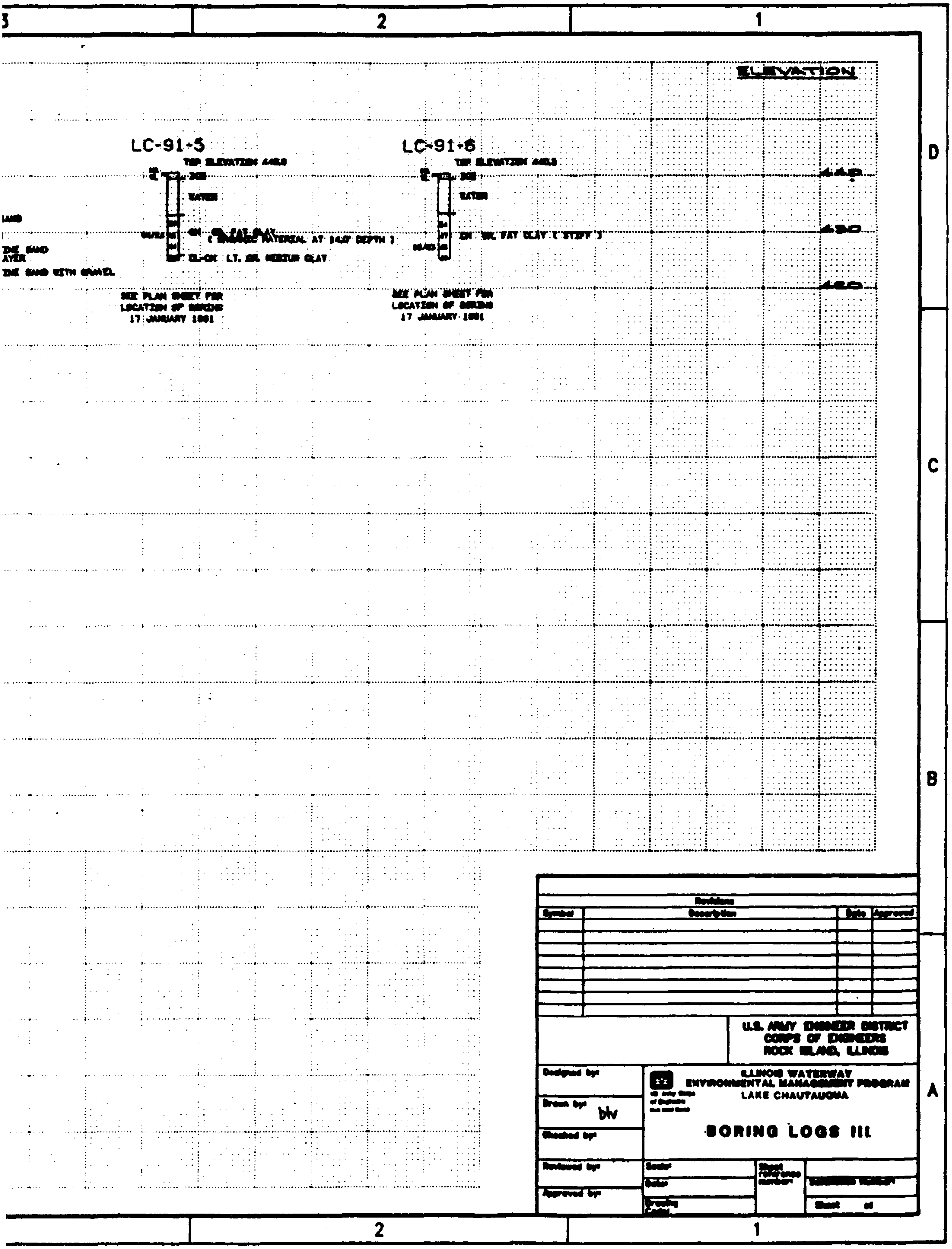
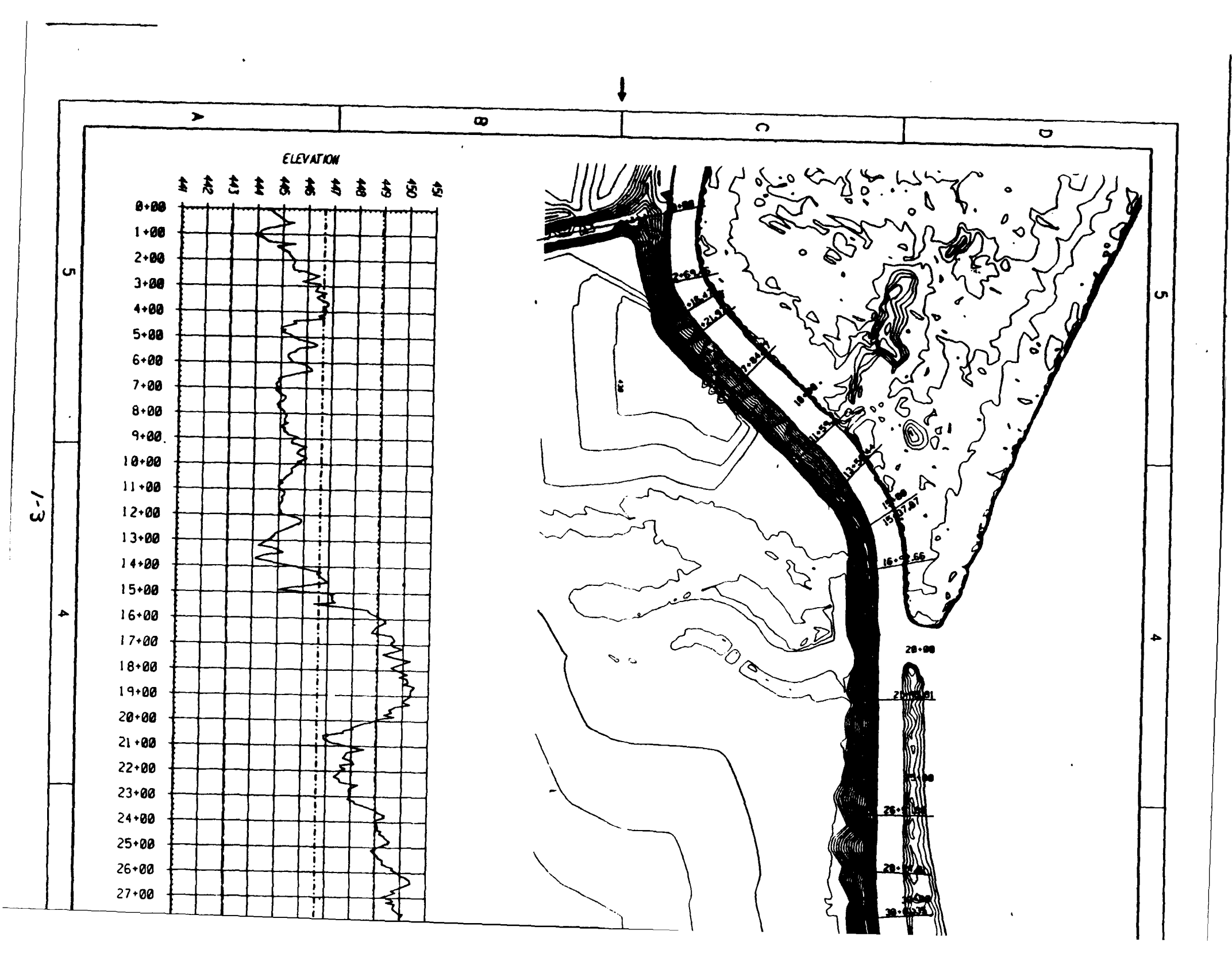

ELEVATION
LC-91-5
LC-91-6
WATER
LT. GR. MEDIUM CLAY
FAT CLAY (STIFF)
SEE PLAN SHEET FOR
LOCATION OF BORING
SEE PLAN SHEET FOR
LOCATION OF BORING
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LAKE CHAUTAUQUA
BORING LOGS III
blv

PLATE 12


A
B
C
D
5
4
ELEVATION
441
442
443
444
445
446
447
448
449
450
451
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
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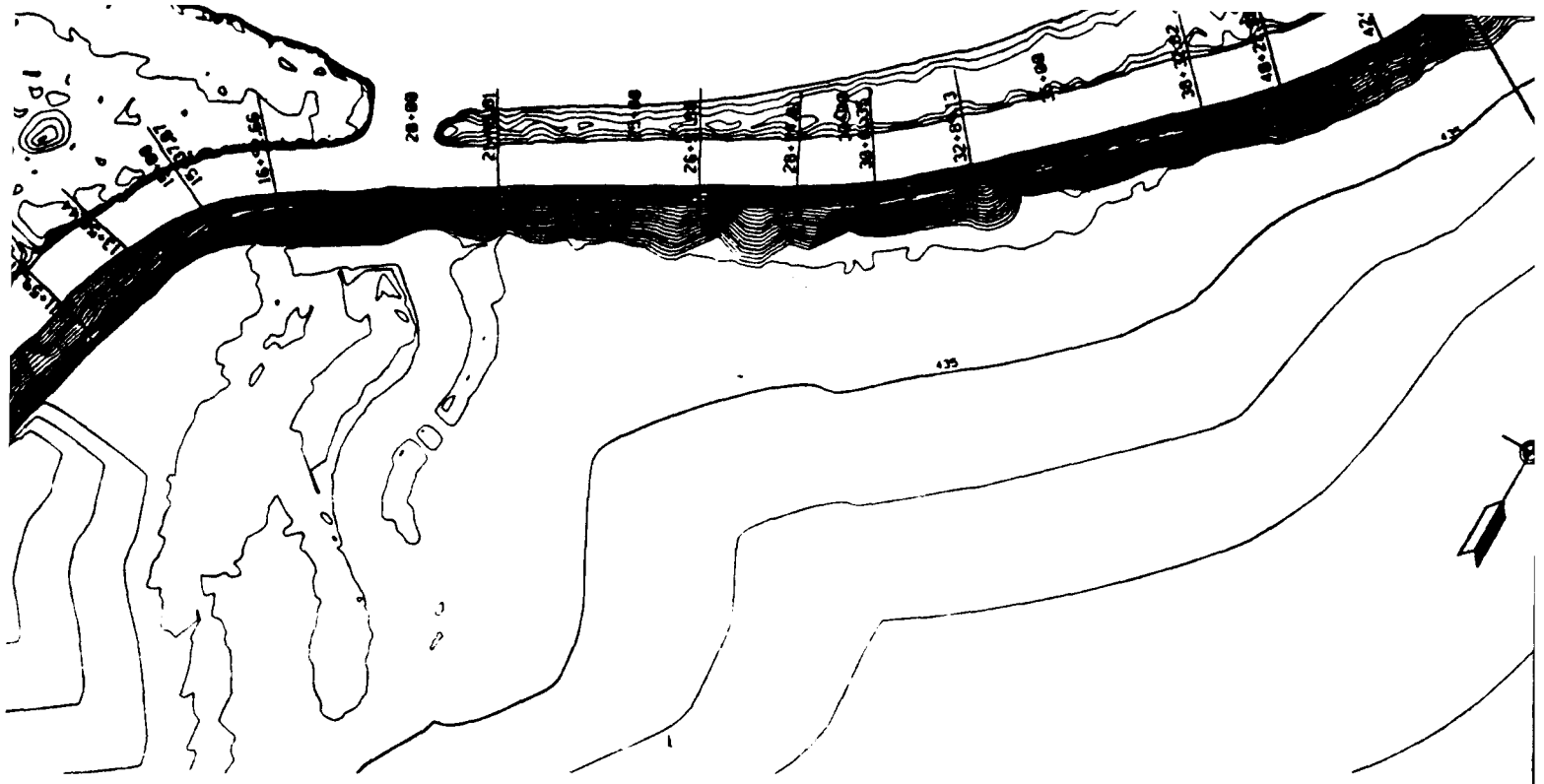
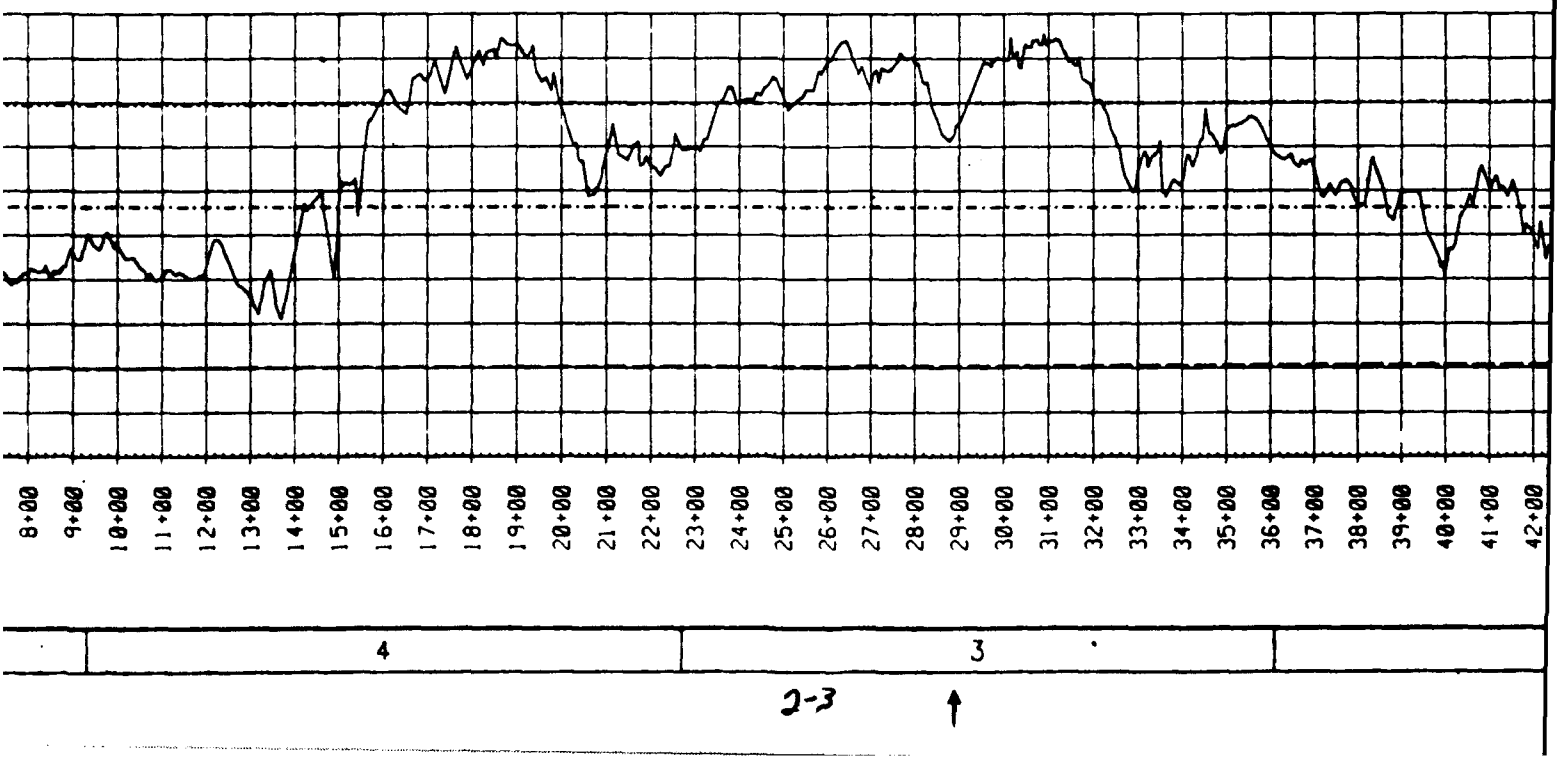
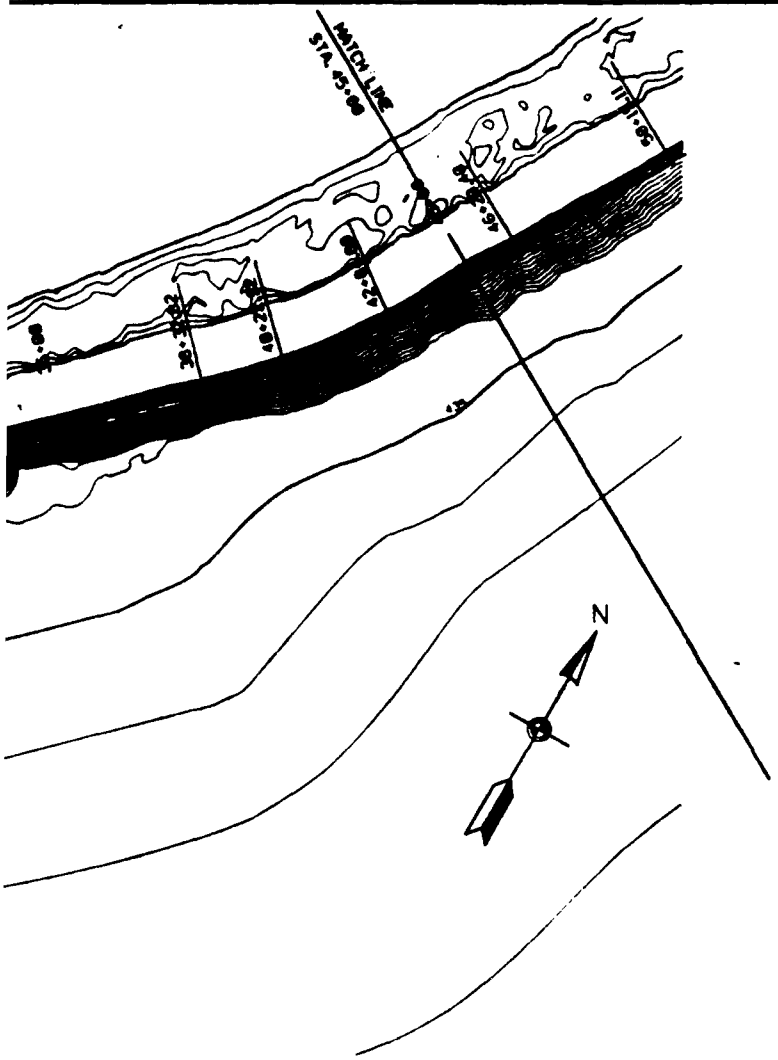
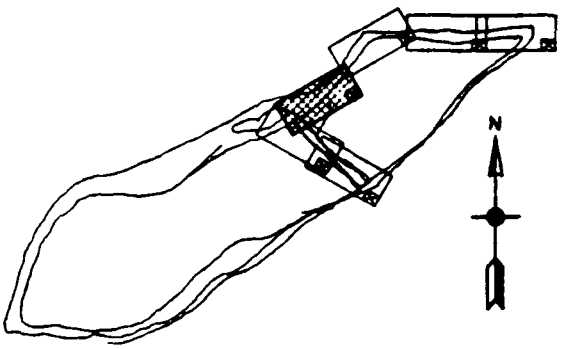
23+00
24+00
25+00
26+00
27+00
28+00




8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
31+00
32+00
33+00
34+00
35+00
36+00
37+00
38+00
39+00
40+00
41+00
42+00
4
3

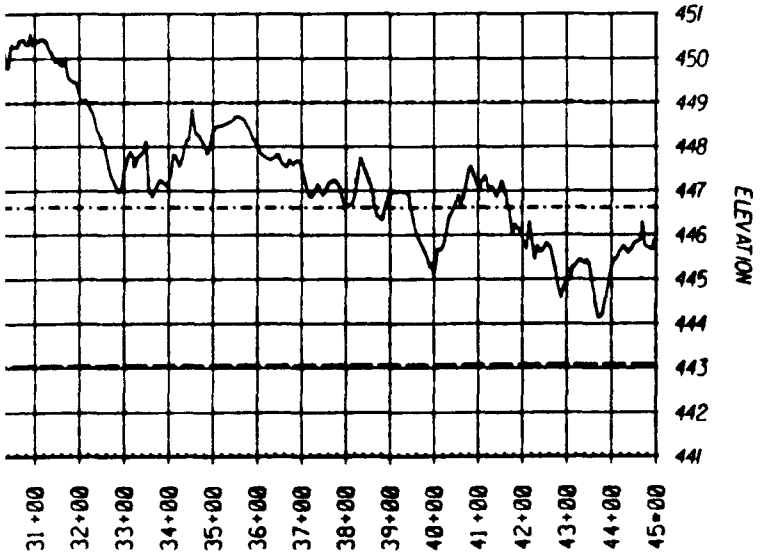
2-3





LEVEE PROFILES

10 YR EVENT
5 YEAR EVENT
2 YEAR EVENT



200 100 0 200 400FT
SCALE 1" = 200'

Revisions			
Symbol	Description	Date	Approved

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

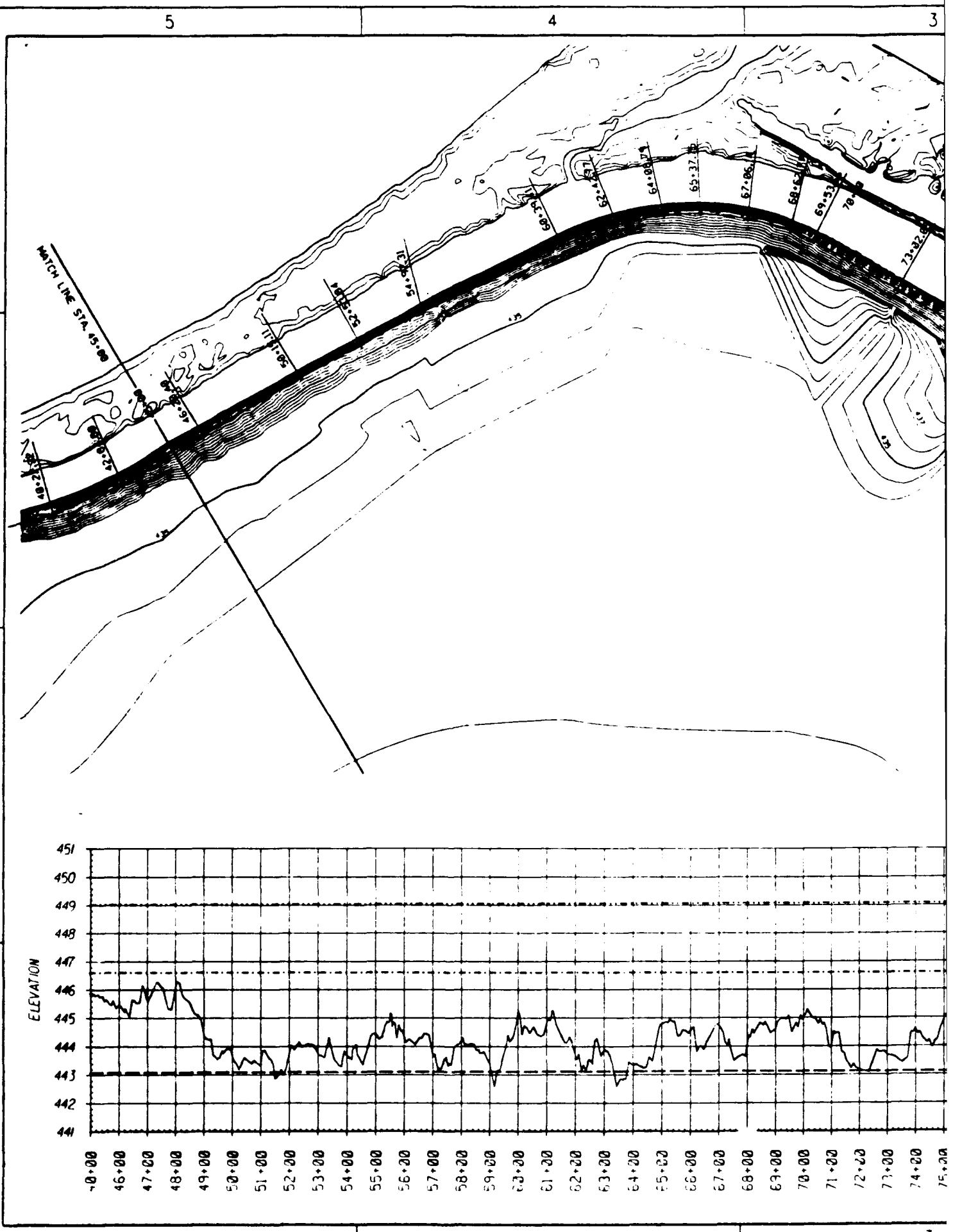
Designed by: D.J.H.
Drawn by: T.E.M.
Checked by: D.R.R.
Revised by: D.J.H.
Approved by:

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.8
LAKE CHAUTAUQUA

PLAN AND PROFILE
PERIMETER LEVEE
STA. 0+00 TO STA. 45+00

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet ___ of

PLATE 13


5
4
3
D
C
B
A
MATCH LINE STA. 45+00
ELEVATION
451
450
449
448
447
446
445
444
443
442
441
45+00
46+00
47+00
48+00
49+00
50+00
51+00
52+00
53+00
54+00
55+00
56+00
57+00
58+00
59+00
60+00
61+00
62+00
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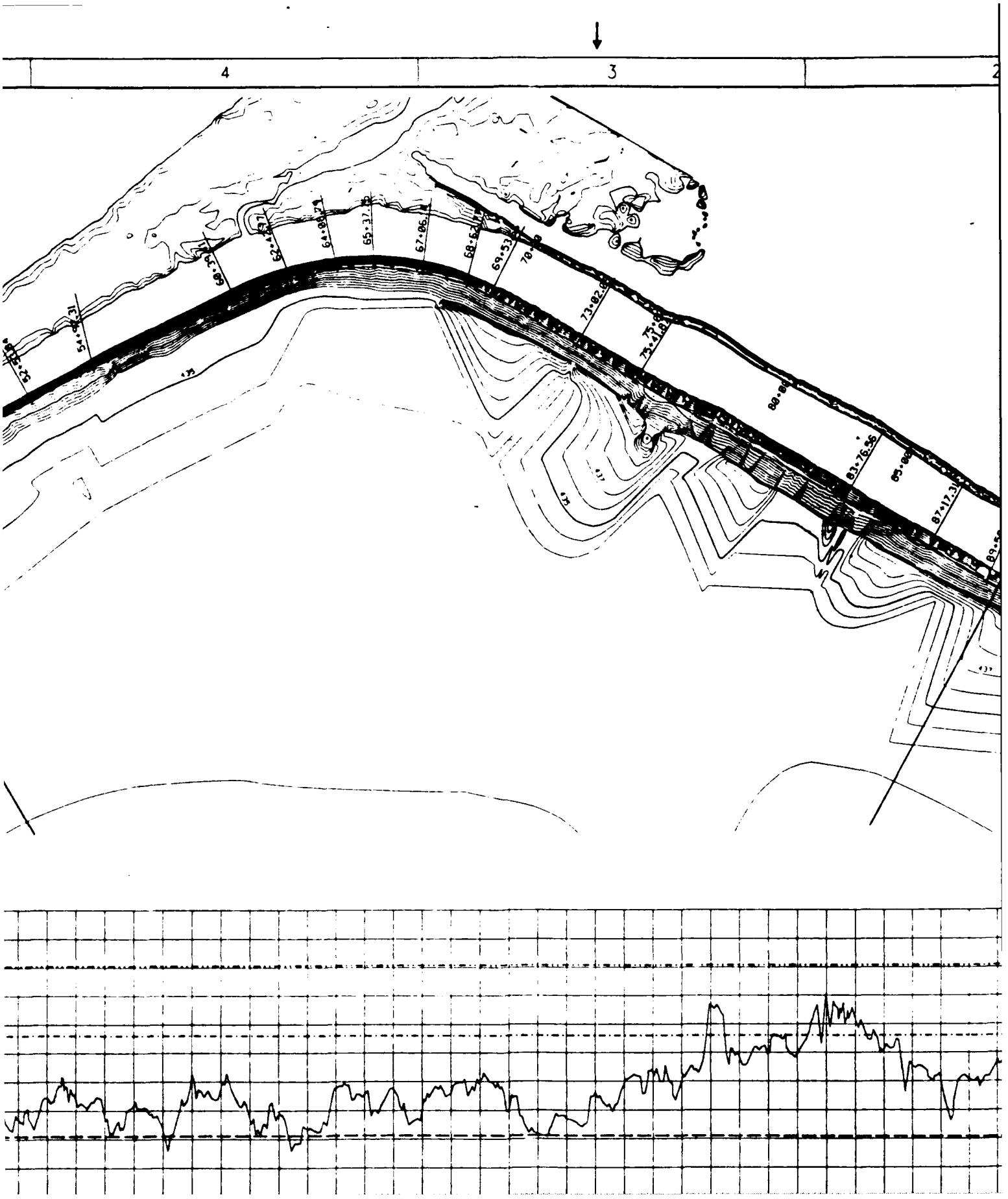
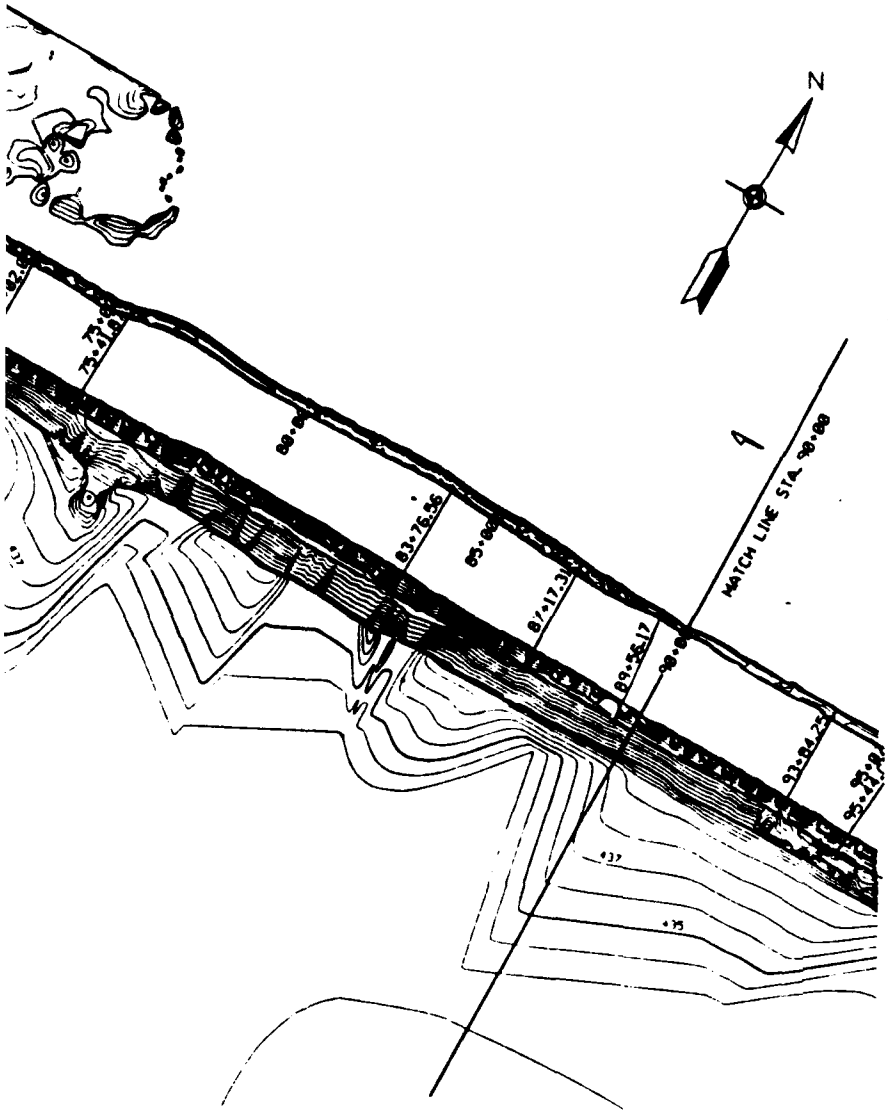
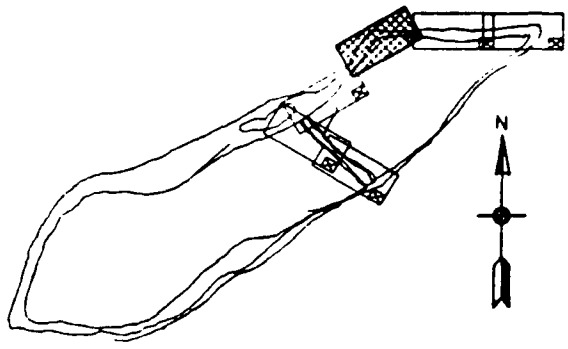
69+00
70+00
71+00
72+00
73+00
74+00


4
3
2

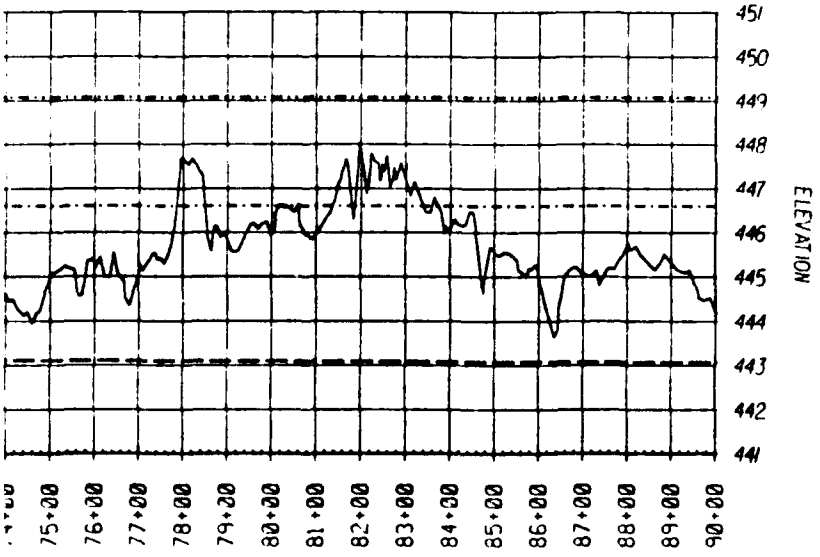




LEVEE PROFILES

10 YR EVENT
5 YR EVENT
2 YR EVENT

200 100 0 200 400FT
SCALE 1" = 200'



Revisions			
Symbol	Description	Date	Approved

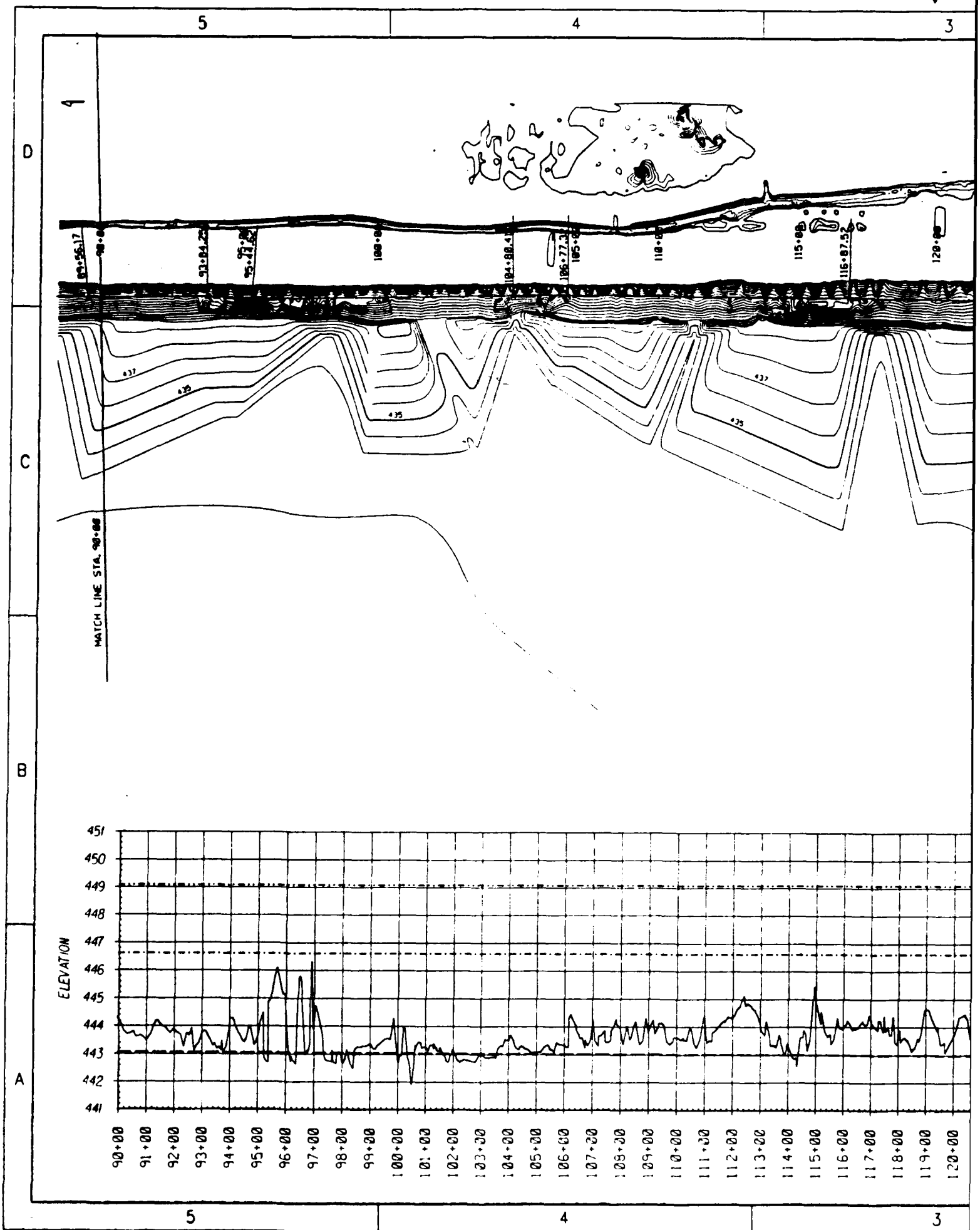
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-124.5
LAKE CHAUTAUQUA

PLAN AND PROFILE
PERIMETER LEVEE
STA. 45+00 TO STA. 90+00

Designed by: D.J.H.	Scale: AS SHOWN	Sheet reference number:	
Drawn by: T.E.M.	Date:		Solicitation Number:
Checked by: D.R.R.	Drawing Code:		Sheet of
Reviewed by: D.J.H.			
Approved by:			

PLATE 14


5
4
3
D
C
B
A
MATCH LINE STA. 90+00
ELEVATION
451
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445
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443
442
441
90+00
91+00
92+00
93+00
94+00
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96+00
97+00
98+00
99+00
100+00
101+00
102+00
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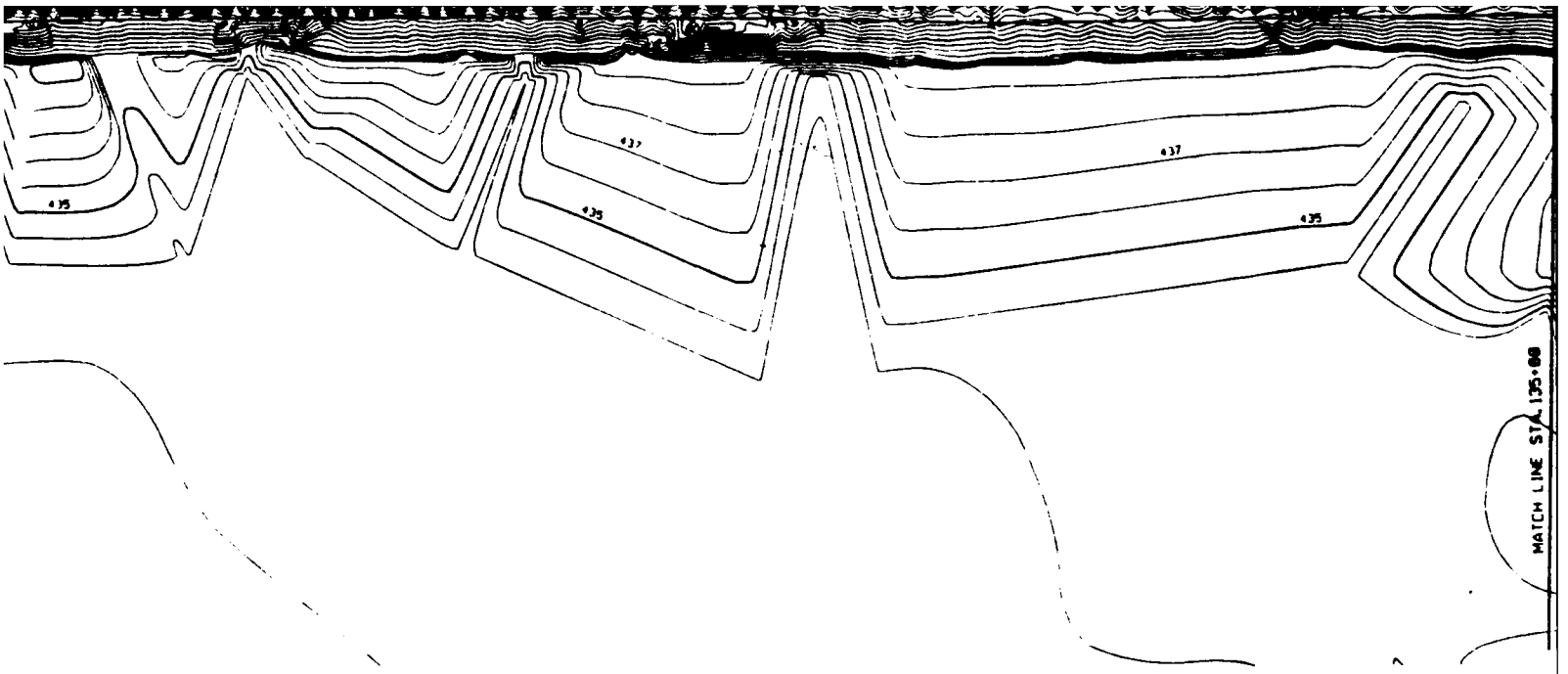
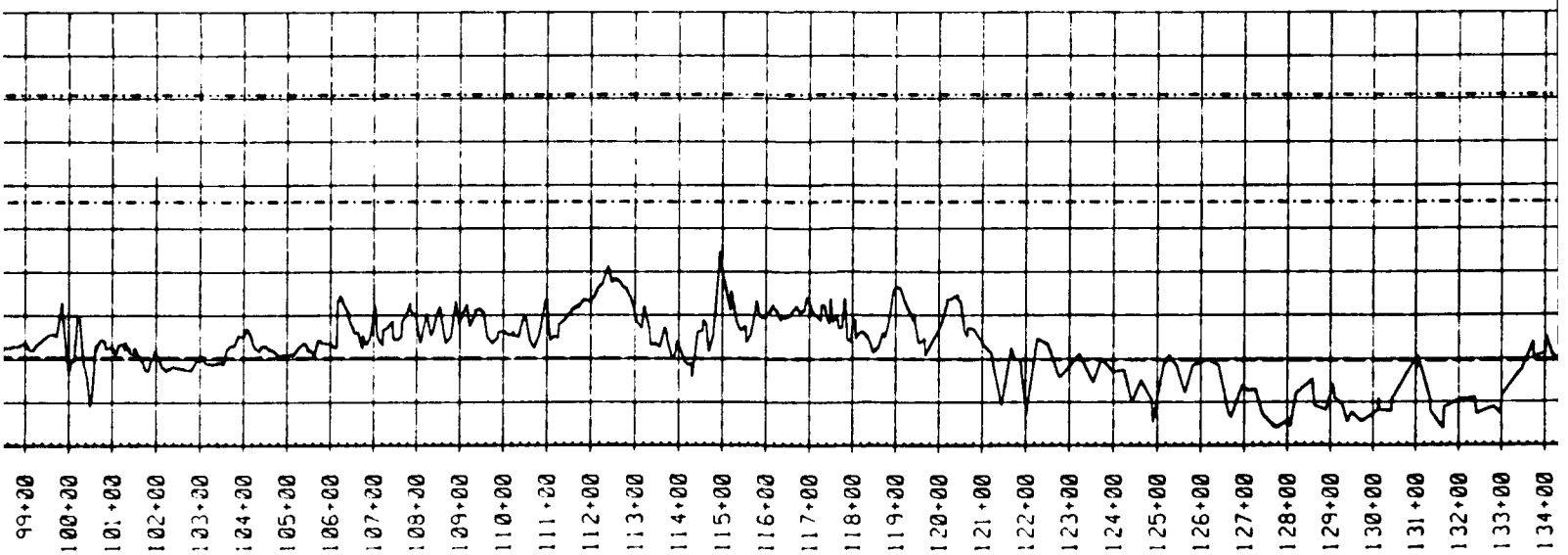
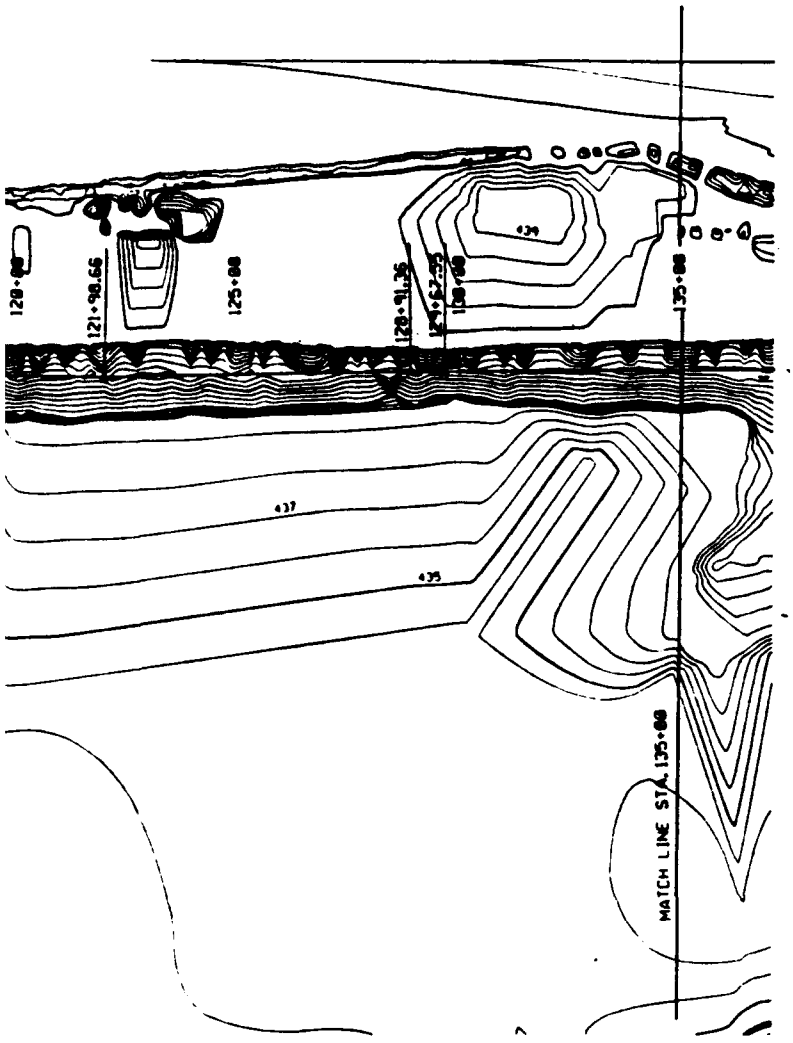
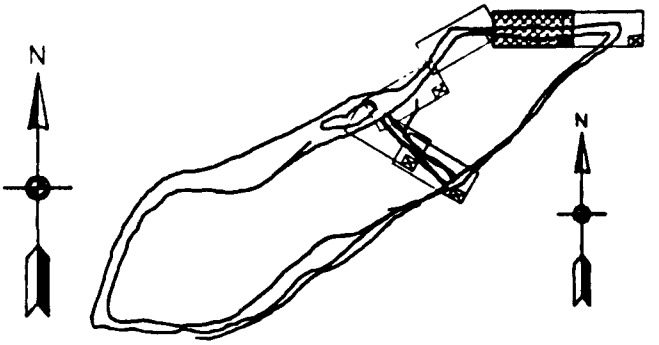




99+00 100+00 101+00 102+00 103+00 104+00 105+00 106+00 107+00 108+00 109+00 110+00 111+00 112+00 113+00 114+00 115+00 116+00 117+00 118+00 119+00 120+00 121+00 122+00 123+00 124+00 125+00 126+00 127+00 128+00 129+00 130+00 131+00 132+00 133+00 134+00

4	3	2

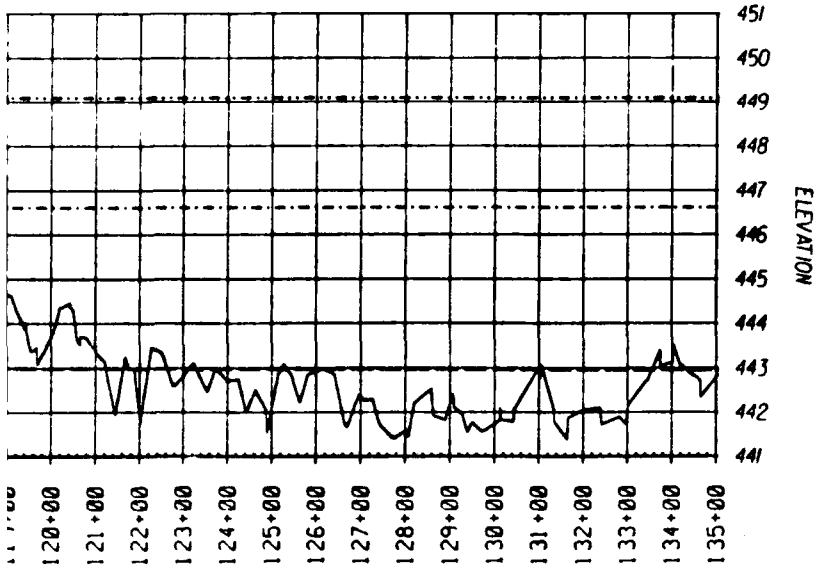




LEVEE PROFILES

10 YR EVENT
5 YEAR EVENT
2 YEAR EVENT

200 100 0 200 400FT
SCALE 1" = 200



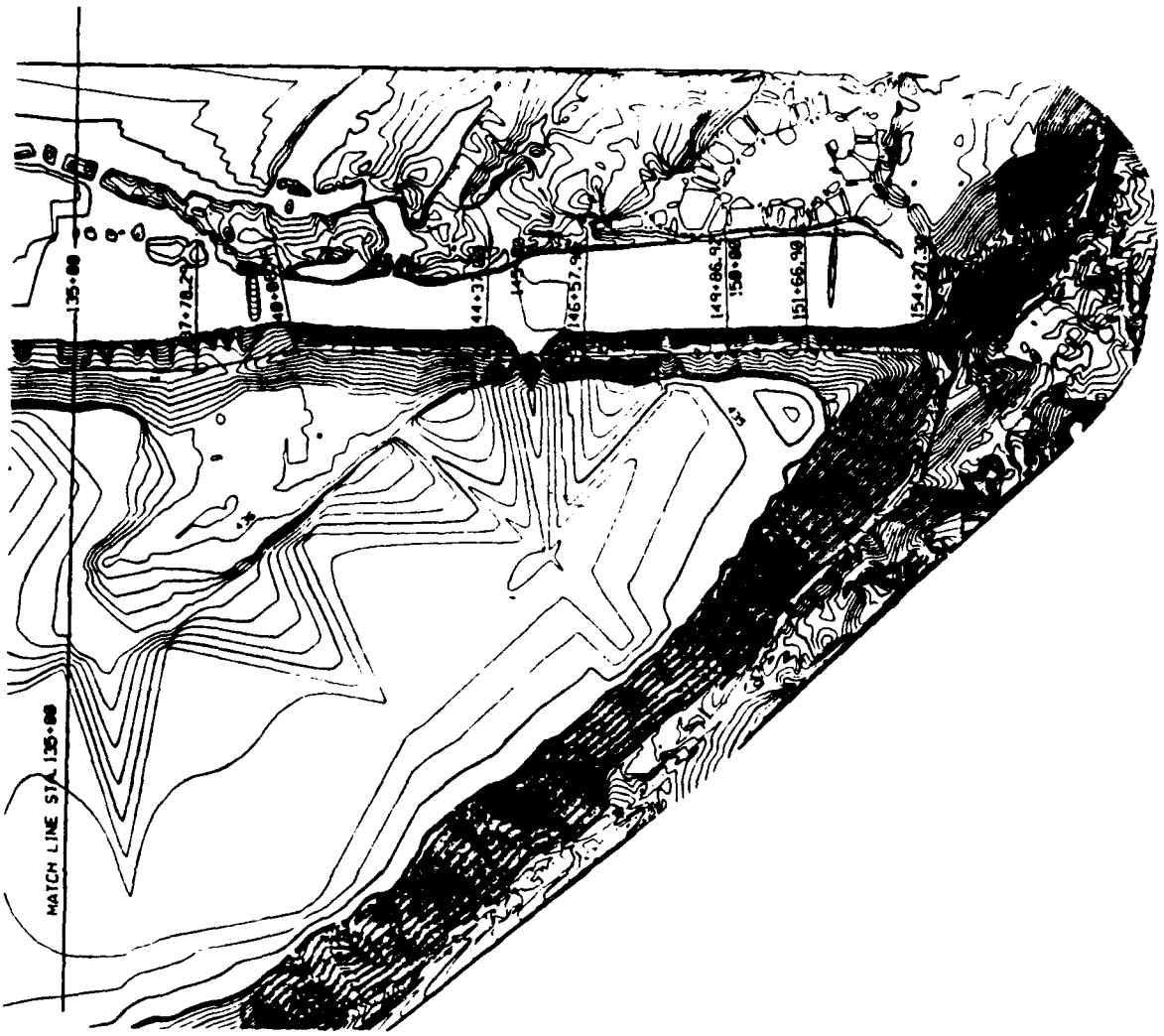
Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.5
LAKE CHAUTAUQUA

PLAN AND PROFILE
PERIMETER LEVEE
STA. 90+00 TO STA. 135+00

Designed by: D.J.H.	Scale: AS SHOWN	Sheet reference number:	Solicitation Number:
Drawn by: T.E.M.	Date:		
Checked by: D.R.R.	Drawing Code:		Sheet of
Reviewed by: D.J.H.			
Approved by:			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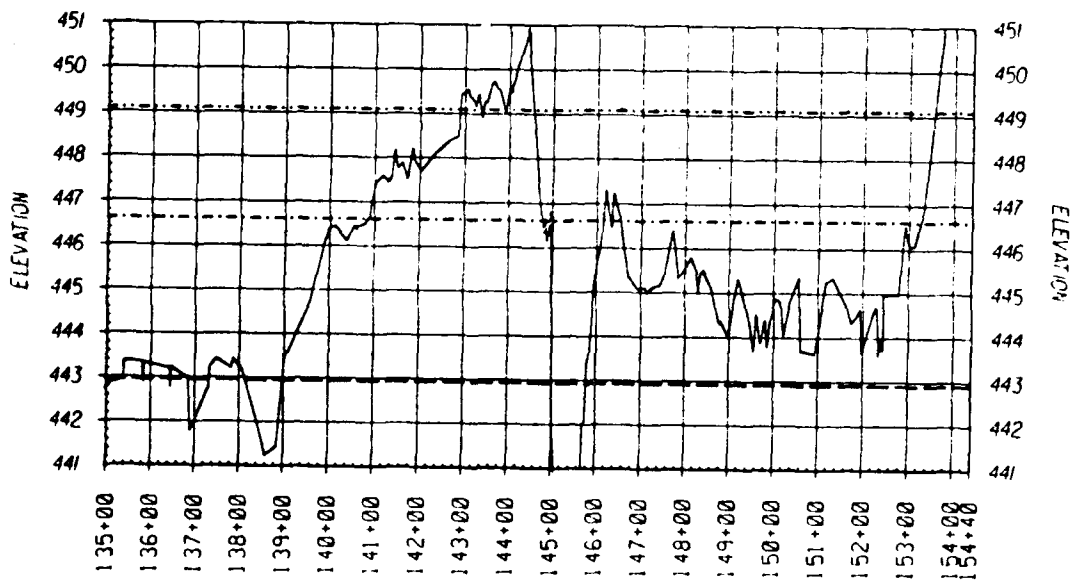
MATCH LINE STA 135+00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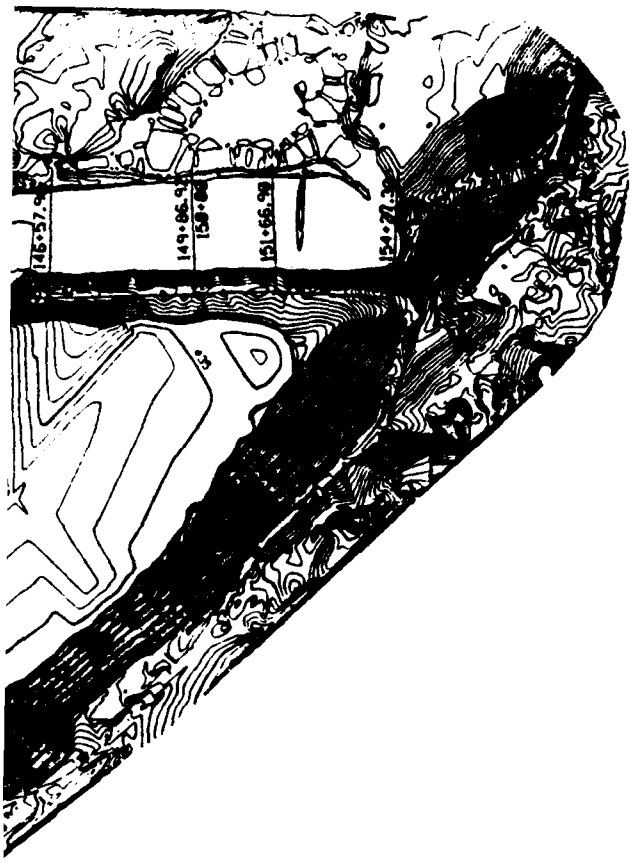
154+00
154+40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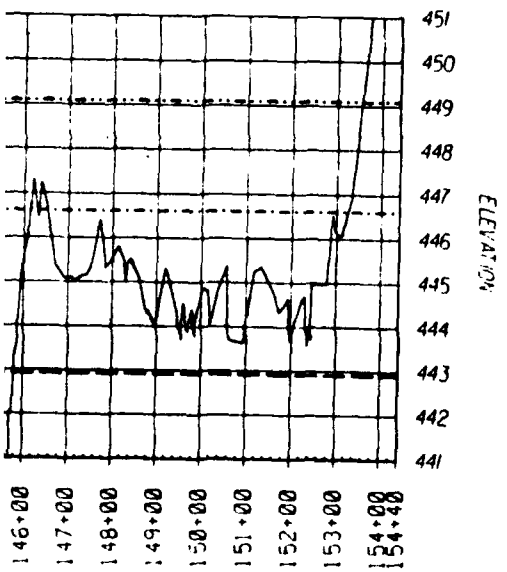
150+00
151+66.38
154+27.3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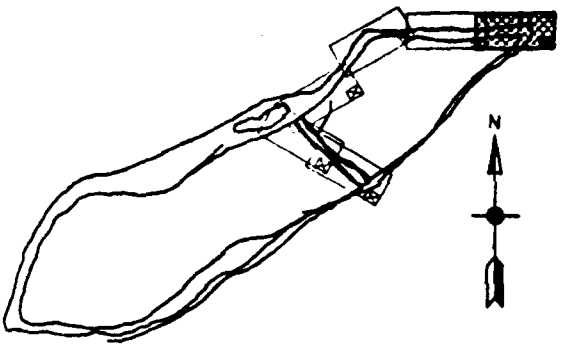
154+48



LEVEE PROFILES

10 YR EVENT
5 YEAR EVENT
2 YEAR EVENT

200 100 0 200 400FT

SCALE 1 - 200

Revisions			
Symbol	Description	Date	Approved

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

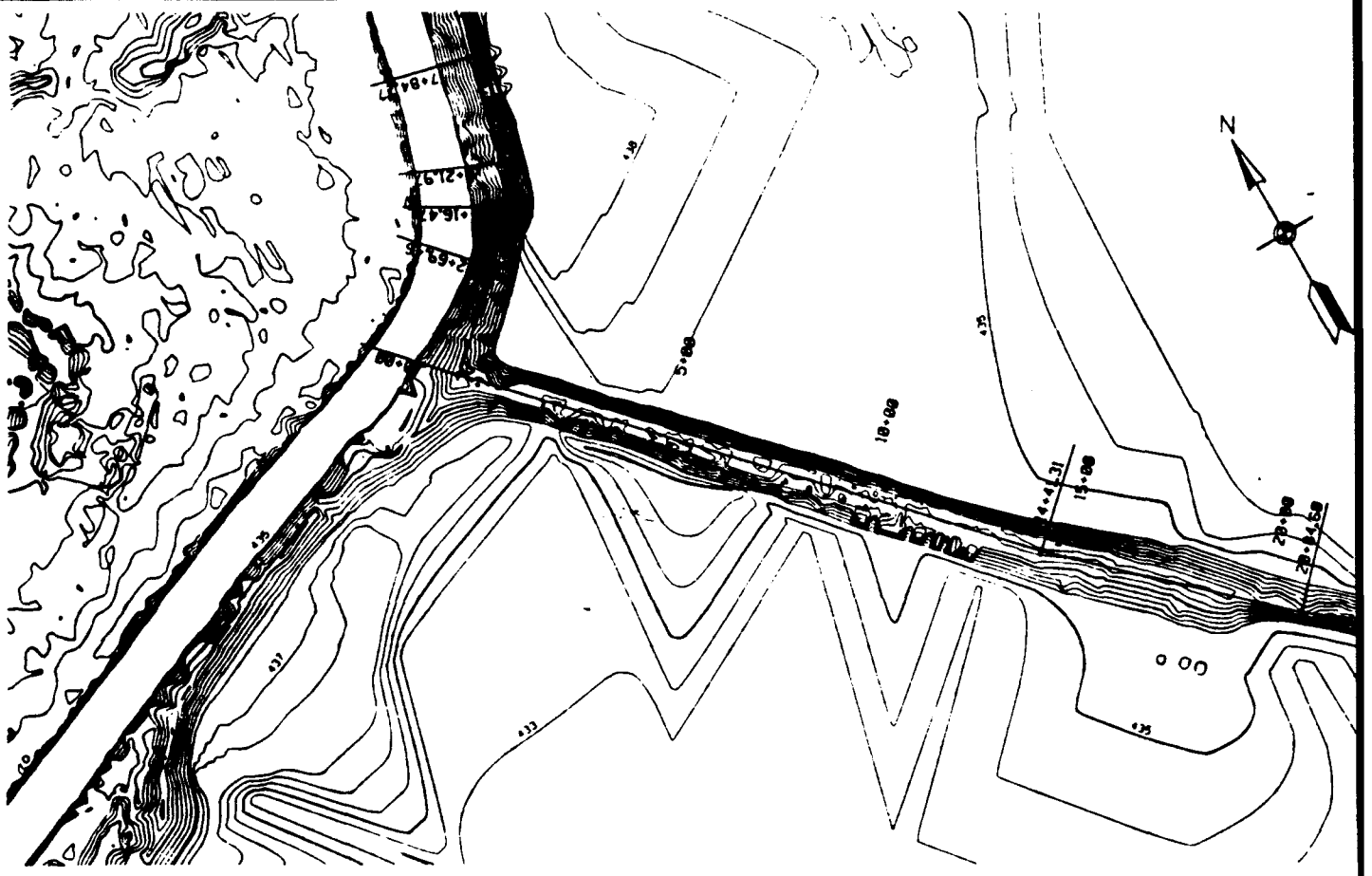
Designed by: D.J.H.
Drawn by: T.E.M.
Checked by: D.R.R.
Reviewed by: D.J.H.
Approved by: JOHN H BROWN COL, CORPS OF ENGINEERS

US Army Corps of Engineers

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.5
LAKE CHAUTAUQUA

PLAN AND PROFILE PERIMETER LEVEE STA. 135+00 TO STA. 154+40

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Solicitation Number:
Sheet of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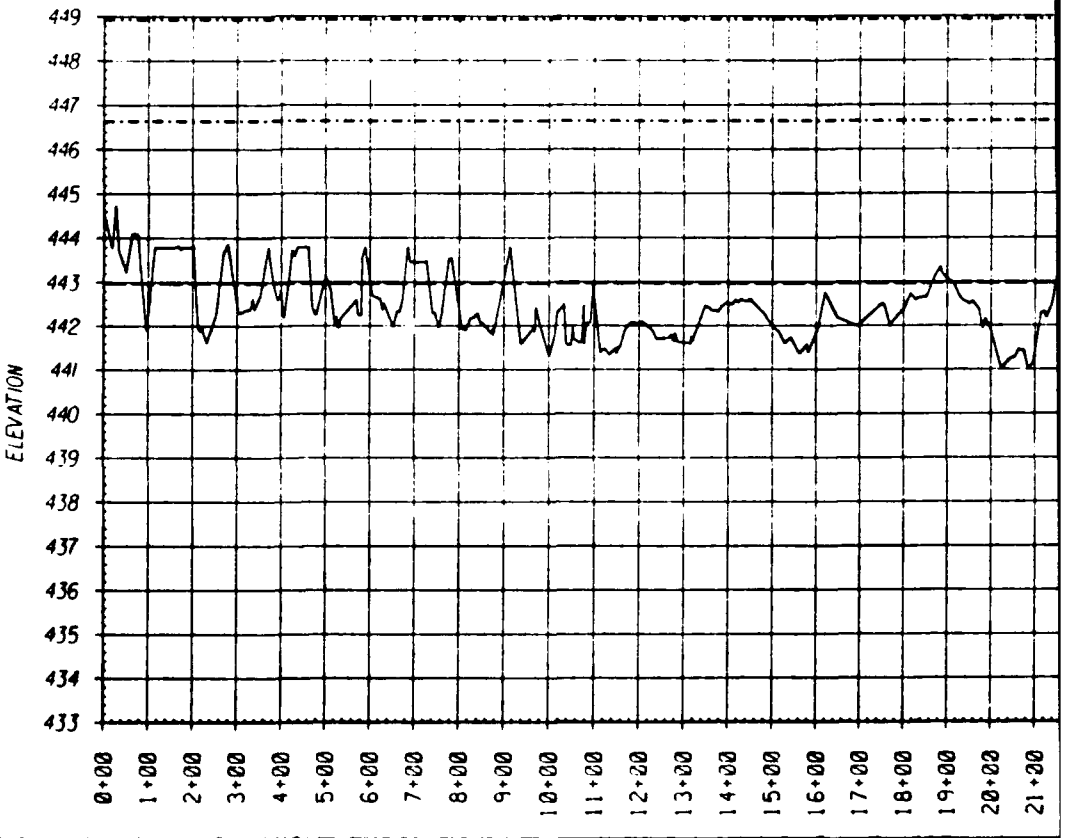
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433
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2+00
3+00
4+00
5+00
6+00
7+00
8+00
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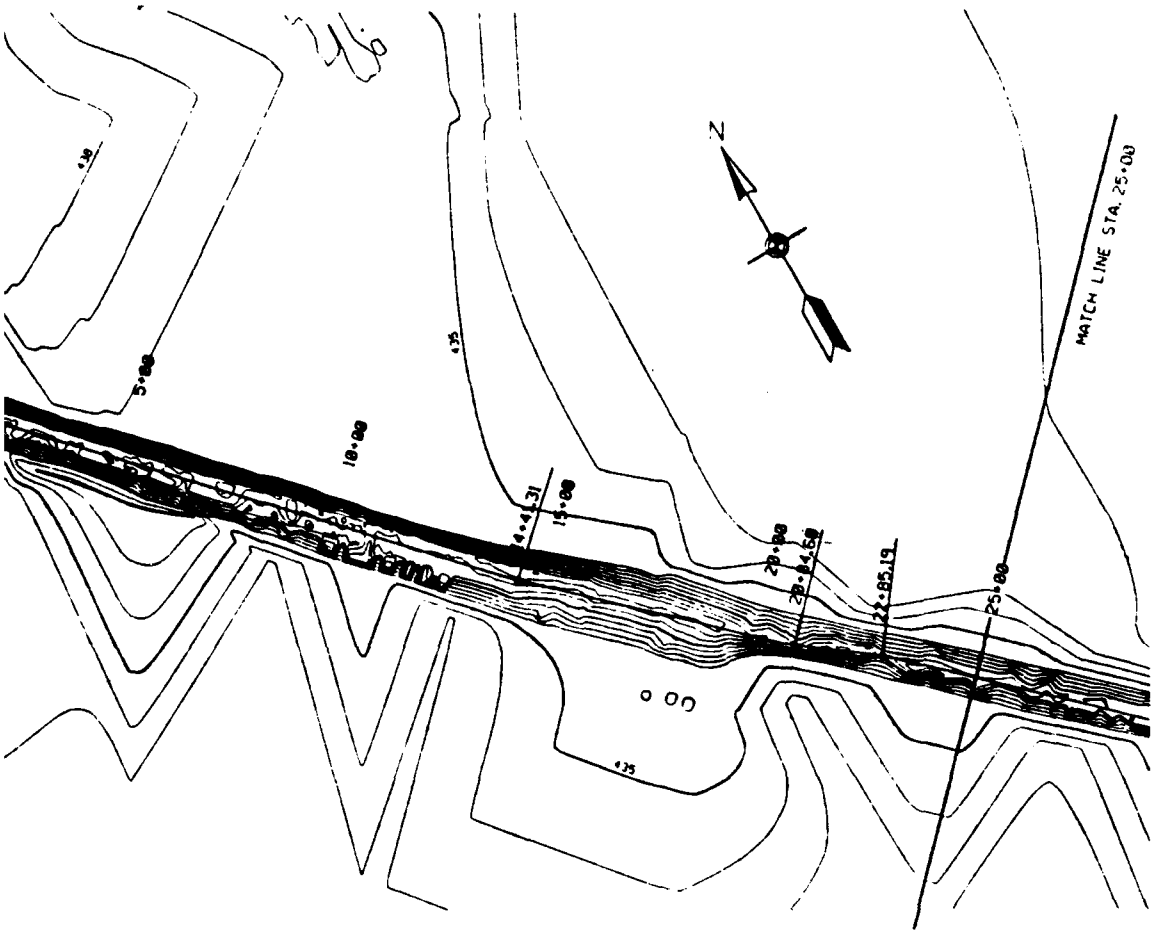
20+00
21+00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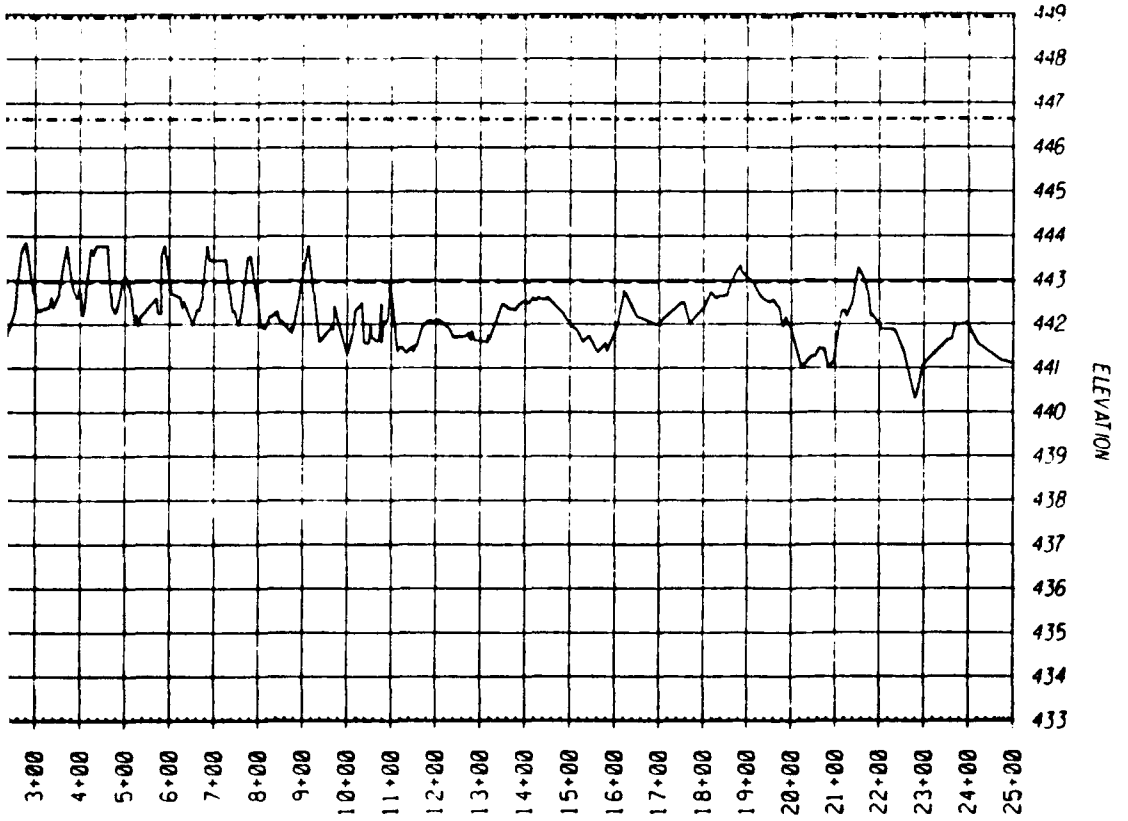
MATCH LINE STA. 25+00
5+00
10+00
15+00
20+00
25+00
435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433
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4+00
5+00
6+00
7+00
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9+00
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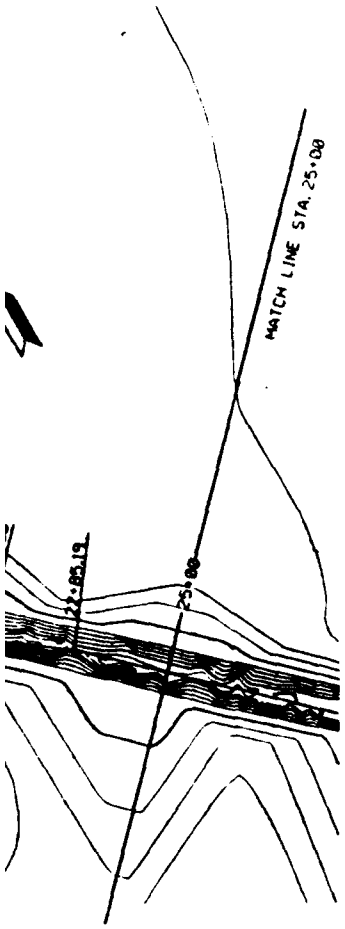
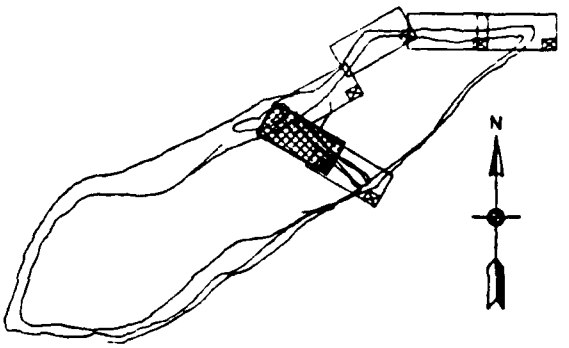
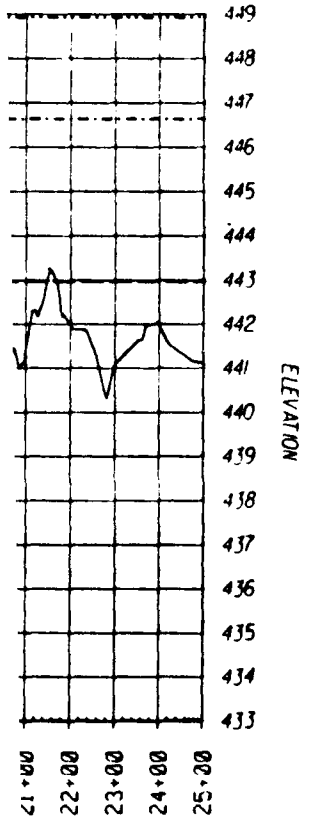




LEVEE PROFILES

10 YR EVENT
5 YR EVENT
2 YR EVENT



200 100 0 200 400FT
SCALE 1" = 200'

Revisions			
Symbol	Description	Date	Approved

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

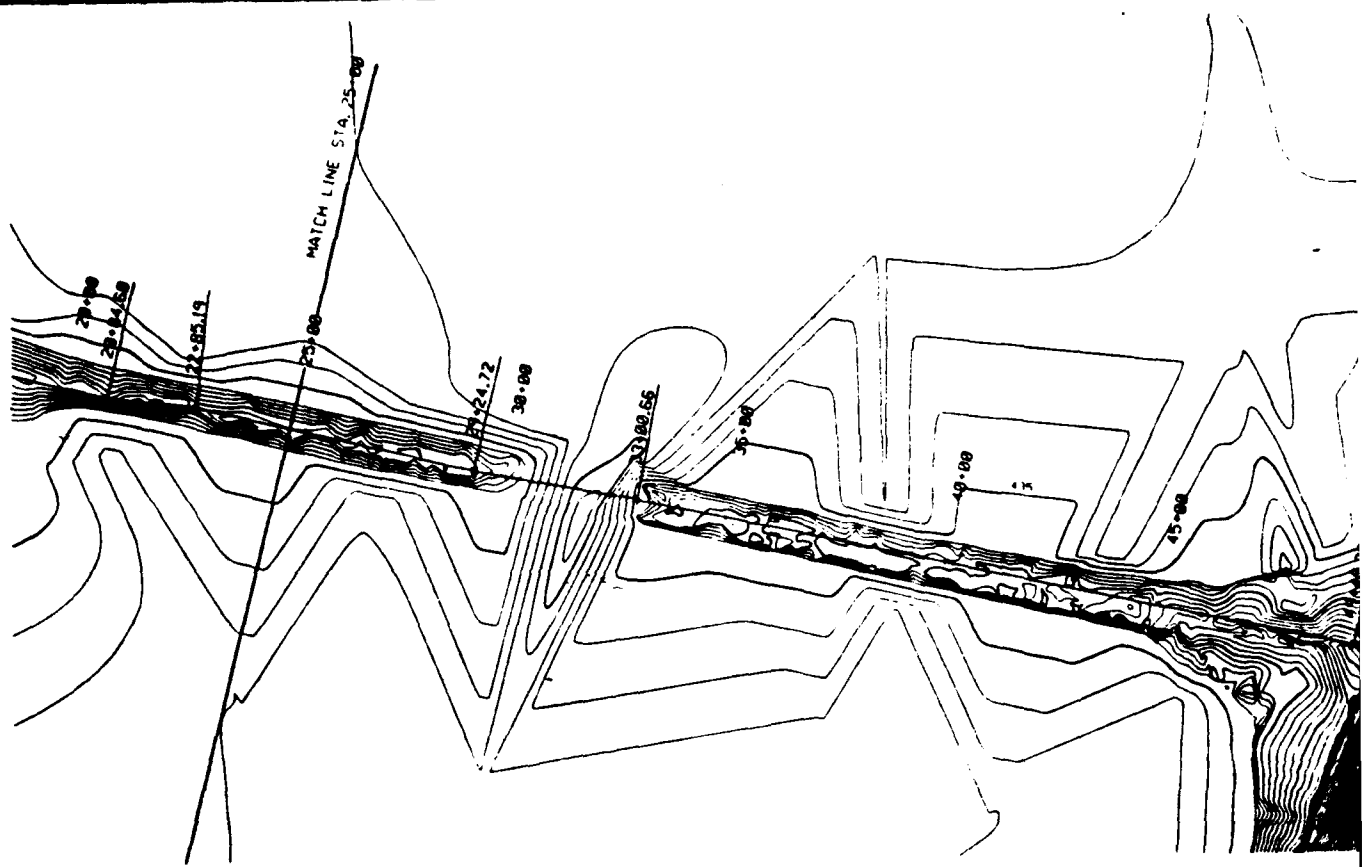
Designed by: D.J.H.
Drawn by: T.E.M.
Checked by: D.R.R.
Reviewed by: D.J.H.
Approved by: CHIEF, ENGINEERING DIVISION

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.8
LAKE CHAUTAUQUA

PLAN AND PROFILE
CROSS DIKE
STA. 0+00 TO STA. 25+00

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Solicitation Number:
Sheet of

PLATE 17


MATCH LINE STA 25+00
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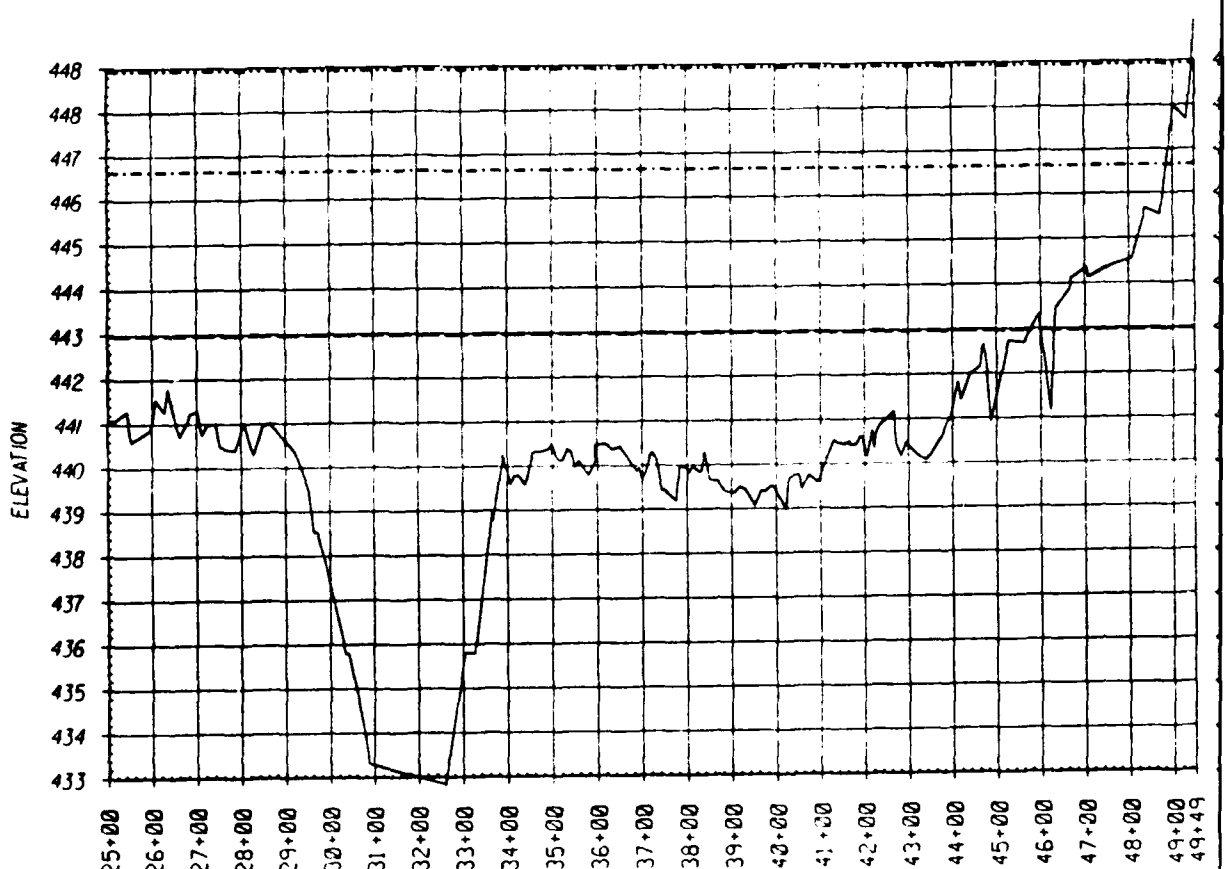
29+24.12
30+00
33+00.66
36+00
49+00
45+00


ELEVATION
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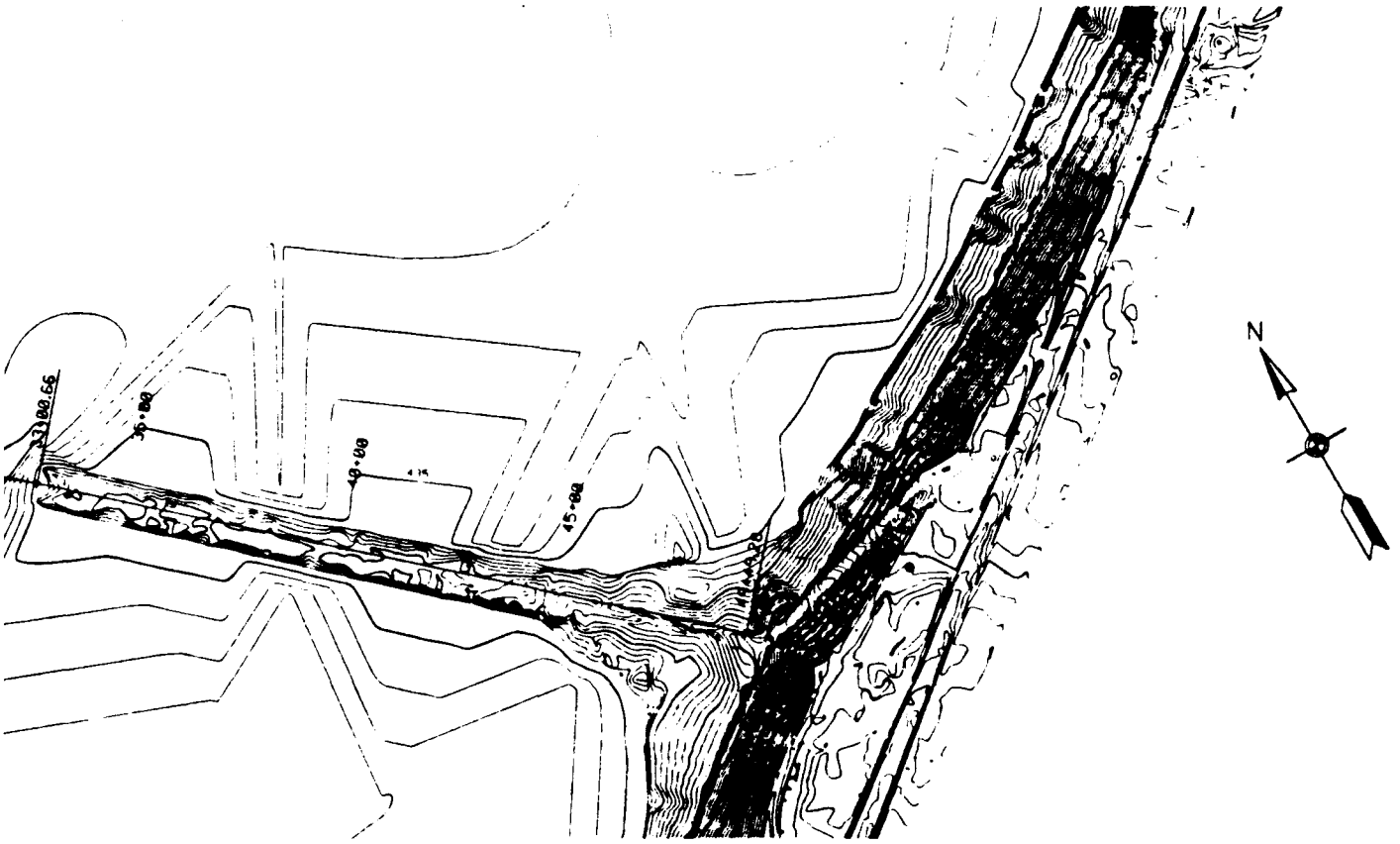
49+00
49+49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40+00
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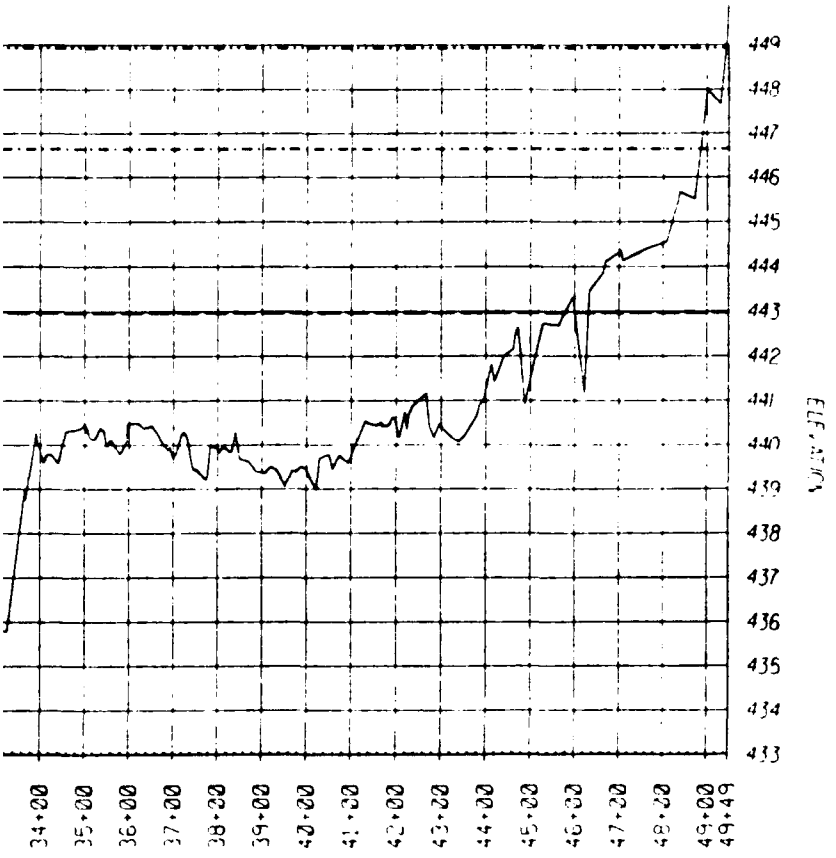
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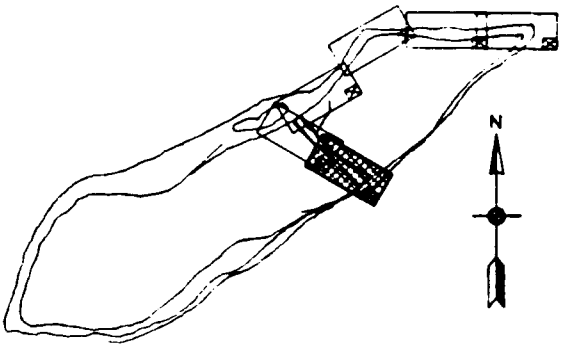
49+49



LEVEE PROFILES

10 YR EVENT
5 YEAR EVENT
2 YEAR EVENT

200 100 0 200 400FT
SCALE 1"= 200'

Revisions			
Symbol	Description	Date	Approved

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

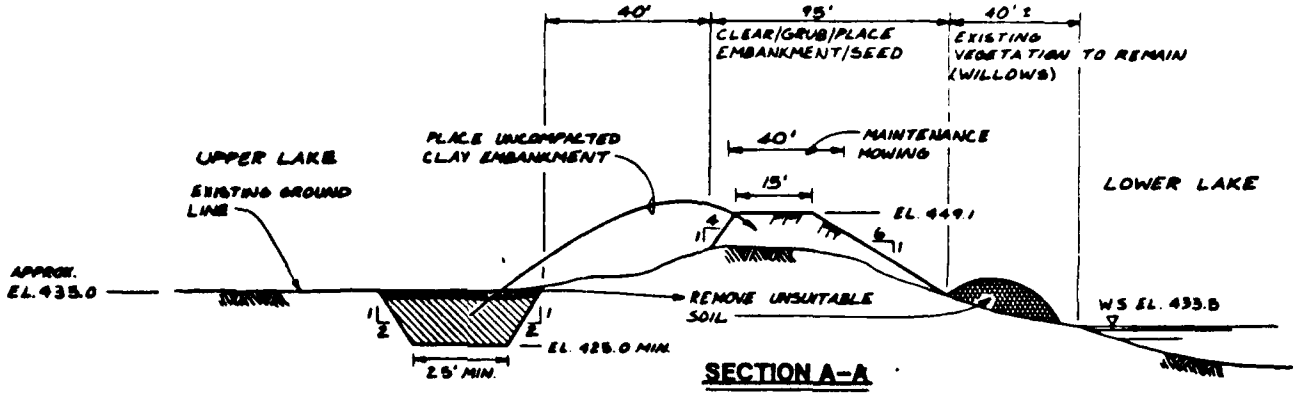
Designed by: D.J.H.
Drawn by: T.E.M.
Checked by: D.R.R.
Reviewed by: D.J.H.
Approved by:

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.8
LAKE CHAUTAUQUA

PLAN AND PROFILE
CROSS DIKE
STA. 25+00 TO STA. 49+49.28

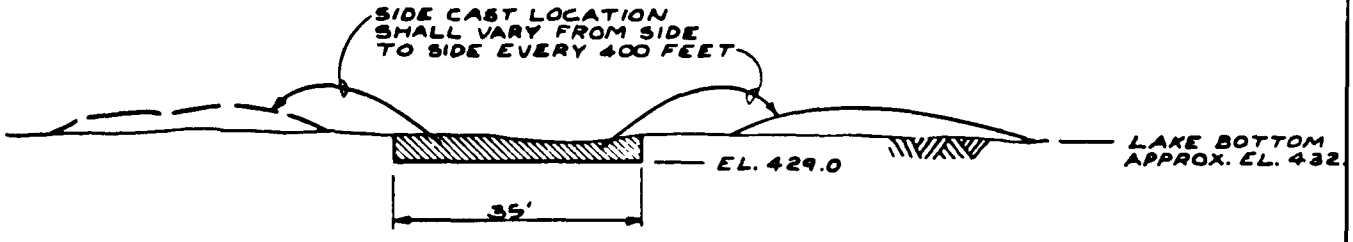
Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Solicitation Number:
Sheet of

PLATE 18



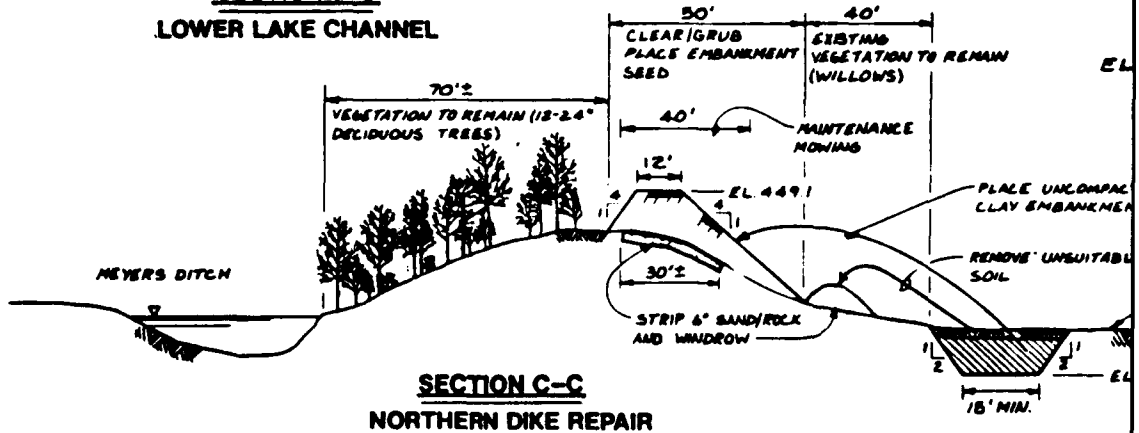
SECTION A-A

CROSS DIKE REPAIR



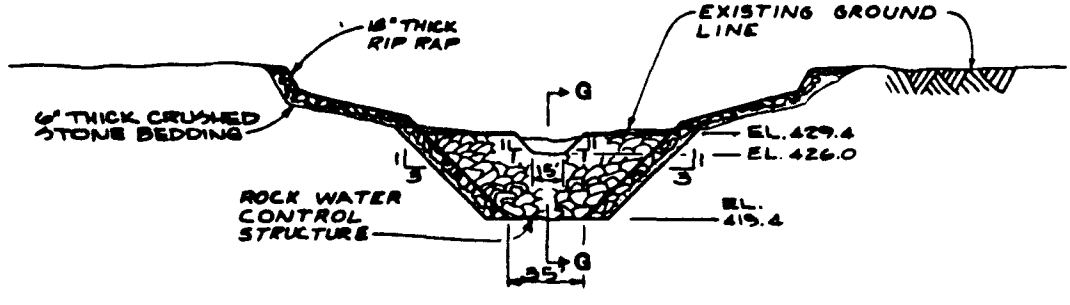
SECTION B-B

LOWER LAKE CHANNEL



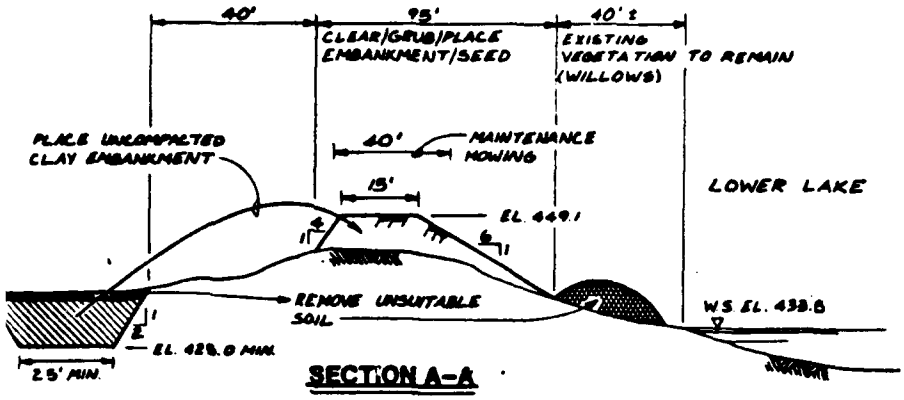
SECTION C-C

NORTHERN DIKE REPAIR



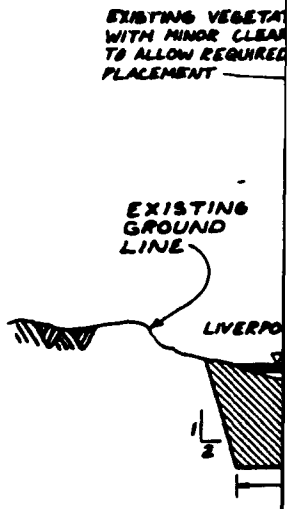
SECTION D-D

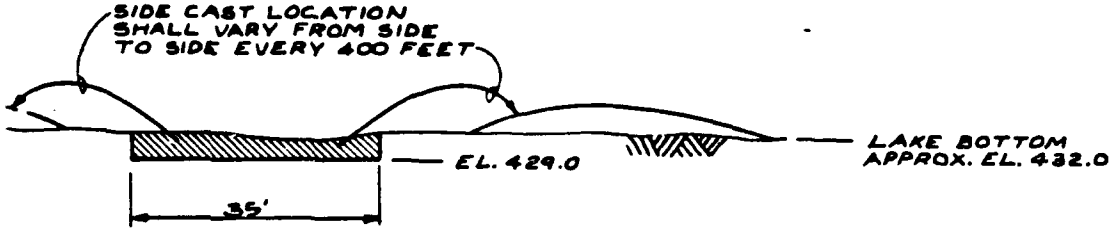
LIVERPOOL WATER CONTROL STRUCTURE



SECTION A-A

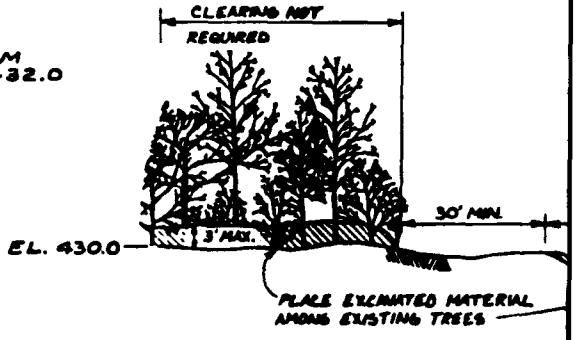
CROSS DIKE REPAIR

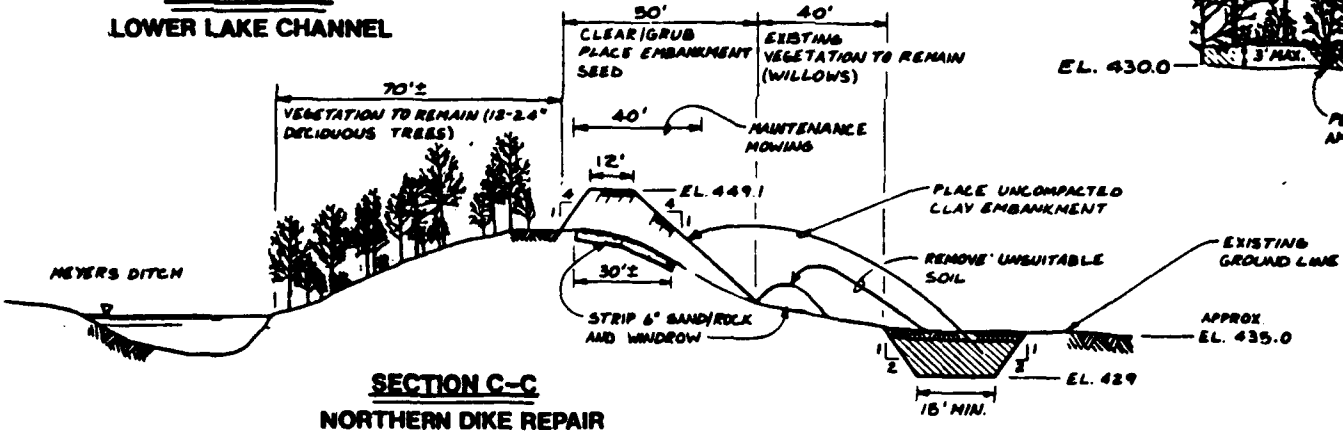




SECTION B-B

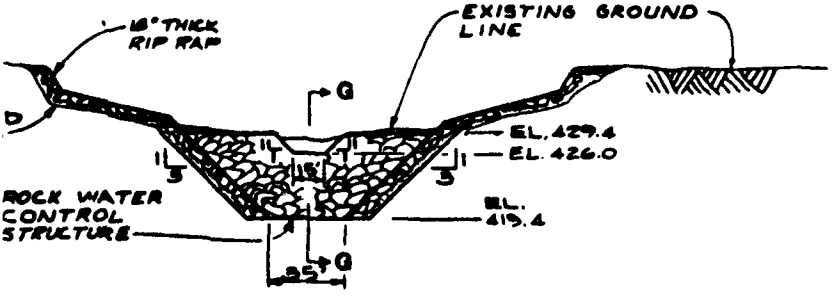
LOWER LAKE CHANNEL



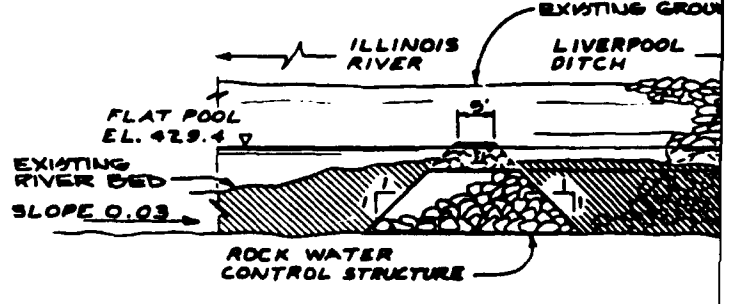


SECTION C-C

NORTHERN DIKE REPAIR

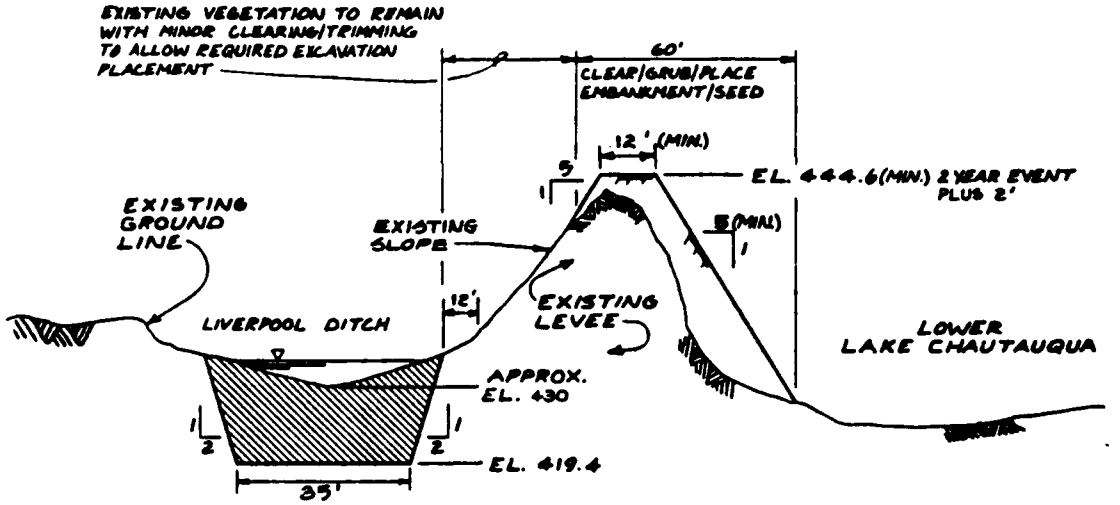


SECTION D-D

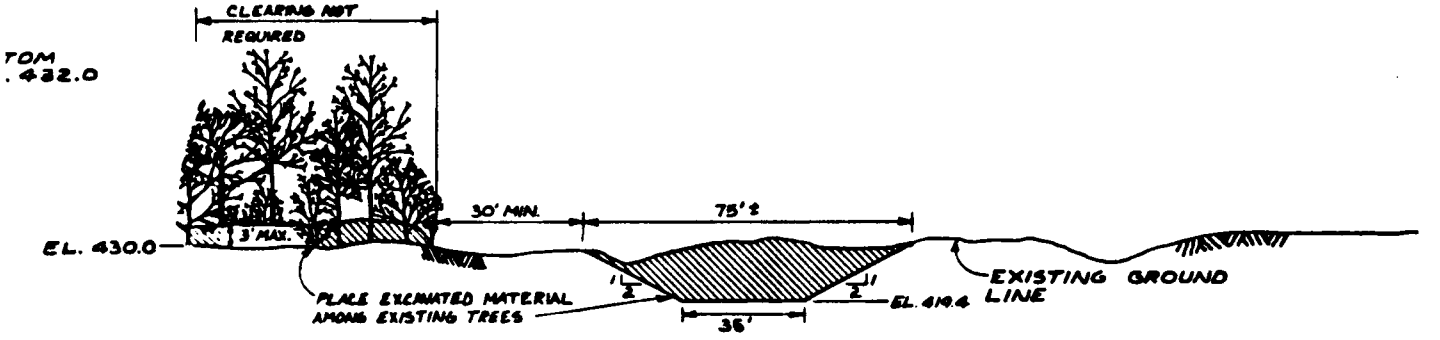


SECTION G-G

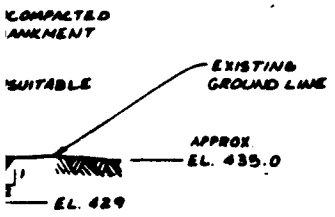
LIVERPOOL WATER CONTROL STRUCTURE



SECTION E-E
LIVERPOOL DITCH EXCAVATION

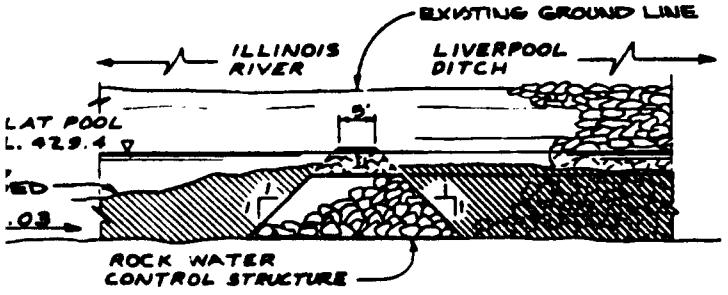


SECTION F-F
FLOWING SIDE CHANNEL



LEGEND

CHANNEL EXCAVATION



SECTION G-G

Revisions			
Symbol	Description	Date	Approved

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

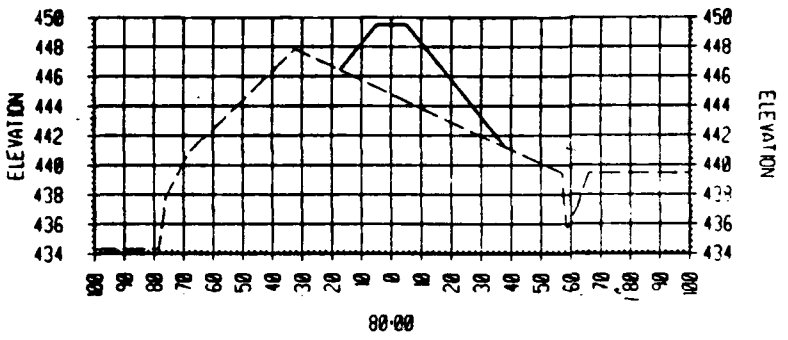
Designed by
Drawn by DJG, jkv
Checked by
Reviewed by
Approved by

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 139.5
LAKE CHAUTAUQUA

TYPICAL SECTIONS

Scale NONE
Date
Drawing Code
Sheet reference number
Sheet _ of _

PLATE 19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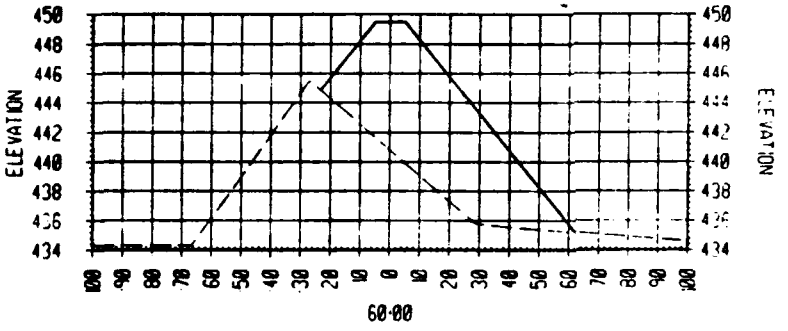
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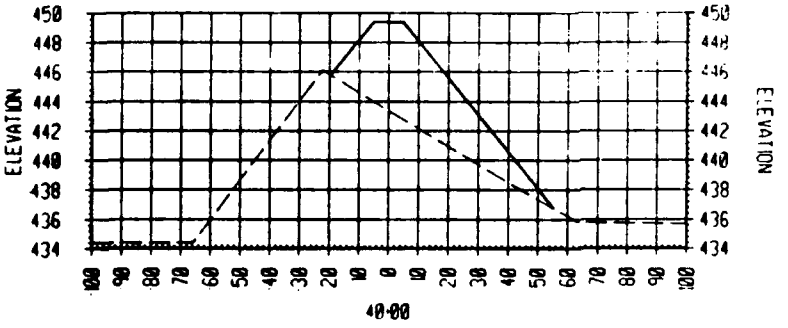
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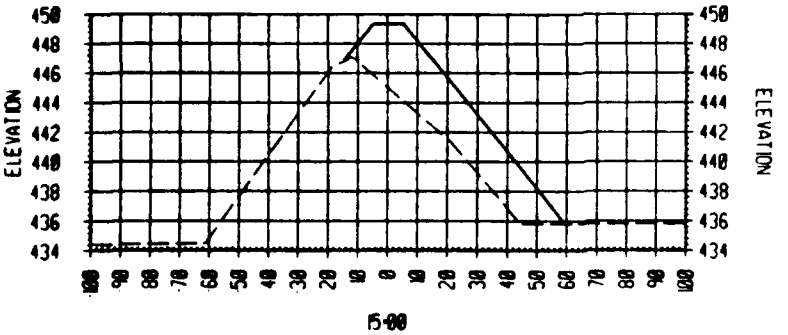
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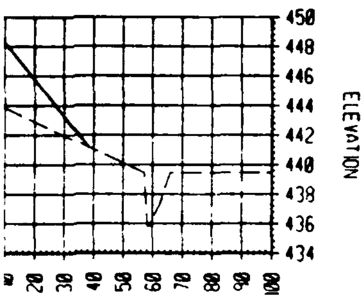

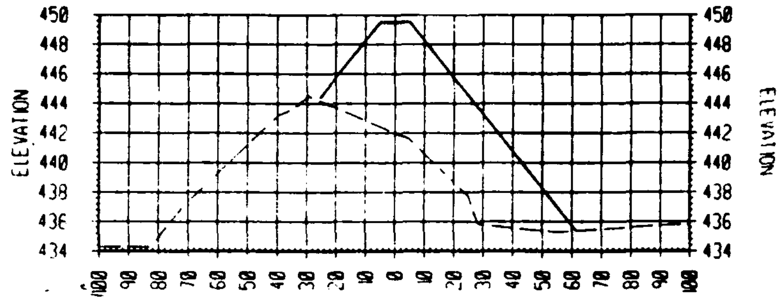

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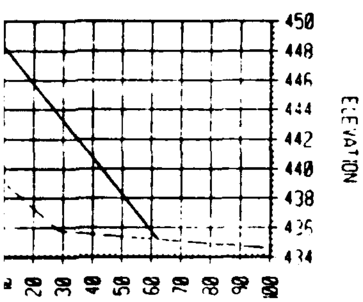

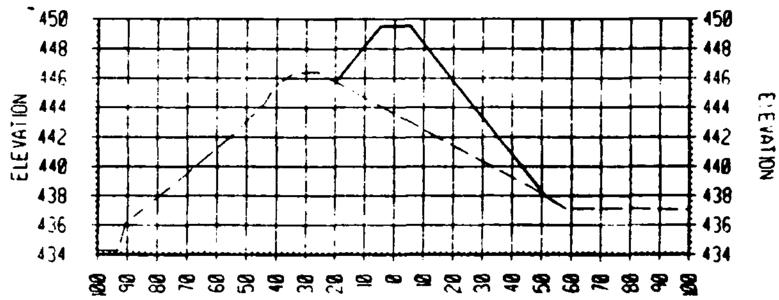

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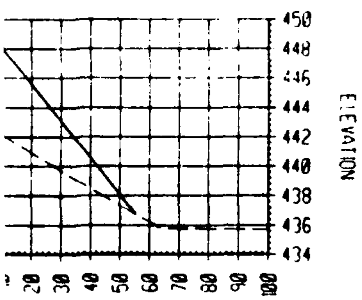

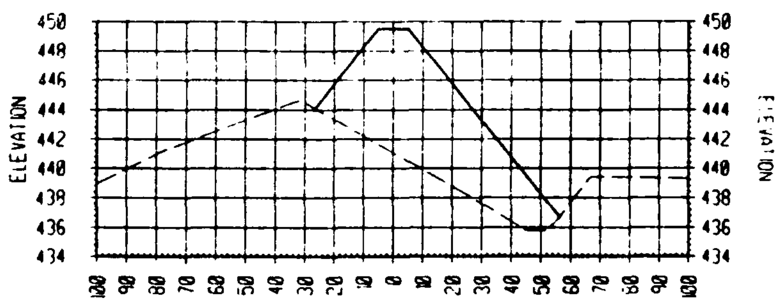

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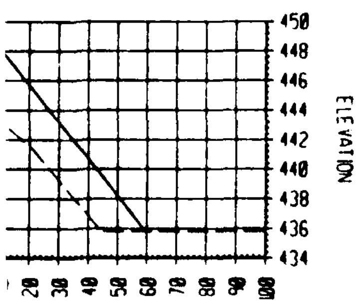

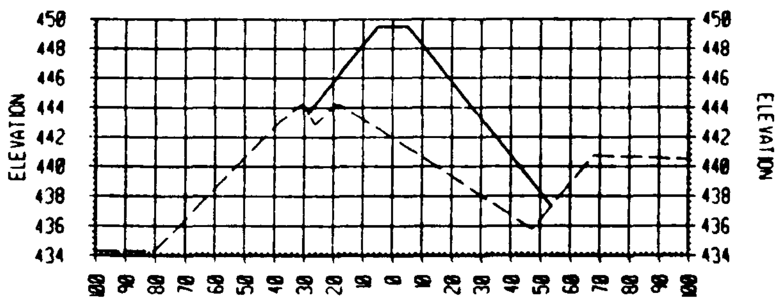

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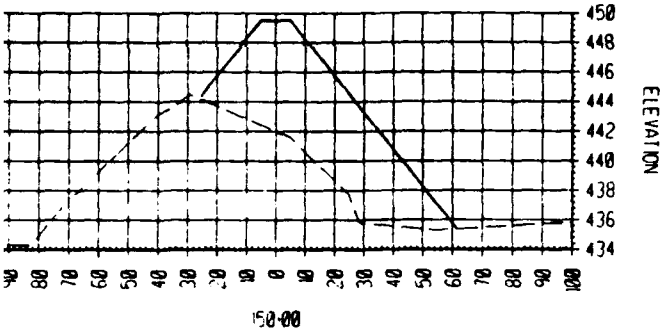

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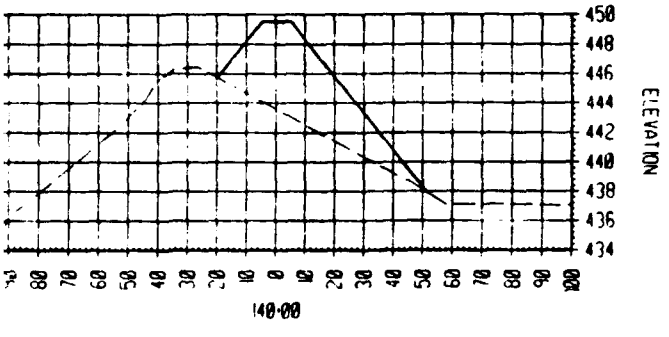

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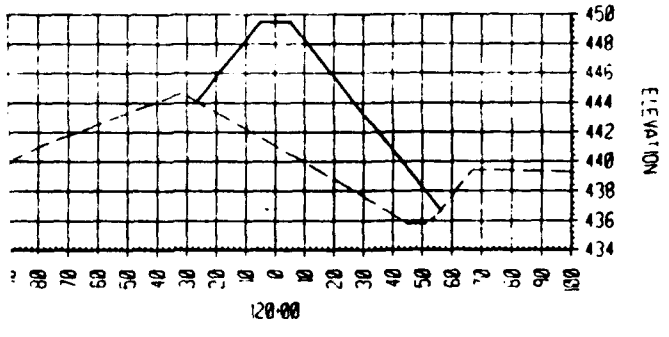

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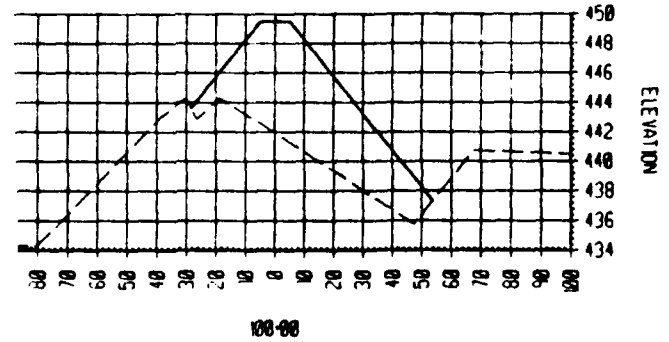

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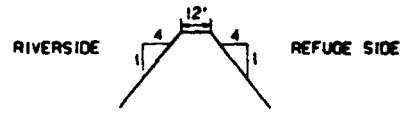
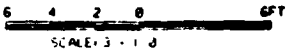


TYPICAL LEVEE

10 YEAR LEVEE

EXISTING SURFACE



VERTICAL SCALE

HORIZONTAL SCALE

REVISIONS			
SYMBOL	DESCRIPTION	DATE	APPROVED

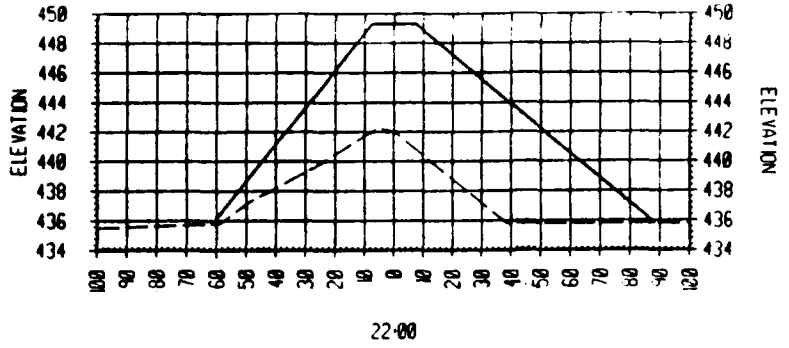
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DESIGNED BY: D. J. H.
DRAWN BY: T. E. M.
CHECKED BY: D. R. R.
REVIEWED BY: D. J. H.
APPROVED BY:

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROJECT
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

TYPICAL CROSS SECTIONS
UPPER LAKE PERIMETER

SCALE: AS SHOWN
DATE:
DRAWING CODE:
SHEET OF



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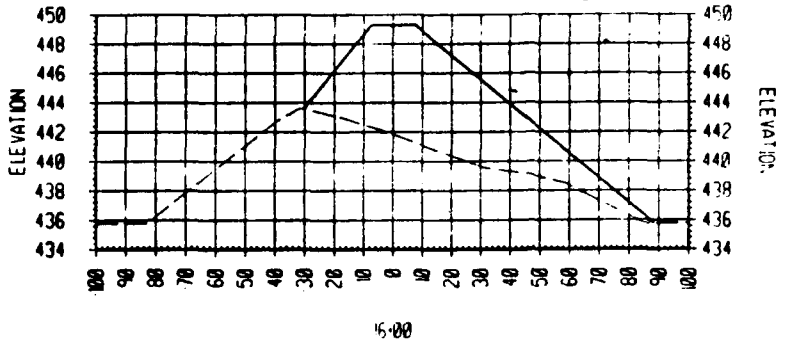

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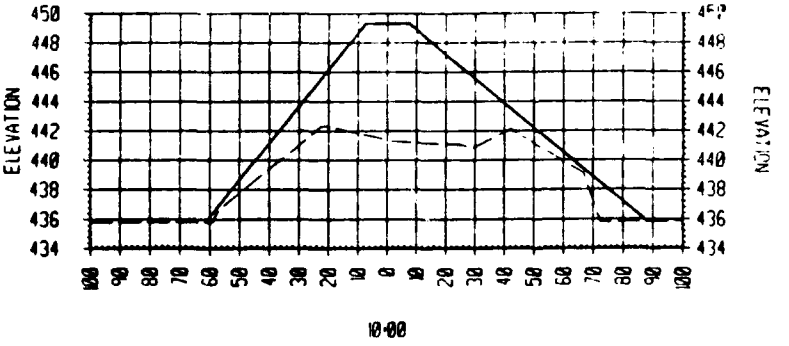

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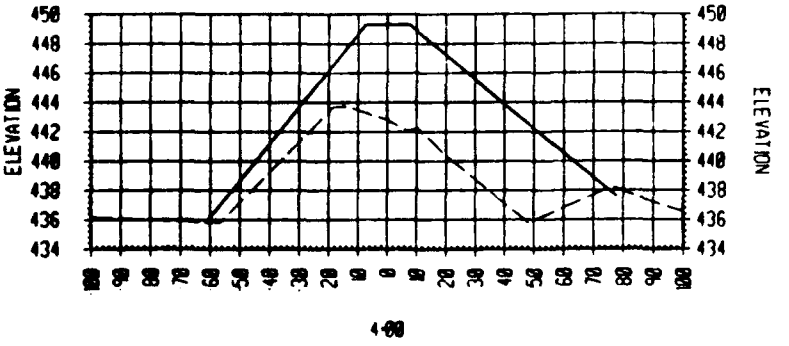

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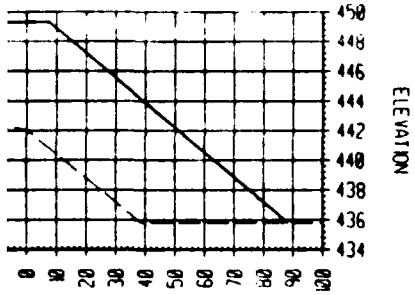

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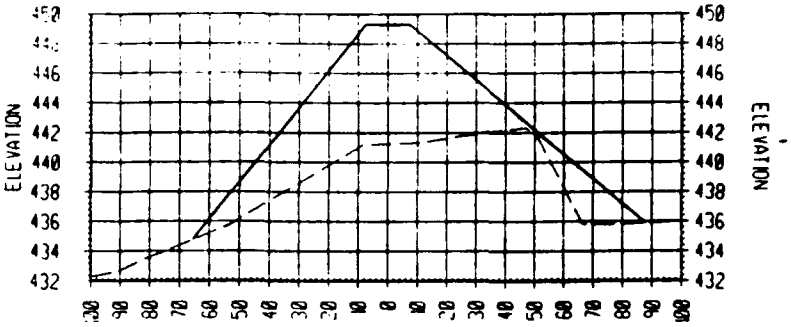

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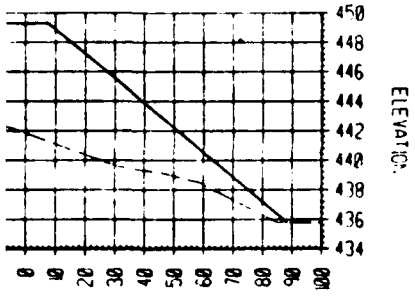

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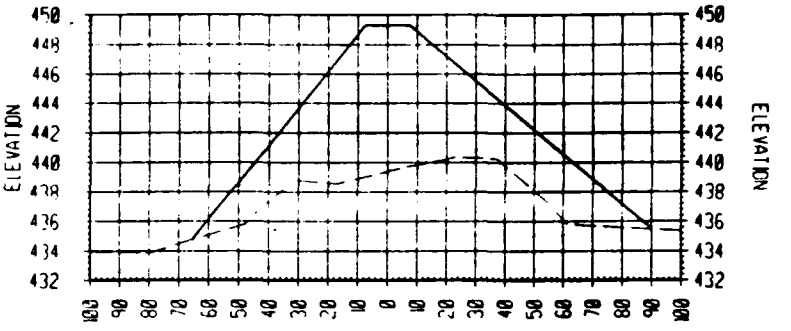

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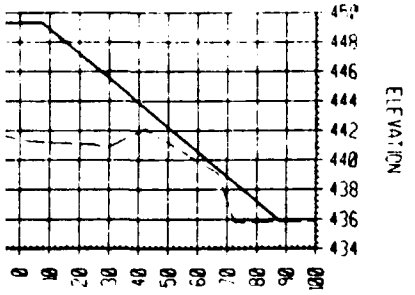

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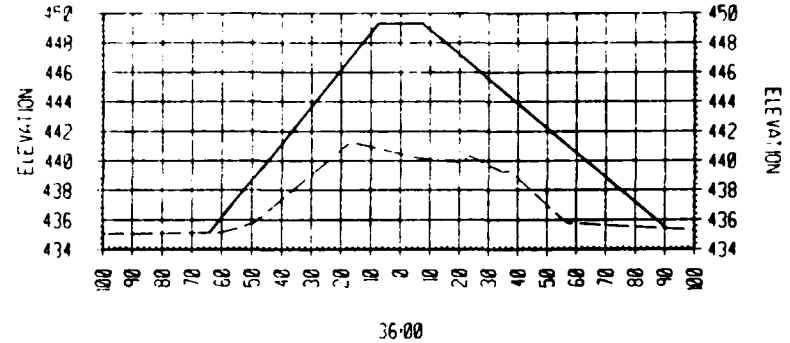

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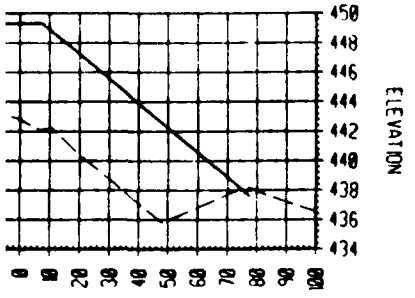

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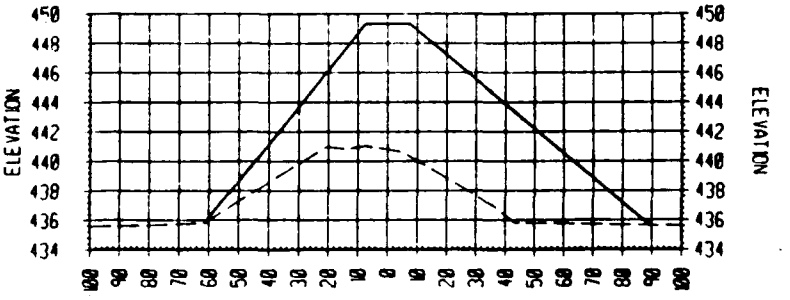

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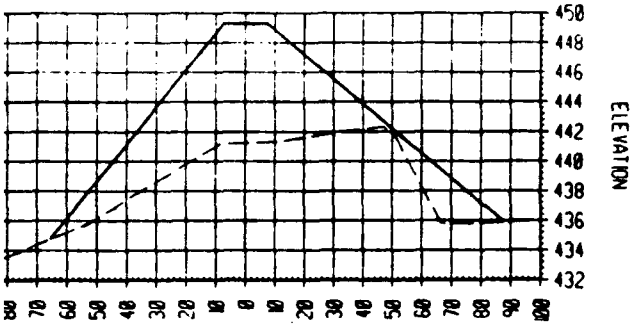

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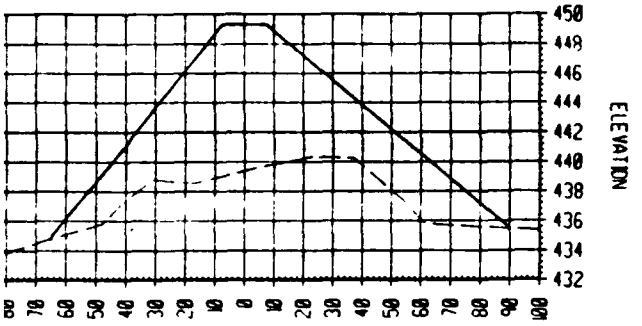

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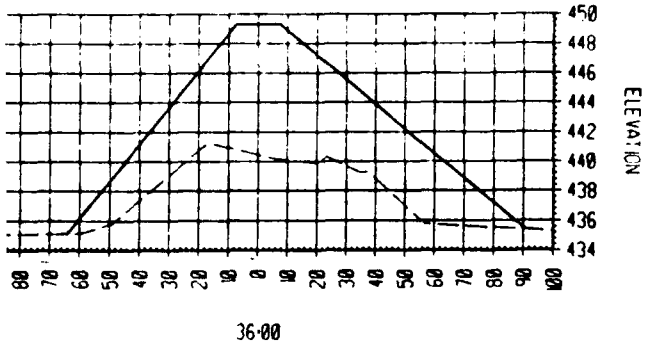

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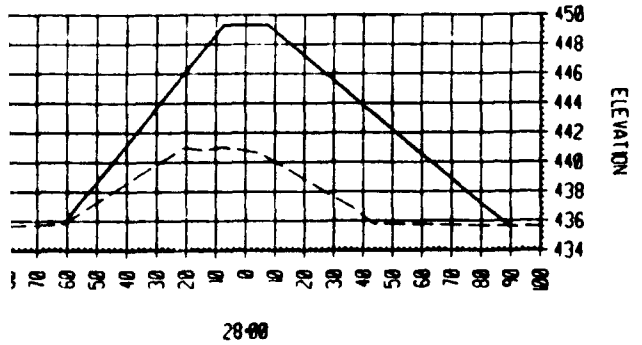

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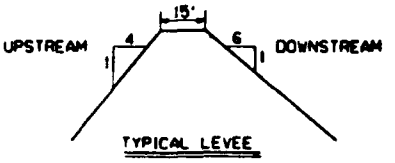


TYPICAL LEVEE

10 YEAR LEVEE

EXISTING SURFACE

REVISIONS			
SYMBOL	DESCRIPTION	DATE	APPROVED

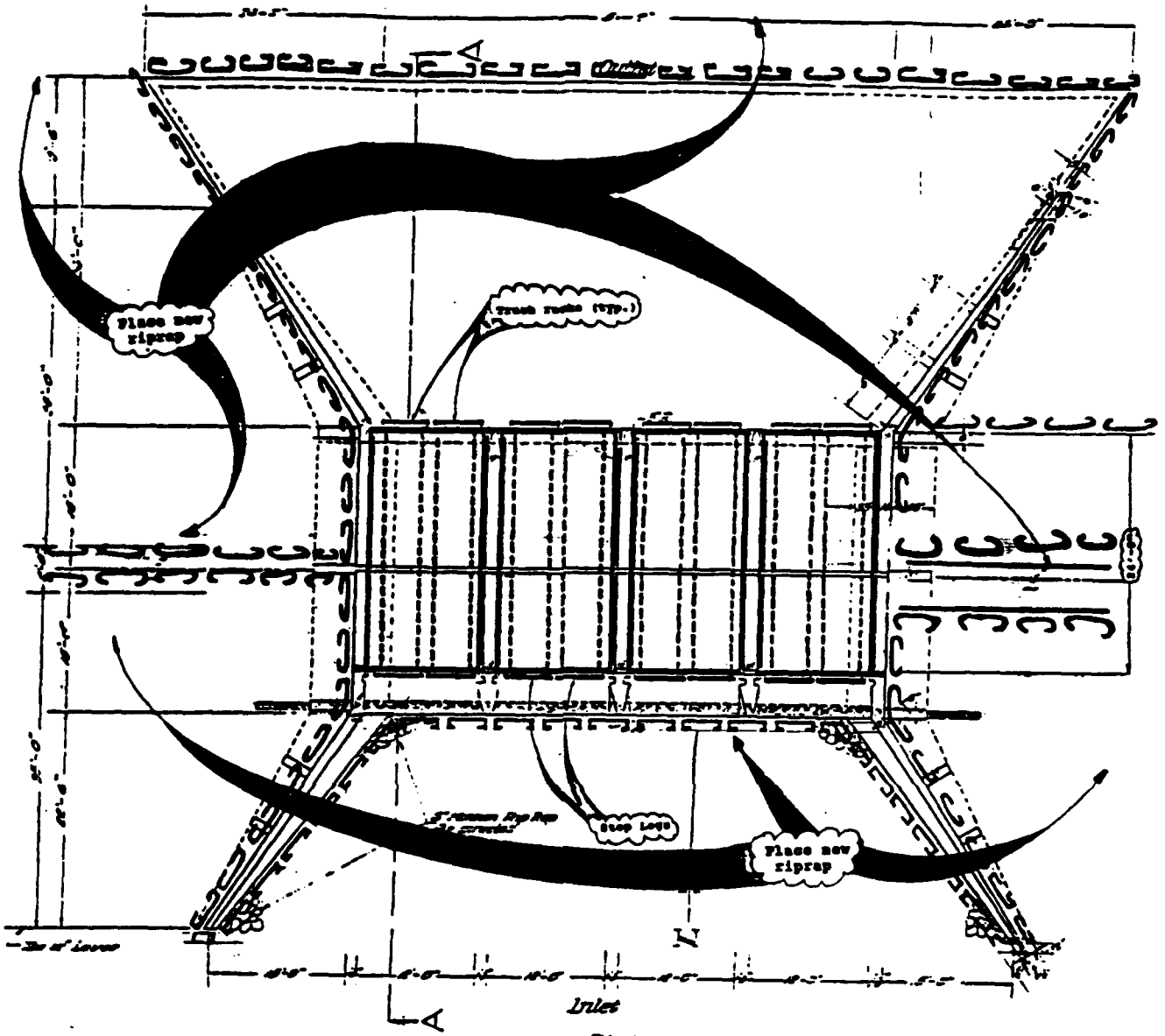
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

DESIGNED BY: D. J. H.
DRAWN BY: T. E. M.
CHECKED BY: D. R. R.
REVIEWED BY: D. J. H.
APPROVED BY:

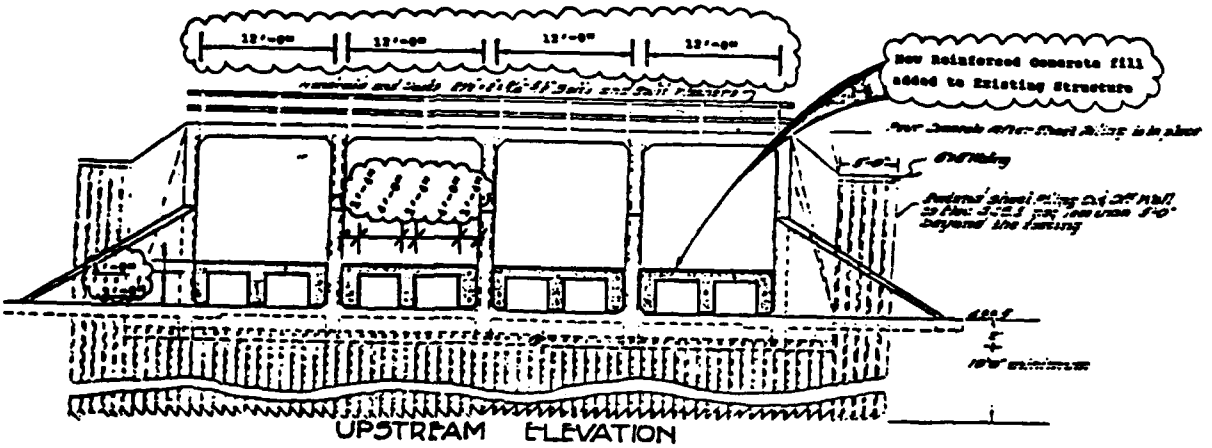
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROJECT
LA GRANGE POOL, MILE 124 - MILE 129.8
LAKE CHAUTAUQUA

TYPICAL CROSS SECTIONS
X-DIKE

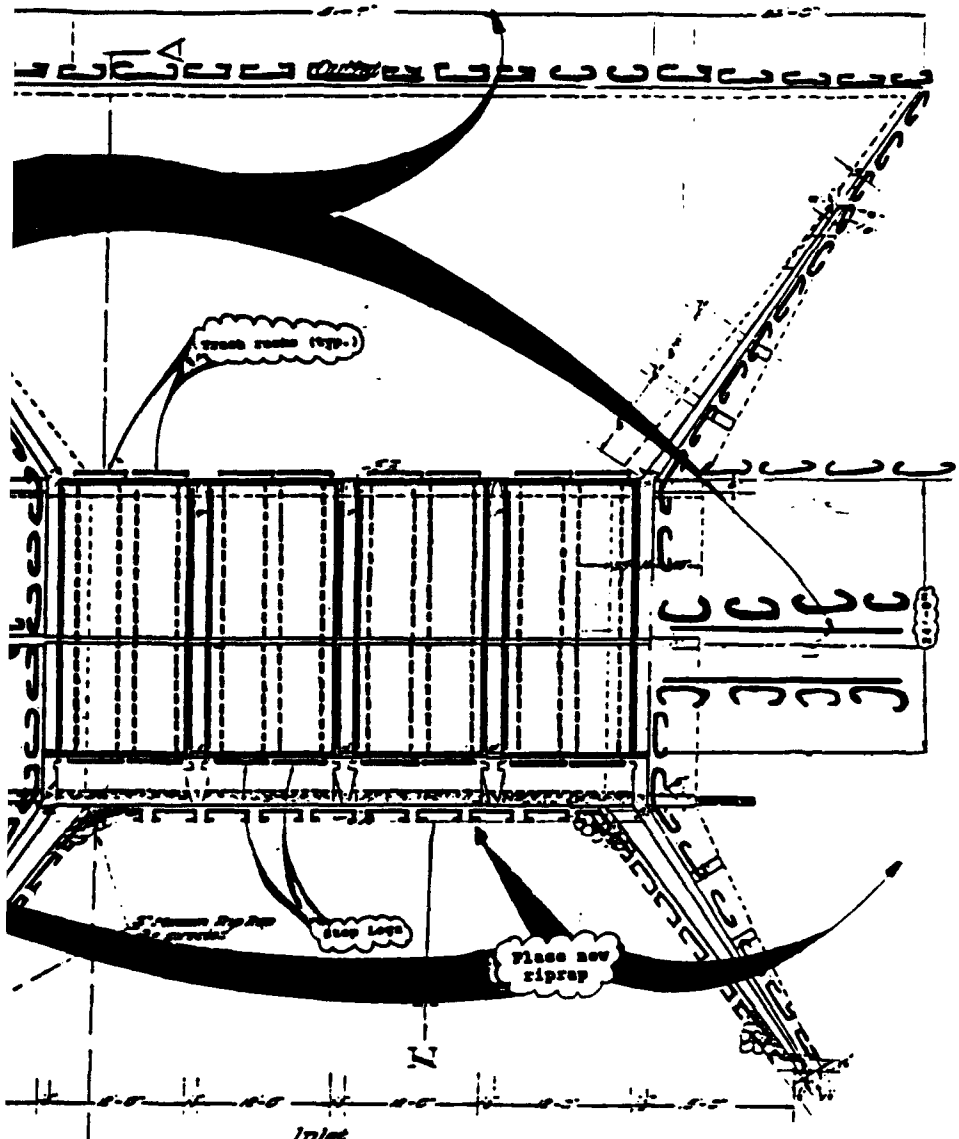
SCALE: AS SHOWN
DATE:
DRAWING CODE:
SHEET NUMBER
SHEET OF



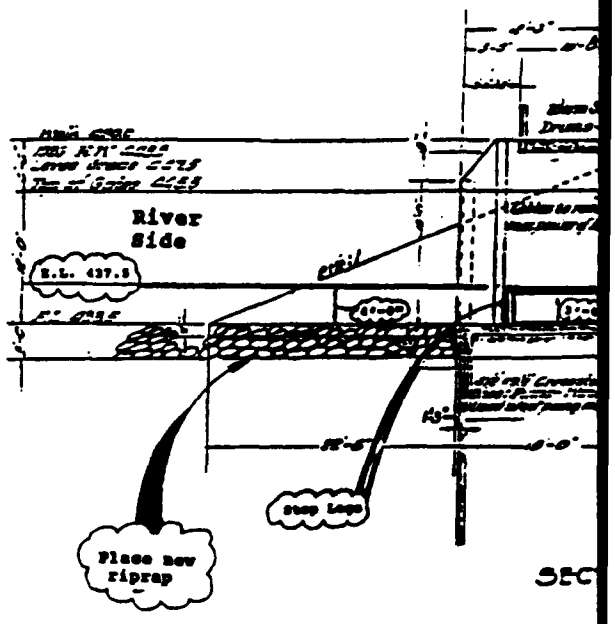
PLAN



UPSTREAM ELEVATION



PLAN



SEC

Modifications to Existing

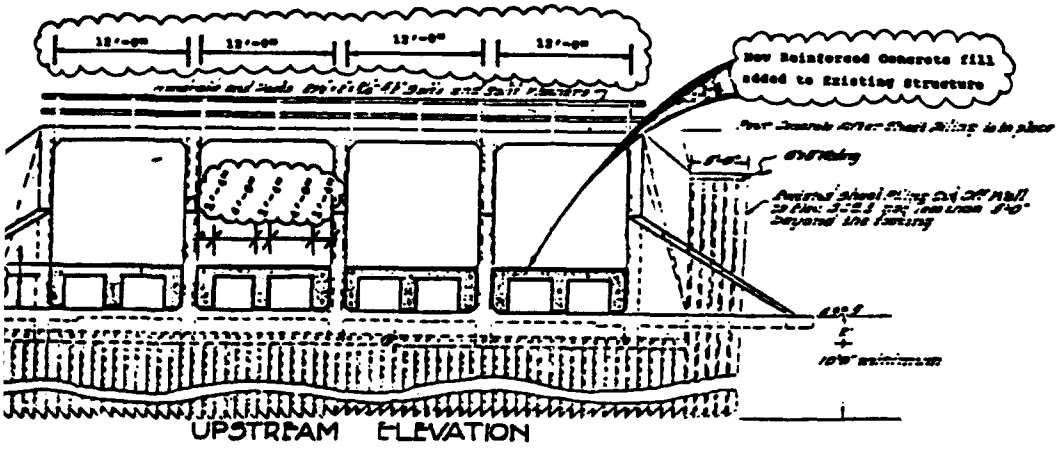
1. Radial gate raised to

2. Reinforced concrete adde
gravity drainage of interi

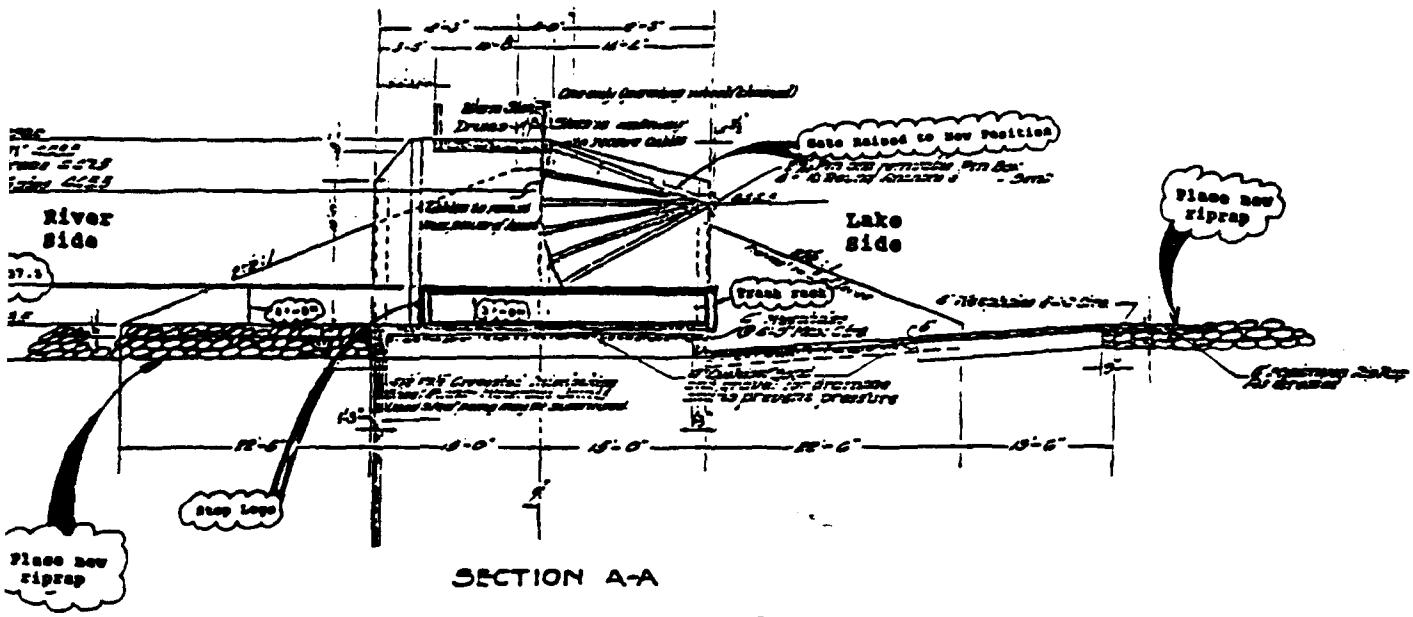
3. Stoplogs placed on each
riverside end of drain ope

4. Trash racks placed on l

5. New riprap placed on up
gate structure.



UPSTREAM ELEVATION



SECTION A-A

Modifications to Existing Structure 1.

1. Radial gate raised to new position.

2. Reinforced concrete added to gate sills with openings for gravity drainage of interior water.

3. Stoplogs placed on each of eight openings to seal riverside end of drain openings during normal operation.

4. Trash racks placed on lake end of openings.

5. New riprap placed on upstream side and downstream side of gate structure.

Symbol	Description	Date	Approved

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

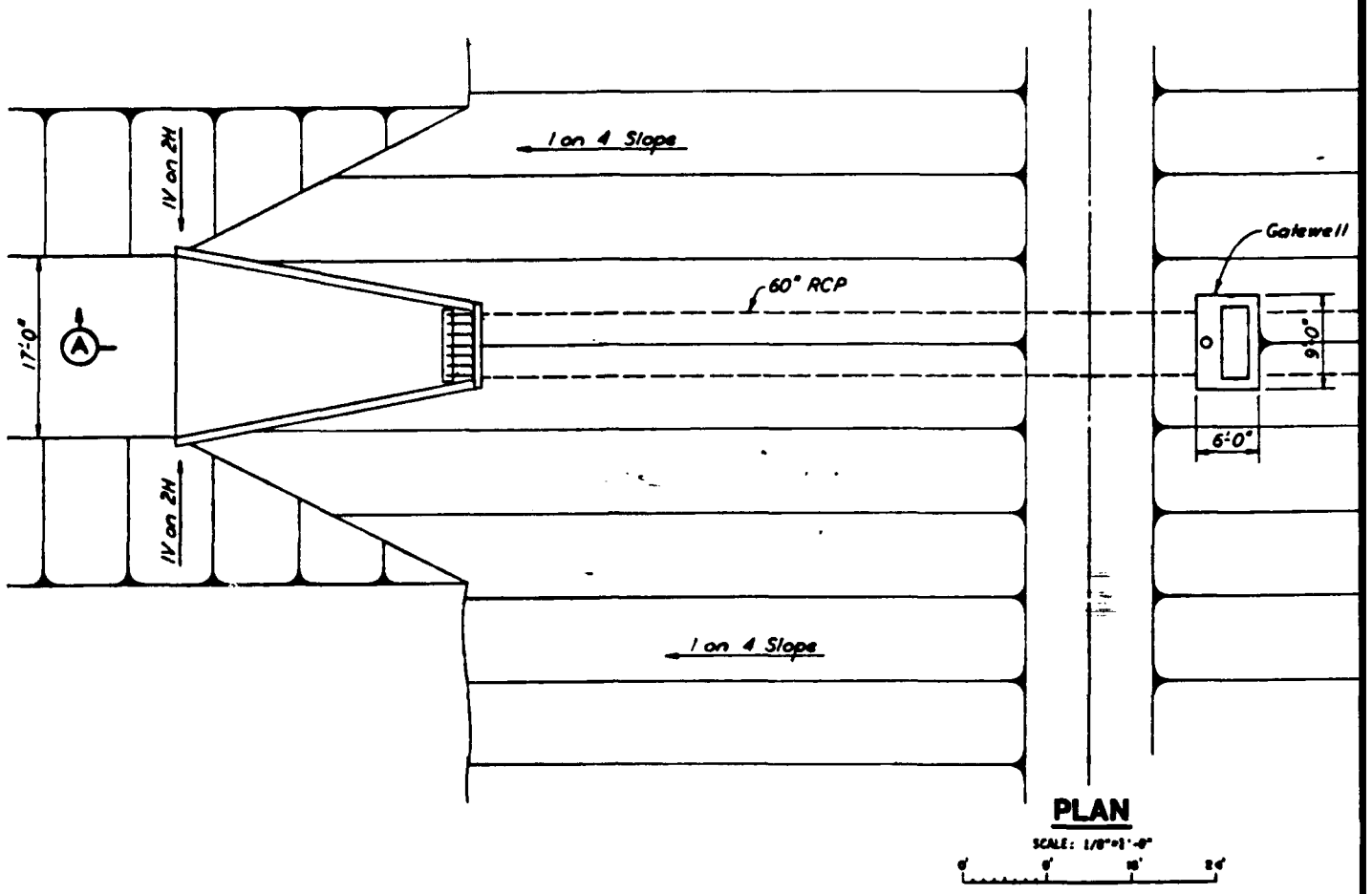
Designed by
Drawn by
Checked by
Reviewed by
Approved by

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

MODIFICATION OF EXISTING RADIAL GATE STRUCTURE

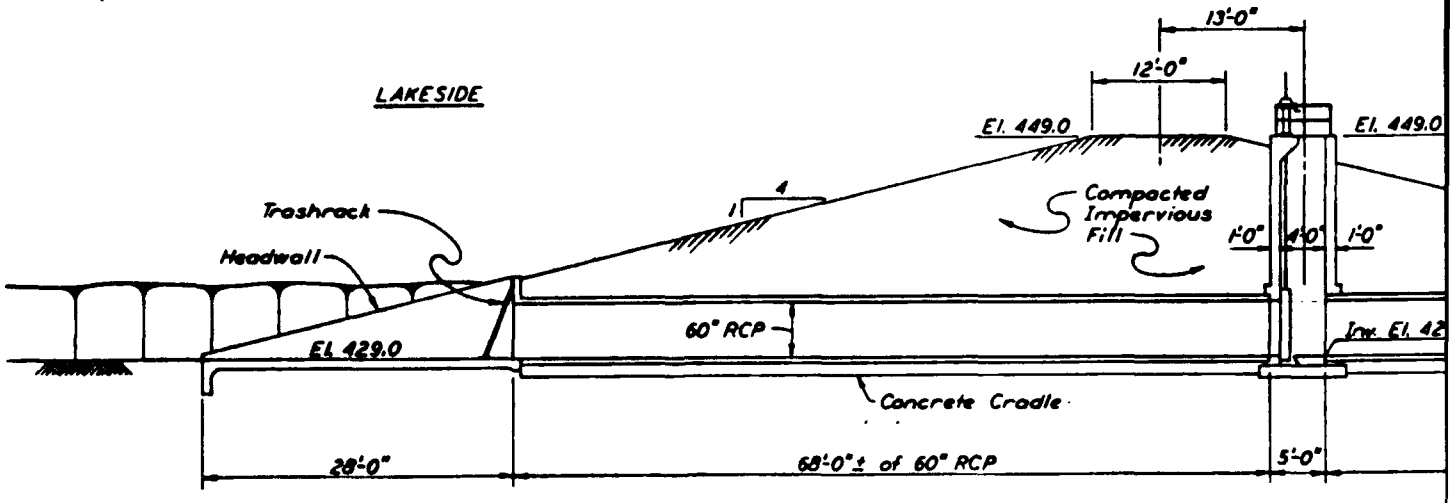
Scale
Date
Drawing Code:
Sheet reference number
Sheet _ _ of _ .

PLATE 22

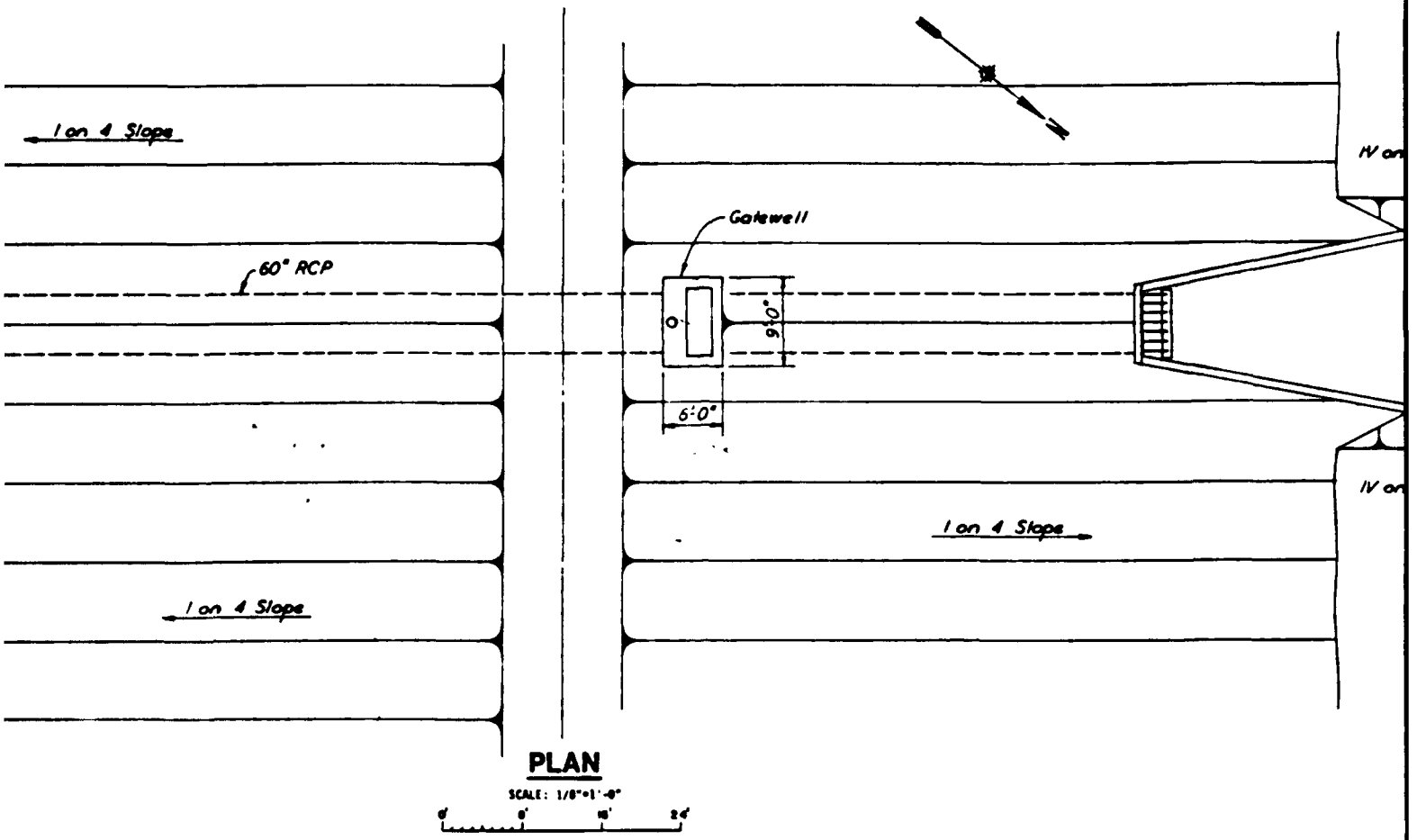


PLAN

SCALE: 1/8"=1'-0"

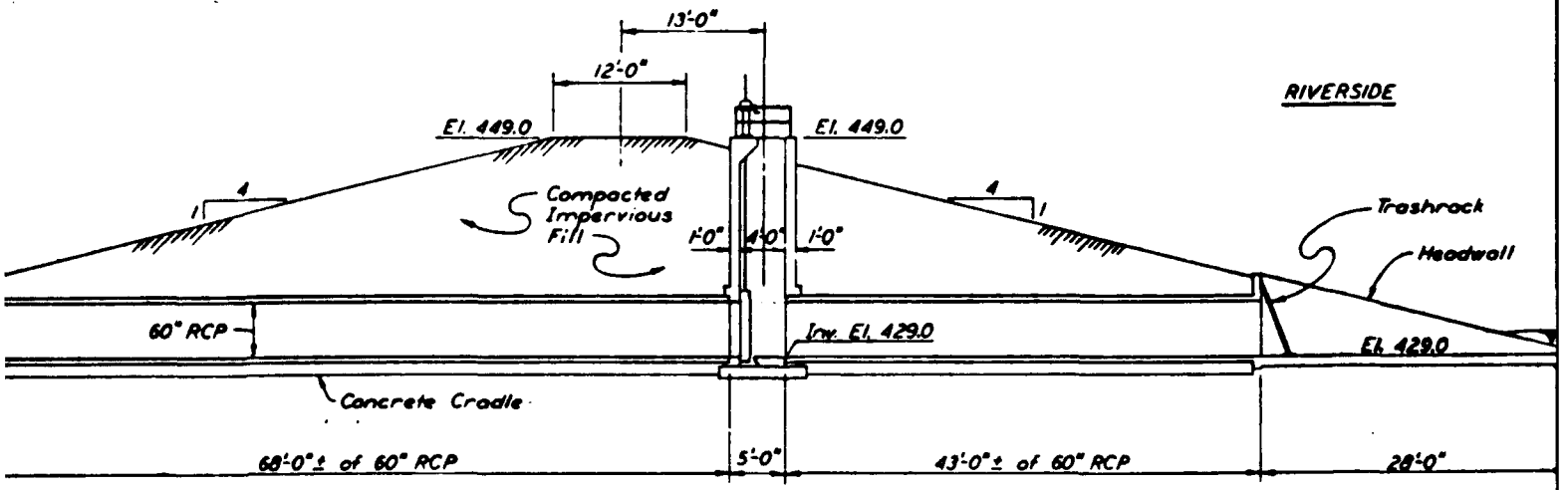


SECTION (A)

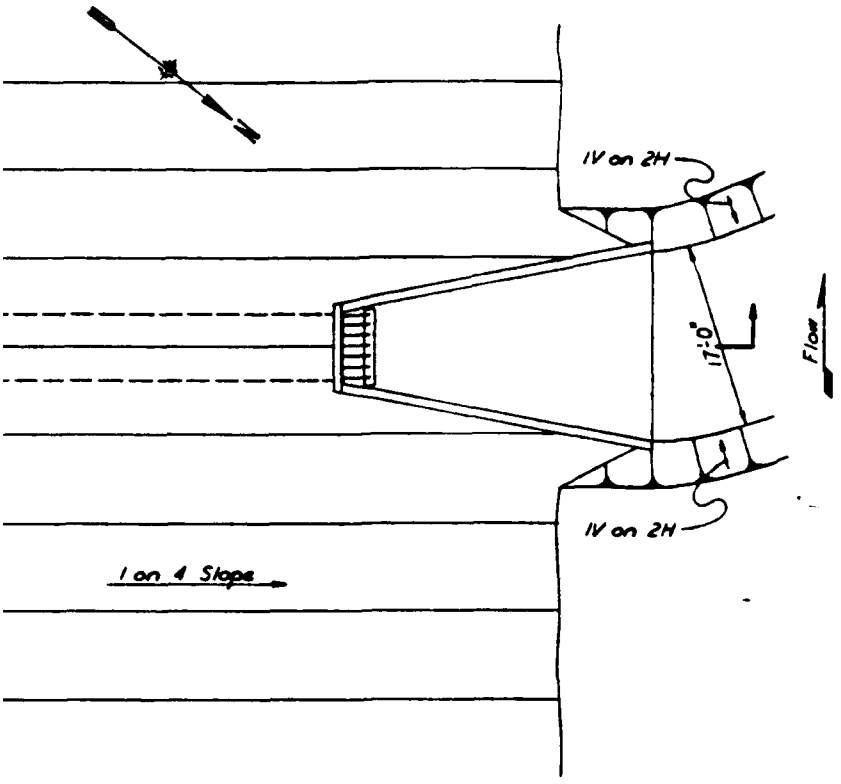


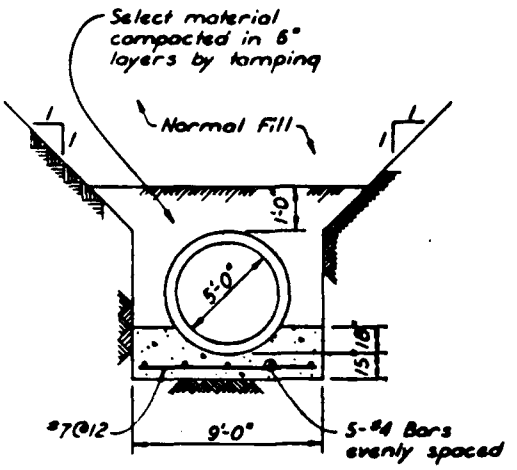
PLAN

SCALE: 1/8"=1'-0"



SECTION (A)

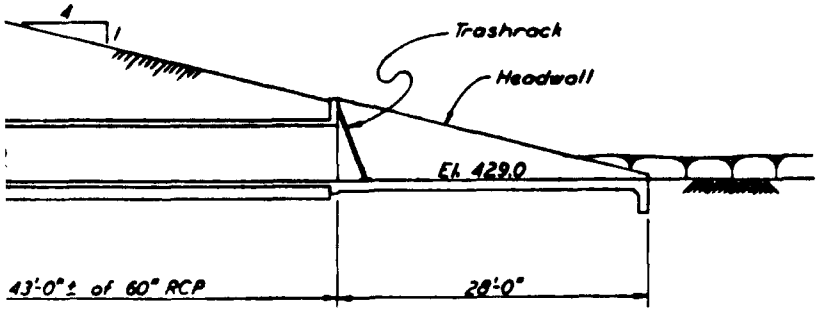




CONCRETE CRADLE DETAIL

NO SCALE

RIVERSIDE



Revisions			
Symbol	Description	Date	Approved

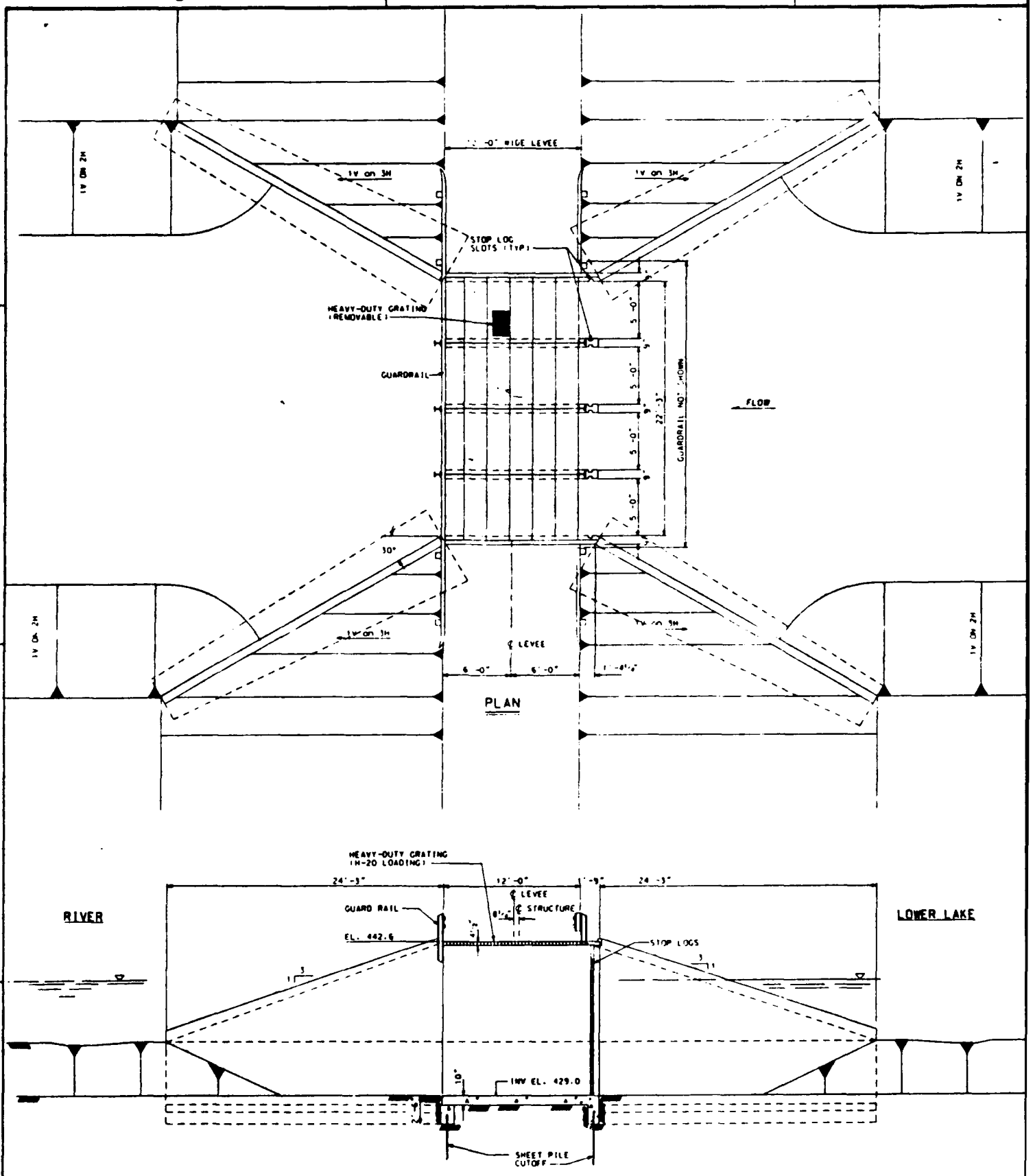
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

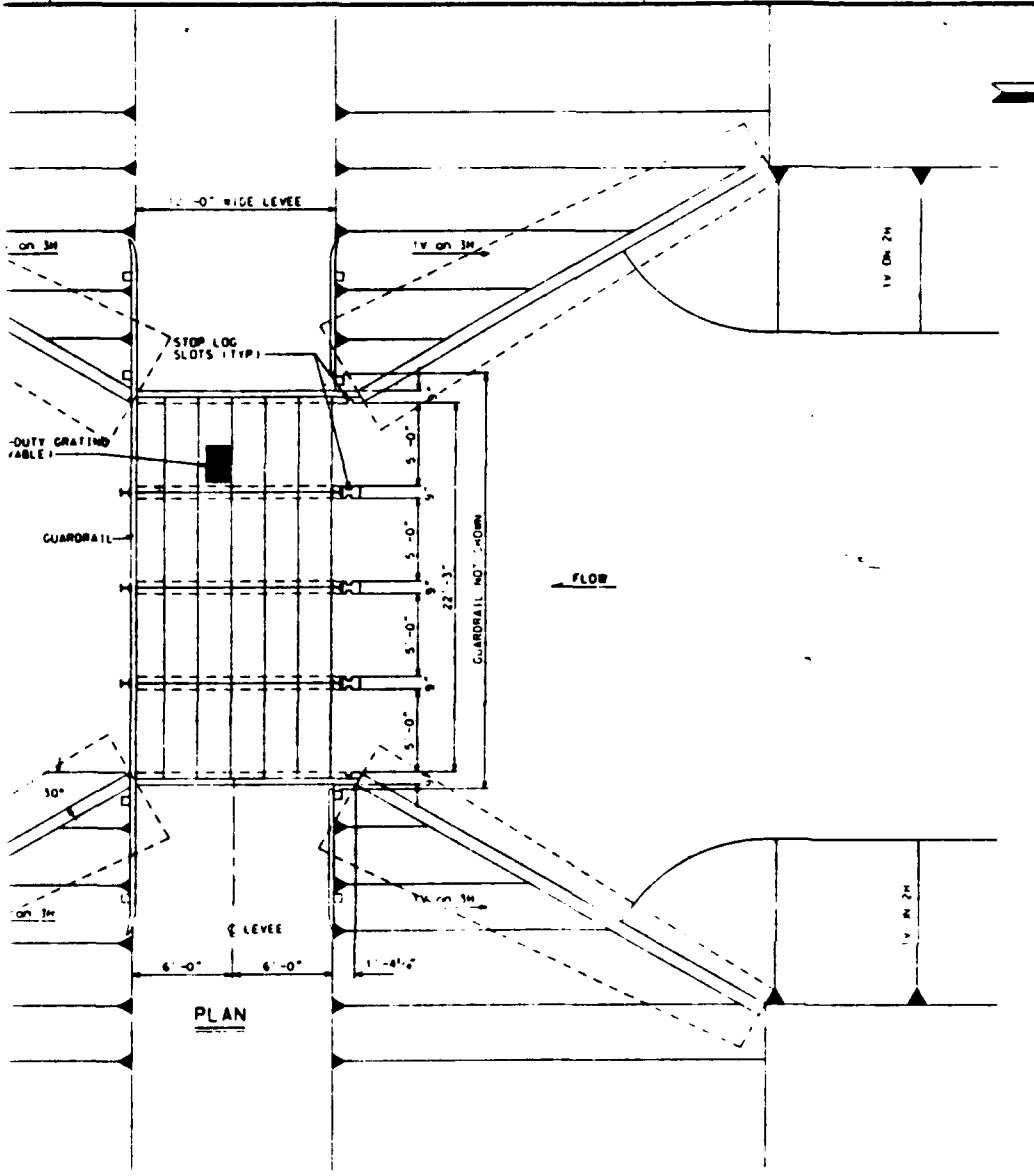
Designed by
Drawn by
Checked by
Recommended by
Approved by

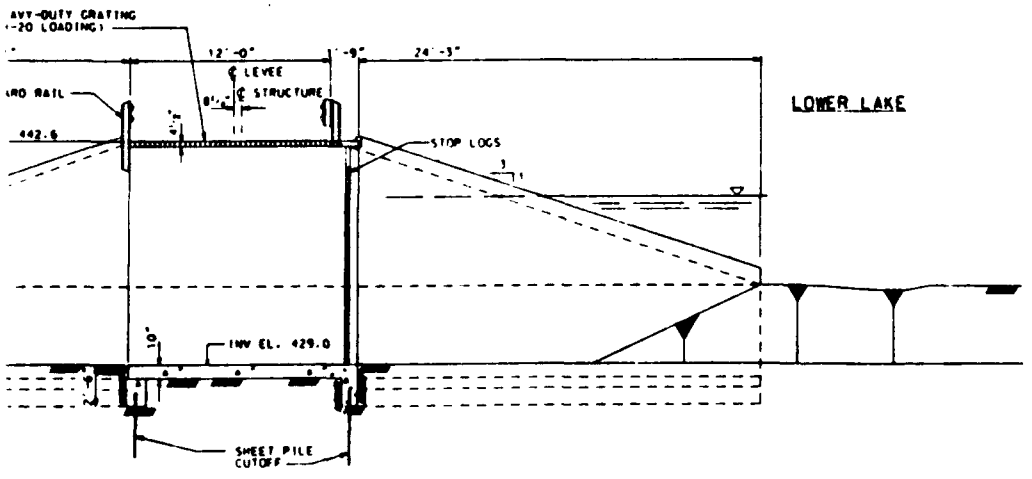
ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 126.5
LAKE CHAUTAUQUA

UPPER LAKE
GRAVITY OUTLET STRUCTURE

Section
Date
Drawing Code
Sheet reference numbers
Sheet _ _ of _


5
4
3
D
C
B
A
1V on 2H
1V on 3H
STOP LOG SLOTS (TYP.)
HEAVY-DUTY GRATING (REMOVABLE)
GUARDRAIL
GUARDRAIL NOT SHOWN
FLOW
30°
℄ LEVEE
6'-0"
PLAN
HEAVY-DUTY GRATING (H-20 LOADING)
24'-3"
12'-0"
9"
RIVER
GUARD RAIL
EL. 442.6
℄ STRUCTURE
LOWER LAKE
STOP LOGS
INV EL. 429.0
SHEET PILE CUTOFF
LONGITUDINAL SECTION
SCALE: 1"-0"





LONGITUDINAL SECTION

SCALE: 1/8" = 1'-0"

Revisions			
Symbol	Description	Date	Approved

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:
ZOE R BROWN
CHIEF, CORPS OF ENGINEERS

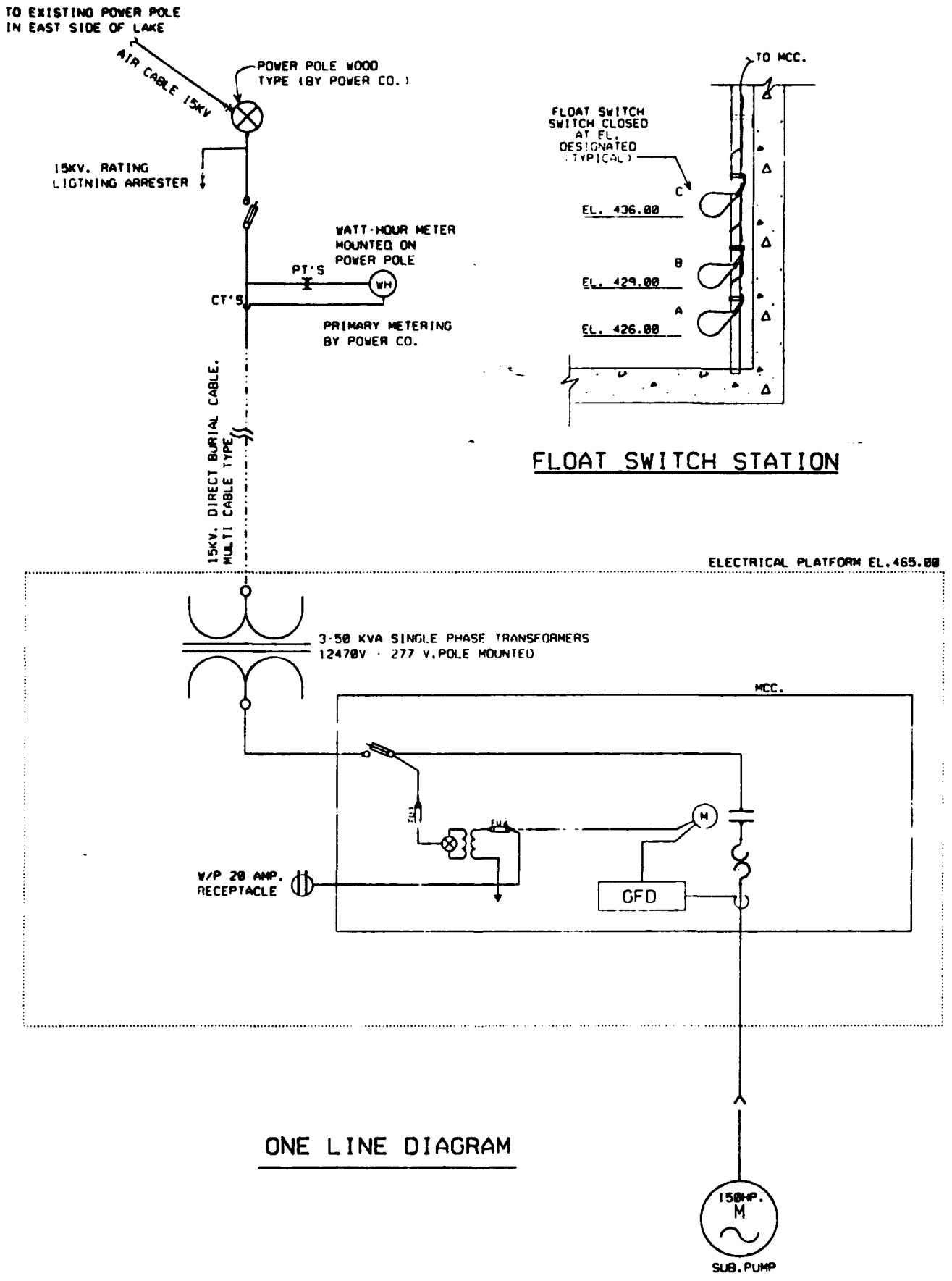
US Army Corps of Engineers
Rock Island District

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

LOWER LAKE
STOPLOG STRUCTURE

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number: op00\p124
Solicitation Number:
Sheet of

PLATE 24

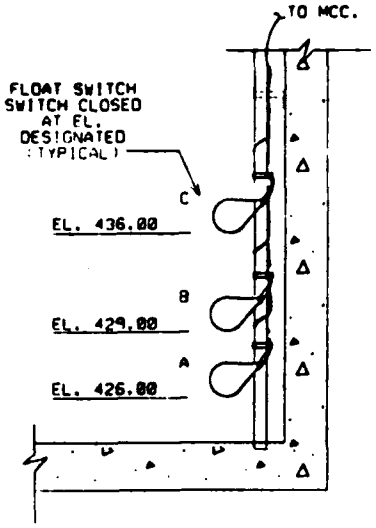

TO EXISTING POWER POLE
IN EAST SIDE OF LAKE
AIR CABLE 15KV
POWER POLE WOOD
TYPE (BY POWER CO.)
15KV. RATING
LIGTNING ARRESTER
WATT-HOUR METER
MOUNTED ON
POWER POLE
PT'S
CT'S
WH
PRIMARY METERING
BY POWER CO.
15KV. DIRECT BURIAL CABLE.
MULTI CABLE TYPE
TO MCC.
FLOAT SWITCH
SWITCH CLOSED
AT EL.
DESIGNATED
(TYPICAL)
C
EL. 436.00
B
EL. 429.00
A
EL. 426.00
FLOAT SWITCH STATION
ELECTRICAL PLATFORM EL.465.00
3-50 KVA SINGLE PHASE TRANSFORMERS
12470V - 277 V.POLE MOUNTED
MCC.
M
W/P 20 AMP.
RECEPTACLE
GFD
150HP.
M
SUB.PUMP
ONE LINE DIAGRAM

E WOOD
POWER CO.)

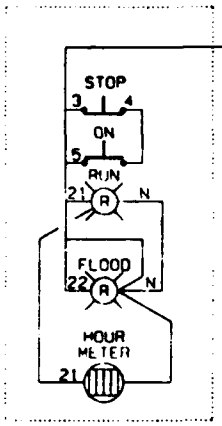
WATT-HOUR METER
MOUNTED ON
POWER POLE

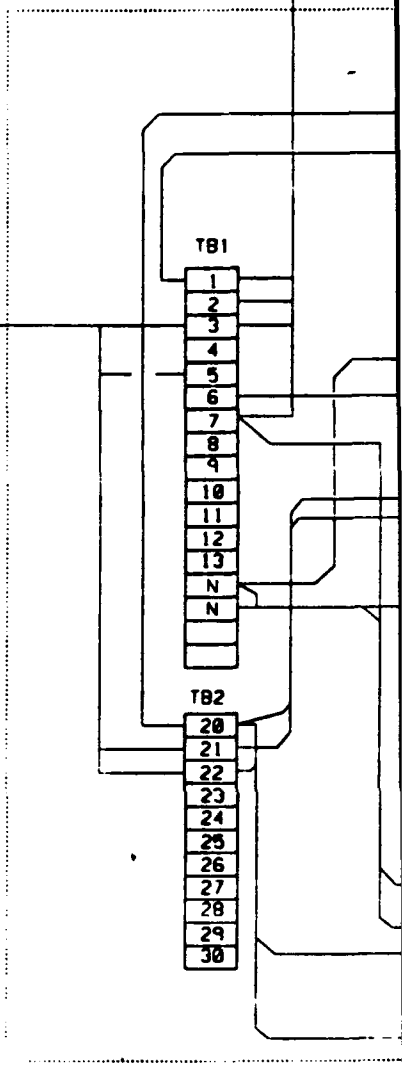
WH

PRIMARY METERING
BY POWER CO.



FLOAT SWITCH STATION

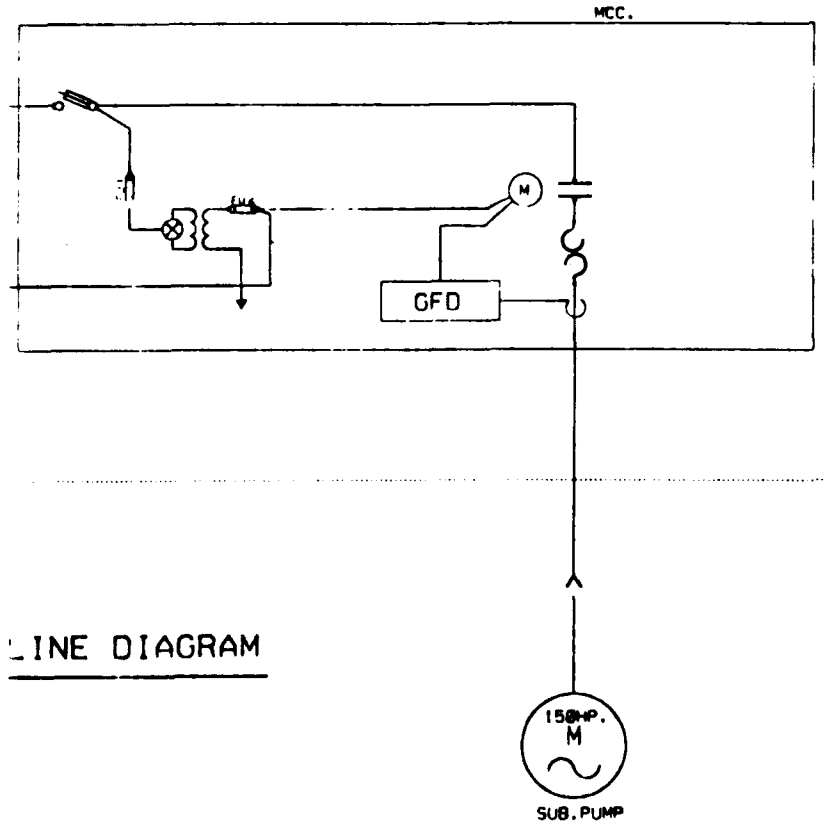




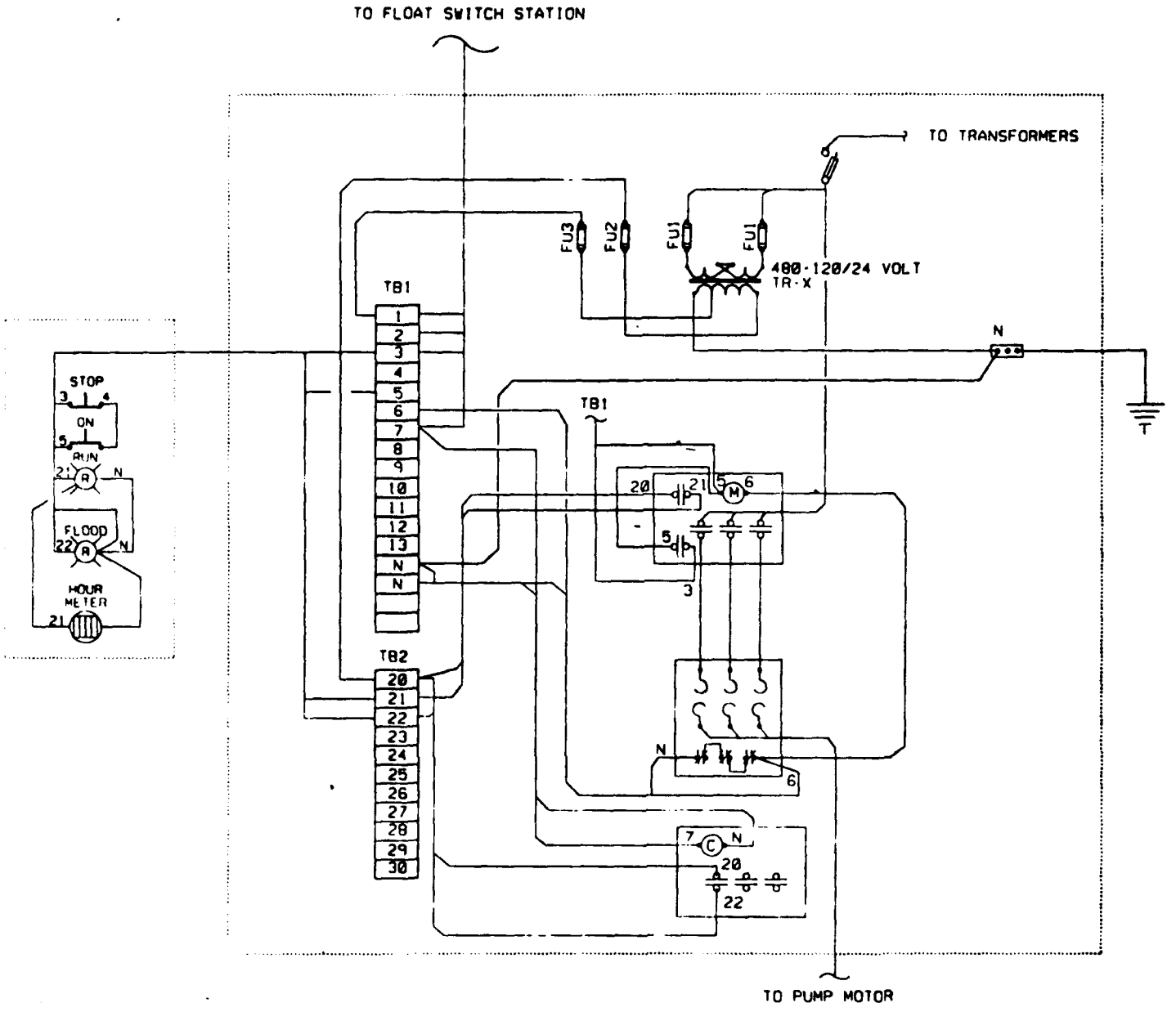
PUMP CONTRO

ELECTRICAL PLATFORM EL.465.00

50 KVA SINGLE PHASE TRANSFORMERS
2470V - 277 V.POLE MOUNTED



LINE DIAGRAM



PUMP CONTROLLER

Revisions			
Symbol	Description	Date	Approved

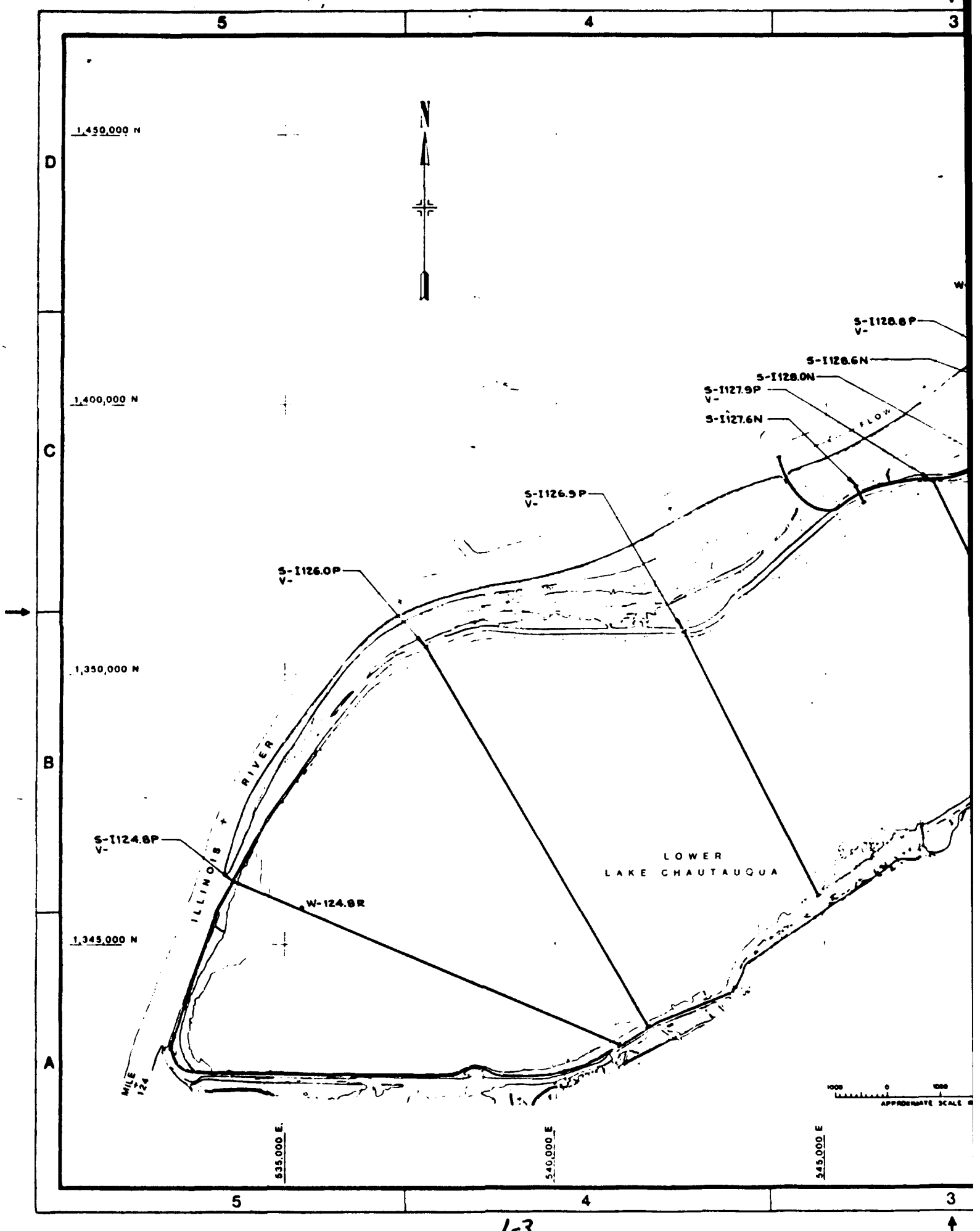
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

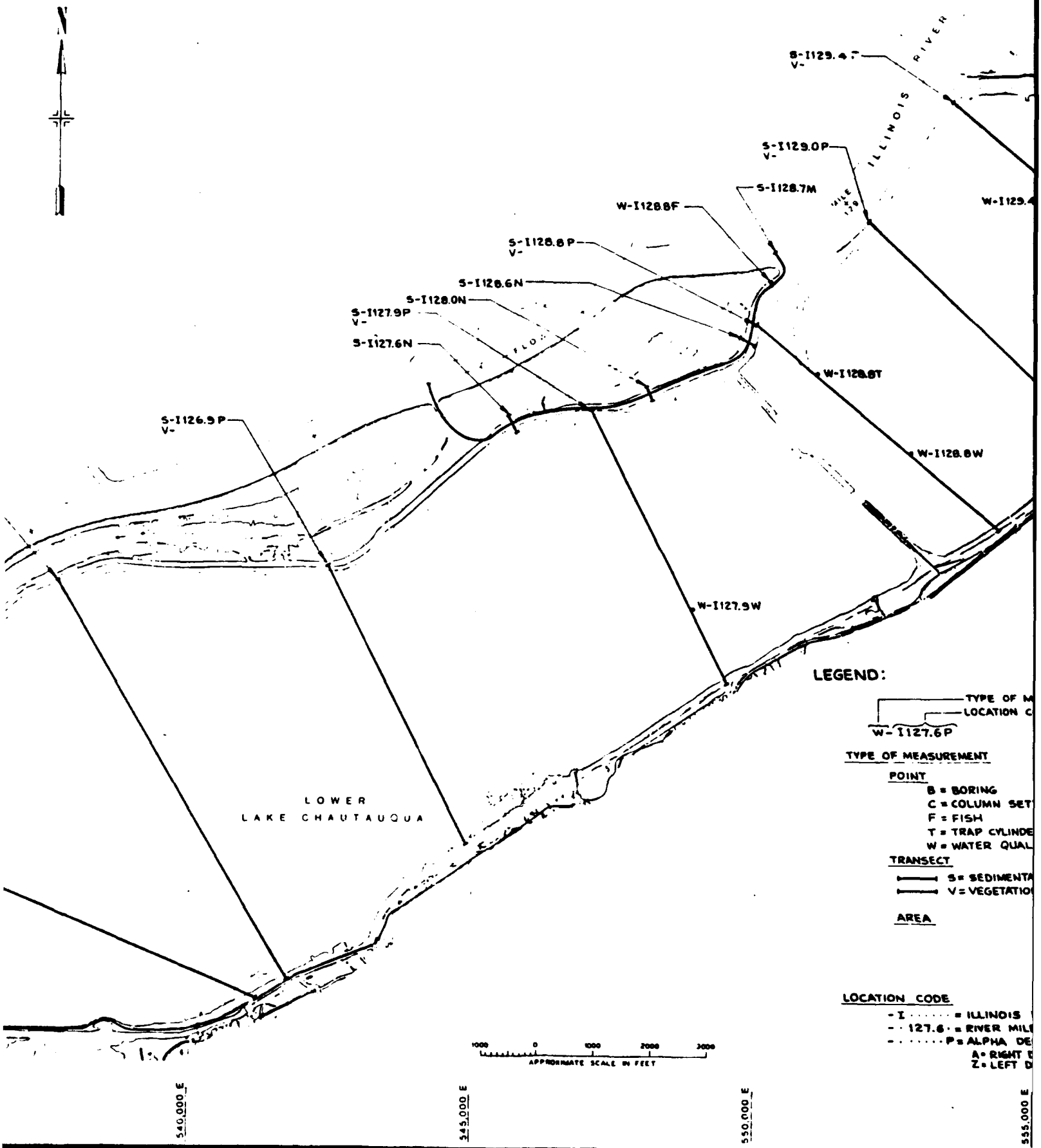
Designed by: TDD
Drawn by: TDD
Checked by:
Reviewed by:
Approved by:

ILLINOIS WATERWAY
ENVIRONMENT MANAGEMENT PROGRAM
LAGRANGE POOL RIVER MILE 124-129.5
LAKE CHAUTAUQUA

ELECTRICAL PLAN

Scale:
Date:
Drawing Code:
Sheet reference number:
Invitation No.
Sheet of


5
4
3
D
C
B
A
1,450,000 N
1,400,000 N
1,350,000 N
1,345,000 N
N
S-1128.8P
V-
S-1128.6N
S-1128.0N
S-1127.9P
V-
S-1127.6N
FLOW
S-1126.9P
V-
S-1126.0P
V-
S-1124.8P
V-
W-124.8R
ILLINOIS RIVER
LOWER
LAKE CHAUTAUQUA
MILE 124
535,000 E.
540,000 E.
545,000 E.
1000 0 1000
APPROXIMATE SCALE



LEGEND:

TYPE OF M
LOCATION C
W-I127.6P

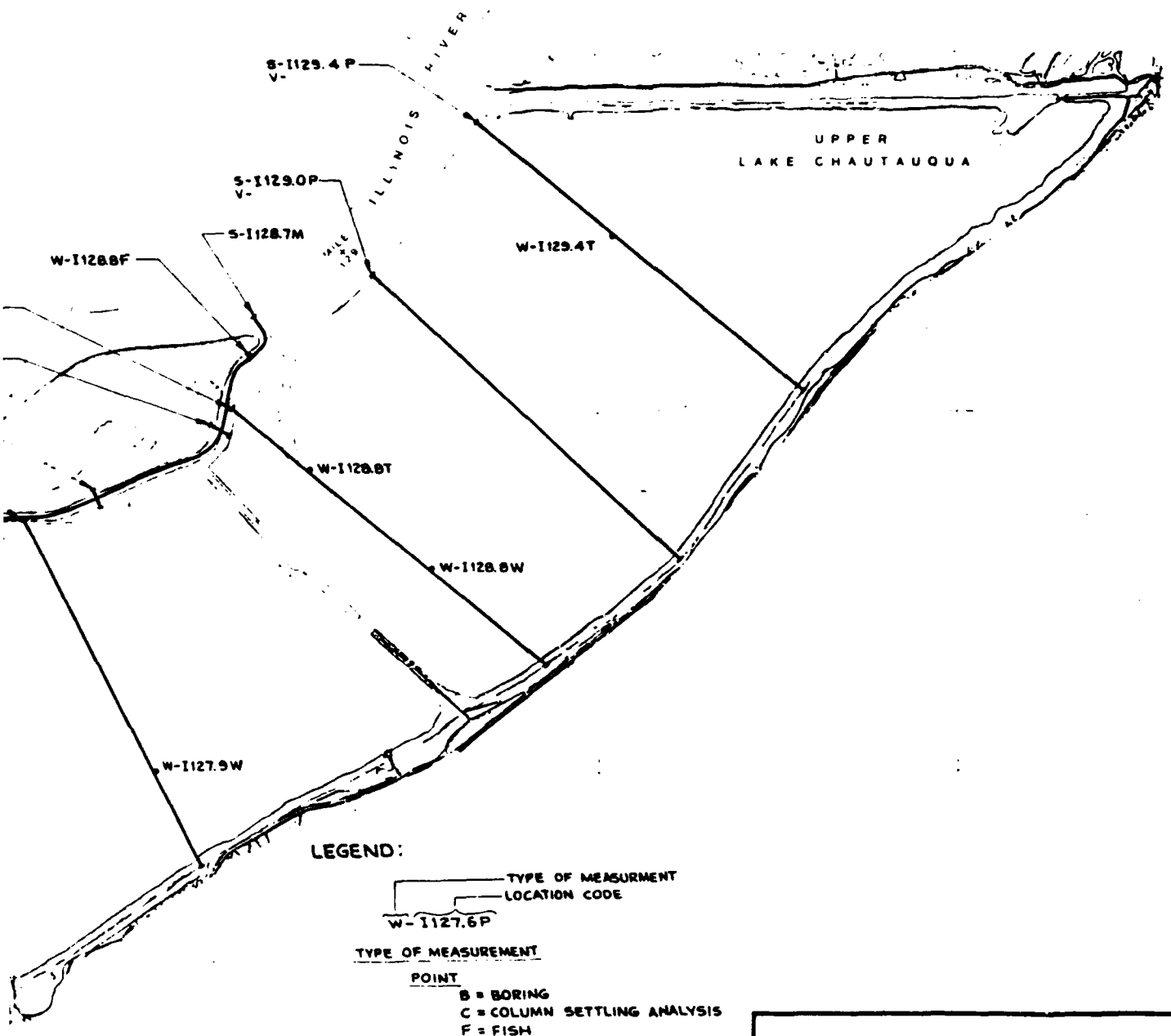
TYPE OF MEASUREMENT

POINT
B = BORING
C = COLUMN SET
F = FISH
T = TRAP CYLINDE
W = WATER QUAL

TRANSECT
S = SEDIMENTA
V = VEGETATIO

AREA

LOCATION CODE
-I····· = ILLINOIS
-·127.6· = RIVER MIL
-·····P = ALPHA DE
A = RIGHT D
Z = LEFT D



LEGEND:

W-I127.6P
- TYPE OF MEASURMENT
- LOCATION CODE

TYPE OF MEASUREMENT

POINT
- B = BORING
- C = COLUMN SETTLING ANALYSIS
- F = FISH
- T = TRAP CYLINDER SEDIMENT
- W = WATER QUALITY

TRANSECT
- S = SEDIMENTATION
- V = VEGETATION

AREA

LOCATION CODE
- I ..... = ILLINOIS RIVER
- 127.6 = RIVER MILE
- ..... P = ALPHA DESIGNATOR
  - A = RIGHT DESCENDING BANK
  - Z = LEFT DESCENDING BANK

1000 2000 3000
SCALE IN FEET

530,000 E

535,000 E

Revisions			
Symbol	Descriptions	Date	Approved

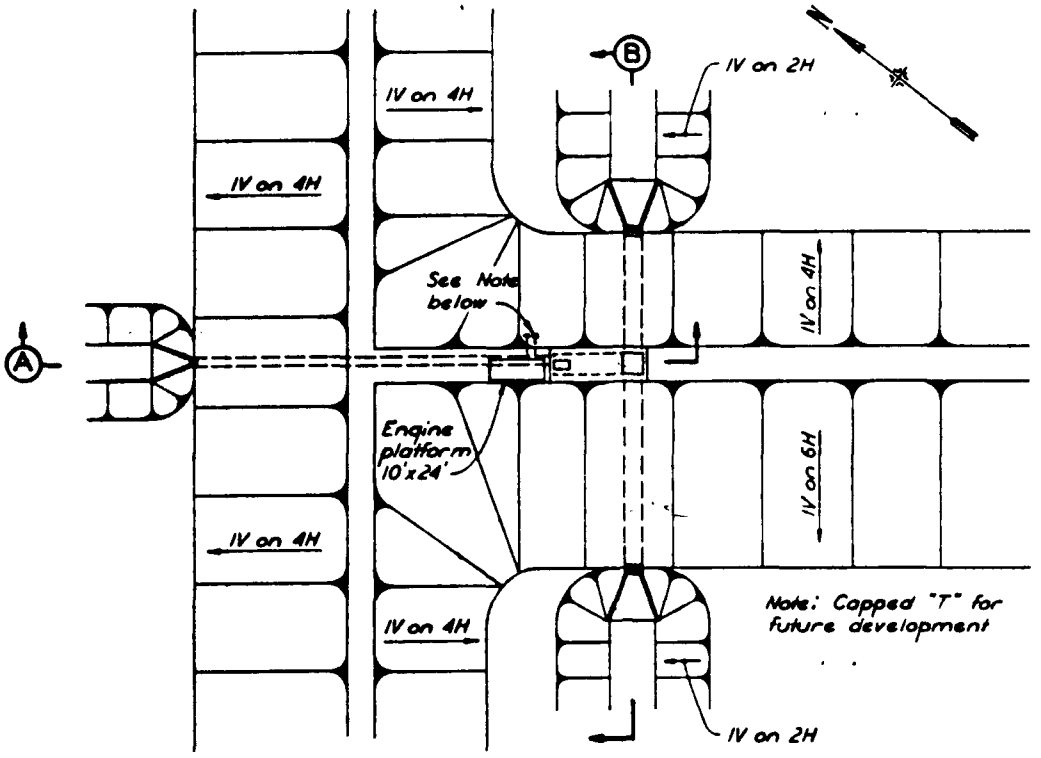
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by:
Drawn by: RC
Checked by:
Reviewed by:
Approved by:

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124-MILE 129.5

MONITORING PLAN

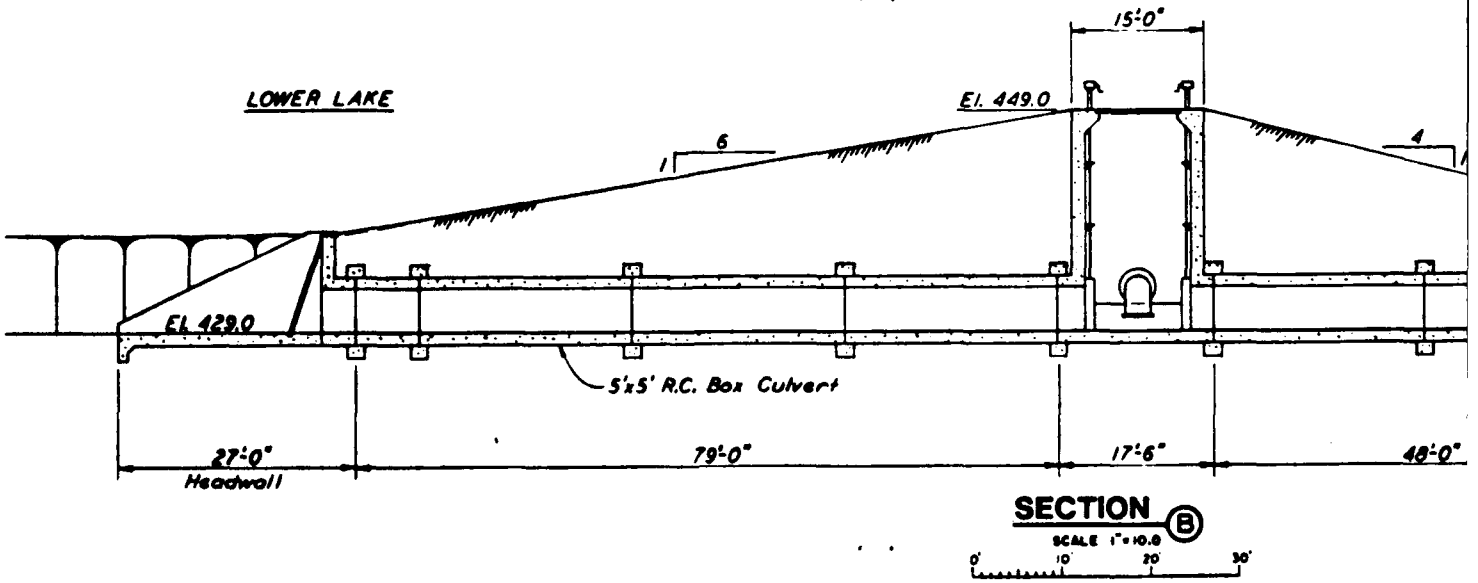
Scale:
Date:
Drawing Code:
Sheet reference number:
Sheet _ of _



PLAN

SCALE 1"=40.0

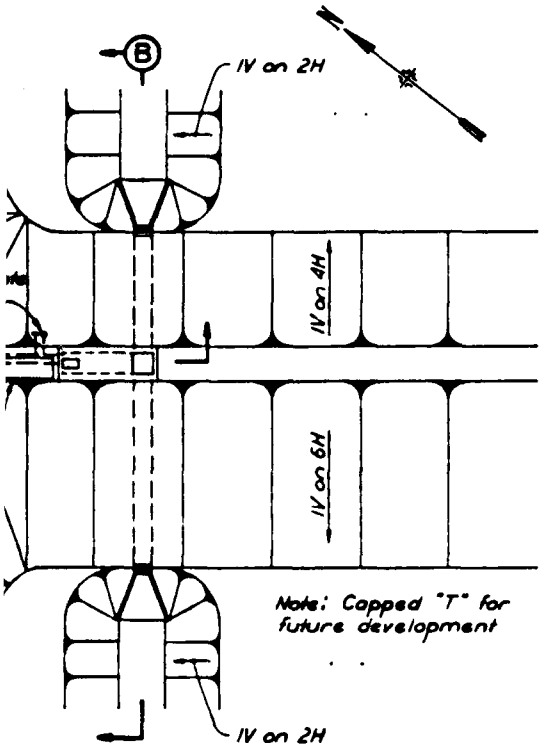
0' 40' 80' 120'



SECTION B

SCALE 1"=10.0

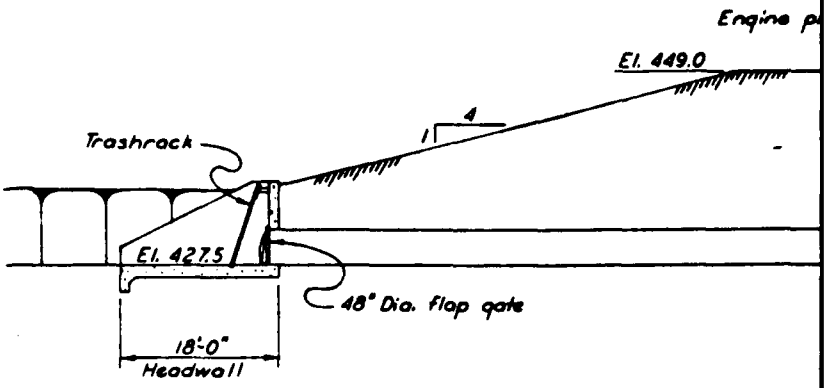
0' 10' 20' 30'



PLAN

SCALE 1"=40.0'

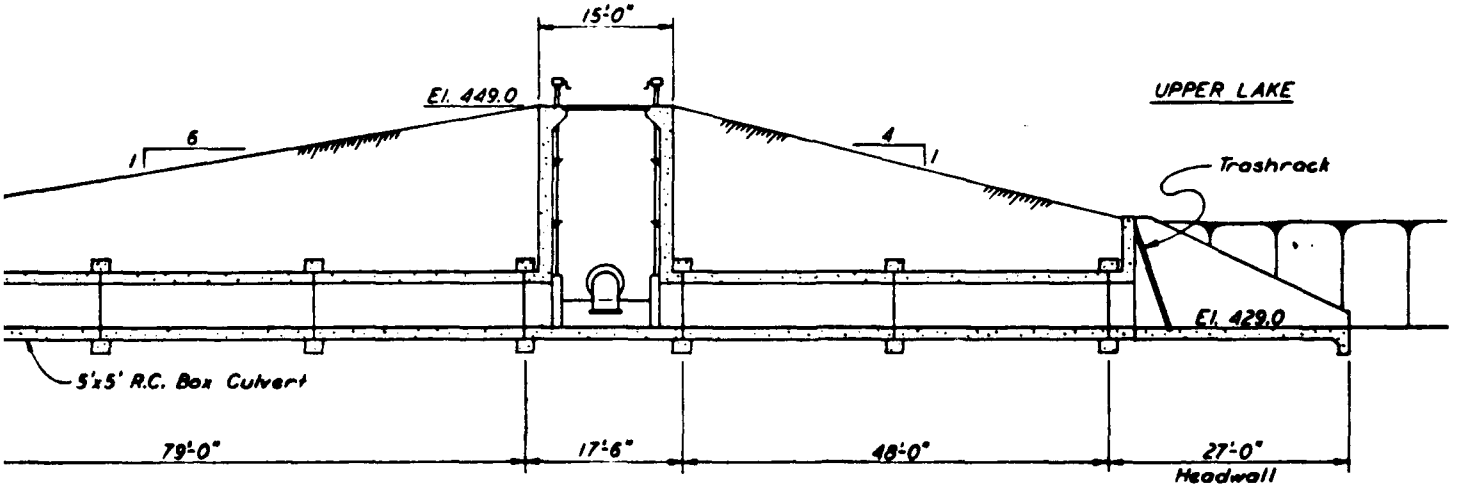
40' 80' 120'



SECTION

SCALE 1"=10.

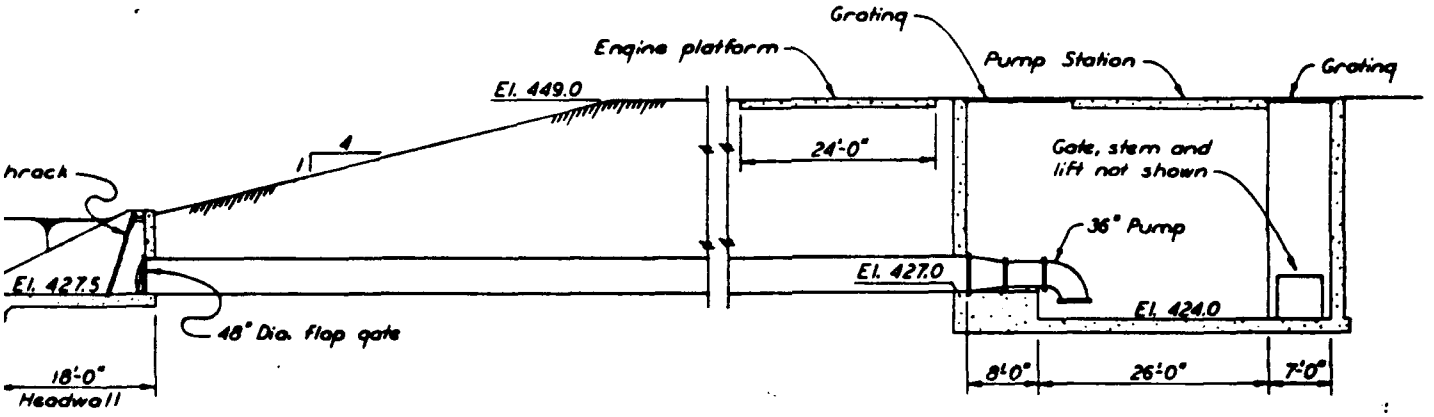
0' 10' 2



SECTION B

SCALE 1"=10.0'

0' 10' 20' 30'

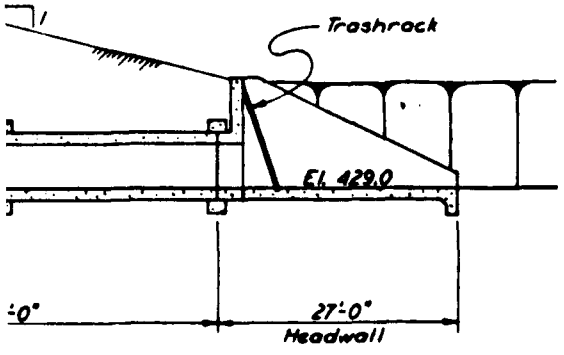


SECTION (A)

SCALE 1" = 10.0

0' 10' 20' 30'

UPPER LAKE



Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL, MILE 124 - MILE 129.5
LAKE CHAUTAUQUA

PUMP STATION
SITE PLAN AND SECTIONS

Designed by | Drawn by | Checked by | Reviewed by | Approved by

Scales | Date | Drawing Code | Sheet reference numbers | Sheet _ of _

PLATE 27