US Army Corps
of Engineers
St. Paul District

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM

DEFINITE PROJECT REPORT /

ENVIRONMENTAL ASSESSMENT (SP-19)

EAST CHANNEL

HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 8
UPPER MISSISSIPPI RIVER
LA CROSSE COUNTY, WISCONSIN AND
WINONA COUNTY, MINNESOTA

SEPTEMBER 1995

EAST CHANNEL HABITAT REHABILITATION AND ENHANCEMENT PROJECTS

EXECUTIVE SUMMARY

The East Channel Habitat Rehabilitation and Enhancement Projects consists of a number of small projects located in the upper portion of pool 8 of the Upper Mississippi River. The study investigated habitat conditions and concerns at six locations in upper pool 8: Interstate 90 Bay, Head of East Channel, Lower Island 98, Minnesota Island, Smith Slough, and French Slough.

The habitat concerns at Interstate 90 Bay, Lower Island 98, and Minnesota Island are primarily related to bank erosion. At Interstate 90 Bay, erosion of a peninsula is threatening the existence of the bay and the habitat values it provides to the fishery resources of upper pool 8. At Lower Island 98 and Minnesota Island, erosion is resulting in the long term loss of island habitat that provides habitat diversity and ancillary benefits by maintaining the East Channel as a large side channel.

The Head of East Channel provides high quality fish overwintering habitat. The concern was with sedimentation and maintaining fish access to this area. The concern at Smith Slough was with sedimentation and the ability of the slough to sustain itself as a running slough. Smith Slough provides a substantial amount of flow to French Slough. Habitat concerns identified for the upper portion of French Slough included localized dissolved oxygen depletion problems and a lack of bathymetric diversity. Much of this area is realtively shallow with a single deep area that exhibits stratification and anoxic conditions during the winter.

The plan formulation process considered a number of alternatives for the habitat problems and opportunities at each of the study locations. At Interstate 90 Bay, the alternatives focused on stabilizing the eroding peninsula and restorating portions already lost. At Lower Island 98 and Minnesota Island the only options were no action or bank stabilization.

At the Head of East Channel, a closure structure was evaluated as a method of reducing sedimentation, and dredging was evaluated as a measure to insure adequate fish access to this area. For Smith Slough, a number of measures were identified to either reduce sedimentation or increase water depths. Dredging was considered for the upper portion of French Slough to increase bathymetric diversity.

No action was determined to be the best course of action for the Head of East Channel, Smith Slough, and French Slough. The sedimentation problem at the Head of East Channel does not appear significant because the natural closing off of the small side channel at the head of this area. Fish access to the Head of East Channel appears adequate at present. The situation will

need monitoring by resource management agencies to determine if fish access to this area is self maintaining or deteriorating.

Dredging in Smith Slough would be costly and not a permanent solution to maintaining the slough. Constructing low level berms (to maintain more high flow in the slough) would have unacceptable impacts on riparian habitats and adjacent wetlands. Controlling sediment inputs to Smith Slough would be difficult, and would reduce flows, which in turn could further aggravate sedimentation in the slough. As with the Head of East Channel, resource management agencies will monitor conditions in Smith Slough to determine if the recent sedimentation is a reflection of the natural pattern of sedimentation and scour that occurs in riverine settings.

A culvert was installed in the lock and dam 7 dike in 1994 to provide additional flow to the upper portion of French Slough. It is determined that no further action should take place in this area until the effects of this added flow on the slough can be evaluated.

The recommended plan for the Interstate 90 Bay is to stabilize the peninsula using rock bank protection and restore a portion of the peninsula lost to erosion using a rock breakwater. The Interstate 90 Bay has been identified by the Wisconsin Department of Natural Resources as a staging area for spawning walleye and as important habitat for young-of-the-year walleye and sauger. Other studies have identified the importance of this type of habitat many species of fish. Maintaining and restoring a portion of the bay will provide substantial benefit to the fishery resources of upper pool 8.

The recommended plan for Lower Island 98 and Minnesota Island is to stabilize these islands using rock bank protection. Both of these islands are "high" islands when compared to most Mississippi River floodplain islands. They support mast producing trees such as oaks and other vegetation more typical of drier sites. As such, they increase habitat diversity in this portion of upper pool 8. In addition, these island help define the East Channel which provides its own unique habitat values to the area. Stabilizing these islands is considered important to maintaining habitat diversity in upper pool 8.

Total direct construction costs for the selected plan are $452,000. Costs for plans and specifications and construction management bring the total implementation cost to $551,000. Because the project is located entirely within the Upper Mississippi River National Wildlife and Fish Refuge, the construction cost of the project would be 100 percent Federal, in accordance with Section 906(e) of the Water Resouces Development Act of 1986. Average annual operation and maintenance costs are estimated to be $5,100. The operation and maintenance requirements would be the responsibilty of the U.S. Fish and Wildlife Service.

DEFINITE PROJECT REPORT/ENVIRONMENTAL ASSESSMENT

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LA CROSSE COUNTY, WISCONSIN AND WINONA COUNTY, MINNESOTA

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WINONA COUNTY, MINNESOTA

INTRODUCTION

1.1 AUTHORITY

The authority for this report is provided by 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 1966.

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of the Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system....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....

1.2 PARTICIPANTS AND COORDINATION

Participants in the planning for the East Channel projects include the Upper Mississippi River National Wildlife and Fish Refuge and the Region 3 Offices of the U.S. Fish and Wildlife Service (USFWS), the Environmental Management Technical Center (EMTC) of the National Biological Service, the

Minnesota and Wisconsin Departments of Natural Resources (DNR), and the St. Paul District, Corps of Engineers. There was active participation by all of these agencies in all facets of project planning beginning with identification of habitat problems on through the identification and evaluation of alternative features and plans.

The USFWS and the Wisconsin DNR were most heavily involved in project planning because all of the areas being studied were located within the Upper Mississippi River National Wildlife and Fish Refuge, and the majority of the study areas were located within Wisconsin. The USFWS would be considered a cooperating agency under Federal regulations governing the implementation of the National Environmental Policy Act of 1969.

The following individuals played an active role in the planning and design of the East Channel projects. For St. Paul District personnel, the discipline and contribution of the individual planning team members are listed. For resource agency personnel, the individual's position title is listed.

ST. PAUL DISTRICT, CORPS OF ENGINEERS

Name	Discipline	Contribution
Gary Palesh	Fishery Biologist	Study Manager
Teri Sardinas	Biologist	Environmental analyses
Sissel Johannessen	Archaeologist	Cultural resources
Scott Goodfellow	Hydraulic Engineer	Hydraulic analyses
Joel Face	Civil Engineer	Geotechnical analyses
Chris Schmitz	Civil Engineer	Design and layout
Gary Smith	Civil Engineer	Cost estimating

U.S. FISH AND WILDLIFE SERVICE

Name	Position
Keith Beseke	Habitat Projects Coordinator
James Nissen	Refuge District Manager
William Thrune	Refuge Asst. District Manager

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Name	Position
Jeff Janvrin	Mississippi River Habitat Specialist
Mark Endris	Area Fisheries Manager
John Sullivan	Mississippi River Water Quality Specialist
Andy Bartels	LTRM Station Fisheries Biologist

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Name	Position
Mike Davis	Habitat Projects Coordinator

NATIONAL BIOLOGICAL SERVICE (EMTC)

Name	Position
Steve Gutreuter	Fisheries Scientist

1.3 PROJECT PURPOSE

1.3.1 RESOURCE PROBLEMS/OPPORTUNITIES

The purpose of this Definite Project Report is to document existing habitat conditions, predict future habitat conditions, identify existing and future habitat deficiencies, define specific habitat objectives, identify and evaluate alternative plans that would address the objectives, and recommend a selected plan for habitat restoration and enhancement.

1.3.2 PROJECT BOUNDARIES

The East Channel projects consist of a number of small projects located in the upper reaches of pool 8 of the Upper Mississippi River (plate 1). Plate 2 shows the general area, while plate 3 shows the upper pool 8 area. The general boundaries for each individual project area are described later in this report under "Assessment of Existing Resources - Physical Setting."

GENERAL PROJECT SELECTION PROCESS

2.1 ELIGIBILITY CRITERIA

A design memorandum (or implementation document) 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 implementation of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP) in January 1986. The U.S. Fish and Wildlife Service, Region 3, and the five affected States (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association. Programmatic updates of the General Plan for budget planning and policy development are accomplished through Annual Addendums.

Coordination with the States and the USFWS during the preparation of the General Plan and Annual Addendums 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 report and the General Plan identified examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the conclusions below:

a. (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 criterion 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....

b. (Second Annual Addendum).

(1) 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 openings/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one

of the other project types)
- limited acquisition of wildlife land (allowed per a letter of 30 November 1994, Headquarters, U.S. Army Corps of Engineers)

(2) A number of innovative structural and nonstructural 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 categorically excluded from consideration, but the policy and technical feasibility of each of these measures will be investigated on a case-by-case basis and the measures will be recommended only after consideration of system-wide effects.

2.2 PROJECT SELECTION

Projects are nominated for inclusion in the District's habitat program by the respective State natural resource agency or the U.S. Fish and Wildlife Service based on agency management objectives. To assist the District in the selection process, the States and USFWS have agreed to use the expertise of the Fish and Wildlife Work Group (FWWG) of the River Resources Forum (RRF) to consider critical habitat needs along the Mississippi River and prioritize nominated projects on a biological basis. The FWWG consists of biologists responsible for managing the river for their respective agency. Meetings are held on a regular basis to evaluate and rank the nominated projects according to the biological benefits that they could provide in relation to the habitat needs of the river system. The ranking is forwarded to the RRF for consideration of the broader policy perspectives of the agencies involved. The RRF submits the coordinated ranking to the District, and each agency officially notifies the District of its views on the ranking. The District then formulates and submits a program that is consistent with the overall program guidance as described in the UMRS-EMP General Plan and Annual Addendums and supplemental guidance provided by the North Central Division.

Projects consequently have been screened by biologists closely acquainted with the river. Resource needs and deficiencies have been considered on a pool-by-pool basis to ensure that regional needs are being met and that the best expertise available is being used to optimize the habitat benefits created at the most suitable locations. Through this process, the East Channel projects were recommended and supported as capable of providing significant habitat benefits.

The FWWG conducted their initial project prioritization in June 1987, for consideration in the St. Paul District's FY 1990 habitat projects program. At

that time, the East Channel projects were evaluated as separate projects. In the initial ranking, as eventually approved by the RRF, the Head of East Channel project (which included the I-90 Bay project) was ranked #9 and the French and Smith Slough project was ranked #12 in priority. In 1988, the FWWG ranked the Head of East Channel project as #4 and the French and Smith Slough project as #7 in priority for consideration in the FY 1991 program. In 1989, the FWWG ranked the Head of East Channel project as #6 and the French and Smith Slough project #8 in priority for consideration in the FY 1992 program. Due to other priorities, neither project was selected by the District for inclusion in either the FY 1990, FY 1991, or the FY 1992 programs.

In 1990, the FWWG ranked the Head of East Channel project as #5 and the French and Smith Slough project #7 in priority for consideration in the District's FY 1993 program. The FWWG also recommended that these small projects in the same general area of upper pool 8 be combined into one study effort for efficiency purposes. After consideration of the recommended priorities, the public interest in the projects, the value of the resource, and the opportunity for rehabilitation and enhancement, the Head of East Channel and French and Smith Slough projects were programmed by the District for study initiation in fiscal year 1993. At that time, the projects were combined under the overall title "East Channel" projects. The Fact Sheet for the East Channel projects was approved in October 1992. The summer flood of 1993 delayed any appreciable work on the project until the fall of 1993.

ASSESSMENT OF EXISTING RESOURCES

3.1 PHYSICAL SETTING

The general setting for the East Channel project is the upper 5 kilometers of pool 8 (plate 2). Lock and dam 7 (L/D 7) is located at river mile 702.5 on the Minnesota side of the river. The lock and dam 7 earthen dike extends from the lock and dam about 2,400 meters in an easterly direction to French Island.

The East Channel branches off the main channel at river mile 701.7. The original head of the East Channel was located at river mile 702.0. However, this area has filled in with sediments (to be discussed in more detail later in this report). The East Channel reenters the main channel at river mile 699.4. For much of its length, the East Channel serves as the Wisconsin - Minnesota state boundary. This differs from most reaches of the Upper Mississippi River where the main navigation channel commonly serves as the interstate boundary.

Two major transportation routes cross the study area. They are Interstate 90 which crosses at river mile 701.8, and the C.M. St.P. & P. Railroad which crosses at river mile 699.8.

The East Channel project consists of a collection of smaller individual projects. The specific study area boundaries for each are described below.

3.1.1 INTERSTATE 90 BAY

The Interstate 90 (I-90) Bay is a small bay located below I-90 on the right bank of the river at river mile 701.6 (plate 3). The bay encompasses about 3.2 hectares and is separated from the river by a narrow peninsula. The mainland shoreline of the bay consists of a narrow strip of land lying between the river and the U.S. Highway 61/C.M. St.P. & P. Railroad transportation corridor. At the head of the bay is a public boat landing managed by the U.S. Fish and Wildlife Service. The I-90 Bay and the peninsula lie within the Upper Mississippi River National Wildlife and Fish Refuge (Refuge).

3.1.2 HEAD OF EAST CHANNEL

The East Channel is a large side channel paralleling the main channel (plate 3). The East Channel originally separated from the main channel at about river mile 702. However, this area has filled in with sediment. As a result, the upper end of the original East Channel has now become an embayment at normal river stages. For the purposes of this report, this water area is

referred to as the "Head of East Channel." The Head of East Channel is defined as that 450 meters of the East Channel above the I-90 bridge.

In the 1960's, a deep hole was excavated in the Head of East Channel immediately above I-90 to obtain fill for the construction of the highway. The dredged area encompassed about 70 percent of the Head of East Channel and created water depths over 9 meters.

The land mass separating the Head of East Channel from the main channel was originally part of a larger island designated Island 98. For purposes of this report, this area is referred to as "Upper Island 98." Upper Island 98 and a portion of the eastern shoreline of the Head of East Channel lie within the Refuge. Some portions of the eastern shoreline are privately owned.

3.1.3 LOWER ISLAND 98 AND MINNESOTA ISLAND

The first major island separating the East Channel from the main channel is located at river mile 701.5 (plate 3). This 4.5-hectare island was once part of the original Island 98. For purposes of this report, this island is referred to as "Lower Island 98."

Minnesota Island is the primary land mass separating the East Channel from the main channel. The island extends from river mile 699.4 to river mile 701.3. Both Lower Island 98 and Minnesota Island lie within the Refuge.

The interstate boundary bisects Lower Island 98 diagonally such that the northeastern portion lies in Wisconsin and the southwest portion lies in Minnesota. Nearly all of Minnesota Island lies within Minnesota, save for the lower tip.

3.1.4 SMITH SLOUGH

Smith Slough is a lateral channel that flows easterly off the East Channel at approximately river mile 700.5 (plate 3). The slough is about 1,200 meters long and joins French Slough about 2,300 meters below the L/D 7 dike. Most of Smith Slough lies within the Refuge. There are two small private landholdings abutting portions of Smith Slough.

3.1.5 UPPER FRENCH SLOUGH

Upper French Slough is that portion of French Slough located above its confluence with Smith Slough (plate 3). This reach is approximately 2,300

meters long (1,400 meters below I-90 and 900 meters above I-90). Below I-90, water depths in French Slough are generally in the 1-2 meter range. Backwater areas adjacent to the slough in this reach are generally less than 1 meter in depth.

In the 1960's, a deep hole was excavated in French Slough immediately above I-90 to obtain fill for the construction of the highway. This created a hole with maximum depths over 10 meters. The hole extends to about 460 meters above I-90. For purposes of this report, this dredged area is referred to as the "French Slough borrow hole." That portion of French Slough above the borrow hole up to the L/D 7 dike has water depths less than 1 meter. Most of the backwater areas adjacent to French Slough above I-90 have water depths less than .5 meter.

3.2 WATER RESOURCES

3.2.1 UPPER MISSISSIPPI RIVER

3.2.1.1 Hydrology

The Upper Mississippi River in the study reach flows in a southeasterly direction with no major bends or other changes in direction. Because the study area is located immediately below lock and dam 7, water surface elevations can be influenced substantially by discharges from lock and dam 7. Lock and dam 8 is located over 23 miles downriver of the study area.

The 50% flow duration at dam 7 is approximately 700 cubic meters per second (cms). Table 3-1 shows the discharges and stages associated with the various high water events for the Mississippi River in this reach of the river.

Table 3-1
Mississippi River High Water Event Data

Event	Dam 7 Discharge	Dam 7 Tailwater Elevation *
5-year (20% chance)	3,680 cms	641.5
10-year (10% chance)	4,450 cms	642.9
50-year (2% chance)	6,260 cms	645.6
100-year (1% chance)	7,140 cms	646.7

* elevations in msl 1912 adjustment

3.2.1.2 Water Quality

The water quality of the Upper Mississippi River (UMR) in the project reach is relatively good. This reach is not immediately downstream of any major sources of contaminants; and sediments in this stretch of river are generally not contaminated, as one would expect with a medium to coarse sand substrate. Recent bulk chemical analyses of main channel sediments from this area have shown low concentrations of metals, while PCBs, pesticides and herbicides were not detected.

Water quality in the Interstate 90 Bay is directly affected by the UMR and the bathymetry of the bay. While there are no large direct flows into the bay, water moves into the bay through eddies and with changes in river stage. The bay does not have any isolated holes or areas that would be likely to have oxygen deficiencies in the winter.

3.2.2 EAST CHANNEL

The East Channel is about 3.7 kilometers long, flowing parallel to the main channel. Typical width of the channel is about 200 meters, with water depths in the 2-3 meter range most common. There are areas of deeper water, especially where the Mississippi River water enters the East Channel above Lower Island 98 and also above Minnesota Island. There is a submerged closing dam across the entrance to the channel separating Lower Island 98 from Minnesota Island, while another closing dam extends from Minnesota Island to the left bank of the East Channel.

The Head of East Channel is that portion of the East Channel located above the Interstate 90 bridge. Over time, the Head of East Channel has become more and more isolated from the navigation channel. At its upper end, a small channel has closed off, making direct navigation channel inflow infrequent. The area around this small channel is becoming overgrown with willows. This should continue to reduce sediment input into the Head of East Channel. Aerial photographs show little change in the shoreline along the upper end of the Head of East Channel. This would imply that little sediment is entering this area. Even after the 1993 period of sustained high water, significant deposition was not clearly evident.

The Wisconsin DNR has made observation of a circulation pattern within the Head of East Channel. It is likely that this circulation is caused by eddy type circulation associated with the flowing portion of East Channel below the I-90 bridge.

The water quality in the lower portion of the East Channel is similar to that of the UMR. The water quality of the Head of East Channel is discussed later under "Problem Identification - Head of East Channel."

3.2.3 SMITH SLOUGH

As stated earlier, Smith Slough is about a 1,200-meter-long channel connecting the East Channel to French Slough. The width of Smith Slough varies from 20 to 50 meters. Water depths in the upper one-half of the slough range up to 3 meters, though depths of .5 to 2 meters are most typical. The lower one-half of the slough is much shallower, with many areas less than .5 meter deep.

During flood conditions, much of the water entering at the upper end of the slough leaves the channel over the right descending bank. As a result, much less flow remains in Smith Slough downstream of the major bend in the slough. This results in a decrease in sediment carrying capacity, likely resulting in the shallower depths in the lower portion of the slough noted above.

Aerial photographs since 1938 as well as maps from the late 1800's and 1900's show a surprising stability in Smith Slough's general alignment and channel widths. The orientation of this slough would seemingly make it a prime candidate for abandonment or breakout along another course. Yet, the channel widths and alignment have not changed significantly in 100 years.

Table 3-2 synopsizes discharge relationship information developed for Smith Slough and French Slough.

Table 3-2
Discharge Relationships for
Smith and French Sloughs

Dam 7 Discharge	Smith Sl. Discharge	French Sl. Discharge	Net Diff.	Smith Sl. as a % of French Sl.
850 cms	3.5 cms	8 cms	4.5 cms	44
1,130 cms	8 cms	12 cms	4 cms	67
1,420 cms	15 cms	19 cms	4 cms	79
1,700 cms	29 cms	34 cms	5 cms	85
1,980 cms	41 cms	57 cms	11 cms	81

This information indicates that at low flows, Smith Slough provides something less than 50% of the flow in French Slough below their confluence. As river discharges increase, the relative contribution of Smith Slough flows increases. French Slough above Smith Slough is fed primarily by an overflow spillway in the L/D 7 dike (via Round Lake), and a culvert recently installed in the L/D 7 dike. It appears that for river discharges up to about 1,700+ cms, the amount of flow entering French Slough from upstream sources is relatively stable in the 4-5 cms range. As river discharges rise to 1,980 cms and above, it appears that overbank flow starts to occur such that the relative contribution of Smith Slough flows to French Slough flows declines.

Because Smith Slough is a side channel conveying flow from the East Channel to French Slough, it is expected that its water quality mirrors that of the UMR.

3.2.4 FRENCH SLOUGH

French Slough extends from the lock and dam 7 dike about 5.6 kilometers downstream to its confluence with the Black River, a short distance above where the Black River joins the Mississippi River. French Slough is highly variable in character, with a wide range of widths and depths. French Slough was a channel of the Mississippi River prior to construction of the locks and dams.

Aside from Smith Slough as discussed above, the other primary water sources for French Slough are from a notched spillway and a gated culvert in the L/D 7 dike and from seepage. Water from the notched spillway passes through the Round Lake wetland complex before entering French Slough. The gated culvert provides flow directly to the upper end of French Slough.

Water quality conditions in French Slough are discussed later under "Problem Identification - Upper French Slough."

3.3 GEOLOGY AND SOIL/SUBSTRATE

The most significant geological event explaining the nature of the Mississippi River within pool 8 occurred at the end of the Pleistocene glaciation approximately 10,000 years ago. Tremendous volumes of glacial meltwater, primarily from the Red River Valley's glacial Lake Agassiz, eroded the preglacial Minnesota and Mississippi River valleys. As meltwaters diminished, the deeply eroded river valleys aggraded substantially to about the present levels. Since post-glacial times, a braided stream environment has dominated this reach of the Mississippi River, due to the river's low

gradient and oversupply of sediment from its tributaries. Prior to the impoundment of pool 8 in the 1930's, the broad floodplain of the river was characterized by this braided stream system that consisted of swampy depressions, sloughs, natural levees, islands, and shallow lakes.

3.4 VEGETATION

Nearly all of the project sites are bordered by mature mixed lowland hardwood forest. All of the sites except for the I-90 Bay are part of a large complex of wetlands downstream of Lake Onalaska. The project sites themselves are primarily open water. Informal vegetation sampling in the French Lake area and nearby backwaters shows many beds of water milfoil (Myriophyllum sp.), with some beds of sago pondweed (Potamogeton pectinatus). It is likely that the lentic, open water areas support vegetation such as curly leaf pondweed (Potamogeton crispus), water milfoil, sago pondweed, coontail (Ceratophyllum demersum), duckweed (Lemna sp.), and elodea (Elodea canadensis).

3.5 HABITAT TYPES AND DISTRIBUTION

The project sites are all located in the floodplain of the Upper Mississippi River in the upper reaches of pool 8. As with most navigation pools, the upper reaches of pool 8 exhibit habitat patterns and types similar to what existed in the pre-lock and dam river. The most common characteristic is a mosaic of wooded islands interspersed with wetland and flowing channels of various sizes. Large areas of open water (excluding the main channel) are uncommon.

The habitats found at each of the individual study locations are described and discussed in further detail under the "Problem Identification" section.

3.6 FISH AND WILDLIFE

The upper pool 8 area supports the wide variety of fish and wildlife typical of the Upper Mississippi River and its floodplain. The fish and wildlife making use of the individual study areas are discussed under the "Problem Identification" section.

3.7 CULTURAL RESOURCES

The La Crosse area and the upper portion of Pool 8 saw relatively intense prehistoric occupation, as well as being a focus of historic activity on the Upper Mississippi River. The Pleistocene terraces and their outliers (some now islands in the river) such as Red Oak Ridge, French Island, and Brice Prairie show evidence of occupation as early as 3000 years ago and continuing into the American fur-trade era of the first half of the nineteenth century. Occupation was more or less continuous with an especially intensive Oneota presence (A.D. 1300-1650), and including occupation by the historic Winnebago.

Known sites near the project area include, on the Minnesota side of the river, a Late Archaic (ca. 1000 B.C.) habitation and burial site (21 WN 15). The islands of Lake Onalaska (Red Oak Ridge, McIlvaine, and Rosebud Islands), just north of Lock and Dam No. 7, have yielded abundant material, including human burials. The materials date primarily to the Early-Middle Woodland (ca. 250 B.C to A.D. 500), with minor presence of Archaic, Oneota, and Middle-Late Historic artifacts. The area also contains a number of historic shipwrecks: the Thomas McRoberts (Wreck 172) came to grief at the foot of Minnesota Island in 1880, and the War Eagle at the mouth of the Black River in 1870.

The immediate project area (the I-90 Bay peninsula, Lower Island 98 and Minnesota Island) had not been systematically surveyed for cultural resources, and thus no sites were known. There are, however, unconfirmed reports of a private collection of artifacts from Minnesota Island (Robert Boszardt, personal communication). St. Paul District archaeologists made a cultural resources survey of the project area in July 1994.

Pre-lock and dam maps show that considerable changes in the land forms have occurred in the last 50 years. The I-90 Bay peninsula existed only as a submerged sandbar in 1929. The channel separating Upper and Lower Island 98 was cut sometime between 1915 and 1929. The present head of Minnesota Island is also completely changed from its early configuration; the entire head and channel side of the island were built up between 1915 and 1929, presumably from dredged material deposits. The original Minnesota Island now exists somewhere in the middle of the present Minnesota Island. Since the peninsula and the head of Minnesota Island have been built up since 1915, they have virtually no potential for containing historic or archaeological deposits. The field survey confirmed the disturbed and recent character of these project areas. In addition, no material or intact deposits were found at the head of Lower Island 98.

PROJECT OBJECTIVES

4.1 PROBLEM IDENTIFICATION

4.1.1 INTERSTATE 90 (I-90) BAY

4.1.1.1 Existing Habitat Conditions

The I-90 Bay is a small 3.2-hectare embayment off the main channel of the river. Table 4-1 shows the distribution of water depths within the bay. Maximum depths in the bay exceed 6 meters.

Table 4-1
Distribution of Water Depths in the I-90 Bay

Depth Range	Hectares	Percent of Bay	Cumulative Percent
0.0 - 0.6 meters	0.3	9	9
0.6 - 1.2 meters	0.7	22	31
1.2 - 1.8 meters	0.7	22	53
1.8 - 3.0 meters	0.7	22	75
> 3.0 meters	0.8	25	100

source: LTRM bathymetric map

Navigation charts show wing dams along the right descending bank extending across the bay. Current bathymetric data does not indicate the presence of these wing dams. It may be that over time they have become buried by river sediments.

The presence of deep water, a direct connection to the main channel, and protection from current make this bay ideal resting and feeding habitat for main channel species. I-90 Bay serves as a pre-spawn staging area for walleye and potentially for sauger. The Wisconsin DNR conducted a radio-telemetry study of walleyes in pool 8 to identify walleye overwintering sites and spawning sites. The study showed that several of the radio-marked female walleyes would stage in the I-90 Bay, or its proximity, before moving to the tailwaters of lock and dam 7 or vegetated backwaters in upper pool 8 (e.g., the Round Lake area) to spawn (Holzer and Von Ruden, 1984). The authors also identified I-90 Bay as a possible overwintering site for walleye in upper pool 8. Some of the walleyes using the I-90 Bay were initially caught over 13 kilometers downstream, indicating that the bay provides seasonal habitat for walleye and possibly for sauger for a large portion of upper pool 8.

The I-90 Bay is also important habitat for young-of-the-year (YOY) walleye and sauger. The Wisconsin DNR has established fall index stations in the area to assess walleye and sauger recruitment in pool 8. Two of six electro-shocking stations are located in the area protected by I-90 Bay. These stations were chosen from an initial survey of several potential areas in upper pool 8. The two I-90 Bay sites usually have the greatest concentration of YOY sauger each year and rank in the top three for concentrations of YOY walleye (Wisconsin DNR, unpublished data).

The Wisconsin DNR fishery investigations indicate that the value of I-90 Bay as a fishery resource extends beyond the bay itself. The bay provides seasonal and life stage habitat considered important to the walleye and sauger populations of upper pool 8.

4.1.1.2 Historically Documented Changes in Habitat

The I-90 Bay was created in the mid-1960's by filling associated with the construction of the I-90 crossing of the Mississippi River. Prior to that time, this area was a minor side channel. Two readily evident changes have occurred to the bay since that time. The first is erosion of the end of the peninsula that forms the bay. This is readily evident on a computer comparison of aerial photographs (plate 4). This comparison shows that 190 meters eroded from the tip of the peninsula between 1974 and 1989. Further analysis using an aerial photograph from 1981 showed that the rate of loss during the period 1974-81 (81 meters or 11.5 m/yr) was relatively consistent with the rate of loss from 1981 to 1989 (109 meters or 13.7 m/yr).

The estimated loss of 190 meters is consistent with available bathymetric data which shows remnants of the tip extending 120-140 meters out from the current shoreline. This shortening of the tip of the peninsula reduced the size of the I-90 Bay from 4.5 hectares to 3.2 hectares from 1974 to 1989.

The second change that has occurred is the breaching of the peninsula approximately 67 meters upstream of the tip. This breach occurred during the mid-1980's. The breach is now approximately 9 meters wide and .5-1.0 meter deep. This breach allows flow into the bay which in turn creates current in the bay. Sediment can also be transported into the bay via this opening.

4.1.1.3 Factors Influencing Habitat Change

The primary factor influencing habitat change at the I-90 Bay is the erosive force of main channel flows. As noted earlier, an estimated 190 meters has been eroded from the tip of the peninsula that forms the bay during the period 1974-89. In addition, main channel flows have breached the peninsula. These flows introduce current to the bay and also carry sediments.

Main channel flow will continue to exert its erosive influence on the peninsula and will continue to affect the bay into the foreseeable future.

Another factor that may be influencing the rate of erosion on the peninsula is the wakes from passing towboats and recreational craft. The peninsula borders the main channel and the water is deep enough to allow the close by passage of towboats and large recreational craft. Whatever the effects of towboats and recreational craft, they are likely to continue unabated into the foreseeable future.

4.1.1.4 Estimated Future Habitat Conditions

If no action is taken, the peninsula forming the I-90 Bay will continue to erode, further diminishing the size of the bay. If erosion continues at the approximate rate exhibited during the period 1974-89, the lower 67 meters of the peninsula below the breach will be lost in about 10 years. This would reduce the size of the bay to approximately 2.4 hectares. During this period, as the breach enlarges, an increased amount of flow will enter and increase current velocities within and sediment influx to the lower portion of the bay.

Above the breach, the peninsula is still relatively narrow for another 60 meters. It is estimated that it would take an additional 10-15 years for this portion of the peninsula to erode away, leaving a remnant bay about 1.6 hectares in size. The remaining portion of the peninsula is 60-90 meters wide. Thus, it is unlikely that the bay will diminish to much smaller than 1.6 hectares within the project planning period (50 years). Table 4-2 shows the projected size of the bay over the next 50 years if no action is taken.

Table 4-2
Projected Size of I-90 Bay under the
Future Without Project Condition

Year	Size
Present	3.2 hectares
Present +10	2.4 hectares
Present +25	1.6 hectares
Present +50	1.6 hectares

Aside from getting smaller, the character of the bay in terms of bathymetry will also change. Those portions of the bay that will eventually be lost as the peninsula erodes contain the deepest water. The 1.6-hectare remnant will likely have little or no water deeper than meters, and most of the bay will be less than 2 meters deep. The value of the I-90 Bay as fishery habitat will decline due to both diminishing size and the loss of deep water.

4.1.2 HEAD OF EAST CHANNEL

4.1.2.1 Existing Habitat Conditions

The Head of East Channel is that portion of the East Channel located above the Interstate 90 bridge. This area has become isolated from most direct flows and is a dead end embayment. The area above the bridge is about 8 hectares and is separated from the main channel of the river by Upper Island 98. Table 4-3 shows the distribution of water depths within the bay above the bridge. Maximum water depth appears to be about 10 meters.

Table 4-3
Distribution of Water Depths in the Head of East Channel

Depth Range	Hectares	Percent of Bay	Cumulative Percent
0.0 - 0.6 meters	1.0	13	13
0.6 - 1.2 meters	1.6	20	33
1.2 - 1.8 meters	0.8	10	43
1.8 - 3.0 meters	0.9	11	54
3.0 - 4.6 meters	0.7	9	63
4.6 - 6.1 meters	0.8	10	73
6.1 - 7.6 meters	1.9	24	97
7.6 - 9.1 meters	0.2	2	99
> 9.1 meters	0.1	1	100
	8.0		

source: LTRM bathymetric map

Most of the water less than 1 meter deep exists in a narrow band along the shoreline of the Head of East Channel. Water depths under the I-90 bridge generally range from 1-2 meters.

Wisconsin DNR winter water quality monitoring data and field observations indicate that some water circulation does take place in the lower portions of the Head of East Channel from water entering this area from below the I-90 bridge.

Fish sampling done in 1989 by the Wisconsin DNR showed a prevalence of bluegill in the area, with black crappie, bullhead minnow, and largemouth bass found to a lesser extent. A total of 645 fish, representing 28 species were

caught. In 1990, sampling showed similar results in terms of species dominance with a total of 4,459 fish caught representing 41 species. The Wisconsin DNR (Von Ruden and Endris, 1990) described the area as having primarily a panfish population, dominated by bluegill and crappie. The report also states that the area has an excellent fishery population with good numbers and size structure.

The Head of East Channel is considered important overwintering habitat for a variety of fish species. This is because it is protected from current and has sufficient water volume to maintain adequate dissolved oxygen and water temperatures suitable for winter fish use. Species of importance that make extensive wintering use of this area are the largemouth bass and black crappie (Wisconsin DNR, personal communication).

4.1.2.2 Historically Documented Changes in Habitat

The Head of East Channel was at one time the upper reach of the East Channel. Over time, the uppermost opening between the East Channel and the main channel has filled in with sand. The occlusion was already taking place in 1938. The opening at that time had been reduced to less than 30 meters at its narrowest point. By 1974, only a narrow channel remained (plate 4).

Presently, the remnant channel provides little flow to the Head of East Channel at normal river stages. The filling of this channel has converted the Head of East Channel to a dead end embayment. The size of the Head of East Channel did not changed appreciably during the period 1974-89.

Construction of Interstate 90 in the mid-1960's also affected the Head of East Channel. This area was dredged to provide fill material for the road embankment. This resulted in the Head of East Channel having the depths noted earlier.

The water under the I-90 bridge is shallower than above and below the bridge. The bridge is built over the site of an old closing dam, and it is unlikely that this structure was totally removed during bridge construction. The shallow water depths under the bridge may be due to the presence of this old closing dam.

4.1.2.3 Factors Influencing Habitat Change

The most important factor affecting the habitat in the Head of East Channel is its relative isolation from the river. Direct inflows from the river are minor, save for during high water events. Eddy flows enter the Head of East Channel from downstream as observed by the Wisconsin DNR.

Another factor that appears important to maintaining this area as high quality winter fish habitat is the underwater "dam" provided by the shallower waters under the I-90 bridge. It is believed, that in the winter, this shallow area prevents the denser, slightly warmer water of the Head of East Channel from flowing out into the less dense, colder water of the rest of the East Channel. This reduces mixing with the East Channel water, allowing the Head of East Channel to retain its stored "heat" and provide suitable winter water temperatures for fish.

4.1.2.4 Estimated Future Habitat Conditions

Because the side channel feeding the Head of East Channel has been substantially filled by sediment, future sediment transport into the Head of East Channel will likely be limited to during high water events on the river. Thus, the Head of East Channel is not expected to decrease in size and depth to any significant degree over the next 50 years. It is expected that the Head of East Channel will remain in approximately its present condition for the foreseeable future.

Should the area under the I-90 bridge become filled with sediment in the future, the amount of flow entering the Head of East Channel from downstream would be reduced and fish access and egress during the winter would be affected. Because of the lack of historic bathymetric data for the area under the bridge, accurately predicting future bathymetric conditions for this area would be difficult.

4.1.3 LOWER ISLAND 98 AND MINNESOTA ISLAND

4.1.3.1 Existing Habitat Conditions

The 4.5-hectare Lower Island 98 was once part of the original Island 98. The island is bounded above and below by cuts that feed main channel waters to the East Channel. The island rises 4-6 meters above the pool and is covered with forest vegetation. Because of its elevation, the island supports vegetation more characteristic of drier sites such as red and bur oaks. The upstream bank of this island is steep and eroded.

Minnesota Island is a large segmented island covered with mature forest. The island is approximately 3,000 meters long with typical widths in the range of 300-350 meters. The island is slightly tapered from its head to its lower end. Like Lower Island 98, portions of Minnesota Island are also higher than typical alluvial islands, resulting in vegetation more characteristic of drier sites. The upstream bank of this island is also steep and eroded.

These islands support a variety of small mammals, birds, reptiles and other fauna typically found in wooded areas of the Mississippi River floodplain. Because these islands are higher than typical floodplain islands and support less flood tolerant vegetation, they provide habitat niches not found in much of the surrounding wooded floodplain. This increases overall habitat diversity for wildlife in the upper reaches of pool 8.

The islands provide perching trees for bald eagles. The shallow water around islands provides habitat for wildlife and fish that use transitional or land/water interface habitat such as mink, beaver, and wading birds.

One of the most significant values of these islands is that they define the East Channel as a side channel and affect the amount of flow passing down the East Channel. Large side channels such as the East Channel are a unique habitat type of the Upper Mississippi River, providing habitat niches not found in the main channel or in the smaller side channels and sloughs.

4.1.3.2 Historically Documented Changes in Habitat

Lower Island 98

As noted earlier, Lower Island 98 was once part of the larger Island 98. The island has become smaller due to erosion at the head of the island. Table 4-4 shows the approximate size of the island in 1938, 1974, and 1989.

Table 4-4
Size of Lower Island 98

Year	Size
1938	7.3 hectares
1974	5.5 hectares
1989	4.7 hectares

A computer analysis of aerial photographs (plate 4) indicates that on average, approximately 73 meters were lost off the head of Lower Island 98 during the period 1938-74. During 1974-89, portions of the island head remained relatively stable, with up to 70 meters eroded from other portions. Contrary to what would be expected, accretion on the downstream end of Lower Island 98 during the period 1938-89 did not occur. Minor erosion has occurred on the lower end of the island, and the channel between it and Minnesota Island has grown wider.

Based on aerial photographs, Lower Island 98 has been forested since 1940, save for a sandbar that exists on the East Channel side of the island. This sandbar is evident on the 1974 aerial photograph. During the period 1974-89, this sandbar appears to have shifted downstream approximately 75 meters and grown in length by about 40 meters.

Minnesota Island

The 1894 Mississippi River Commission Surveys show a rock-lined Minnesota Island with wing dams. A 1915 map shows a similar situation; however, the Brown Survey map (1931) shows a larger Minnesota Island laterally. This could be due to sand accretion caused by the wing dams. During the period 1935-52, considerable dredging was done in the main channel adjacent to Minnesota Island. A 1938 aerial photo shows disposal on the island and in the main channel border area adjacent to the island.

A review of available aerial photos indicates changes have occurred to Minnesota Island during the period 1938-89. One evident change is that many of the small sloughs and wetlands that were part of the island in 1938 appear to have filled in with sediment. The island has also become more densely covered with forest vegetation since 1938.

On average, approximately 53 meters eroded off the head of Minnesota Island during the period 1938-74 (plate 4). During 1974 to 1989, the head of the island remained relatively stationary.

4.1.3.3 Factors Influencing Habitat Change

The most important factor affecting Lower Island 98 and Minnesota Island is the erosive force of water on these islands. This is expected to continue unabated into the future.

4.1.3.4 Estimated Future Habitat Conditions

It is likely that Lower Island 98 will continue to become smaller due to erosion. The rate of decline during the period 1938-89 was about 0.05 ha/year. If the decline in island size continues at that rate, Lower Island 98 will be reduced to approximately 2 hectares in size by the year 2045.

The sandbar on the East Channel side of Lower Island 98 is expected to continue to grow and shift downstream, the same pattern of change exhibited during 1974-89.

The head of Minnesota Island remained fairly stable during the period 1974-89. No appreciable loss of island is discernible from post-flood 1993 aerial photographs. However, the long term historic record is believed to be best estimator of long term future conditions. Therefore, it is expected that over the next 50 years, the head of the island will recede because of the erosive forces acting on it. At present, it is estimated that the rate of island loss over will be approximately the same as over the past 50 years, approximately 1.7 hectares.

The erosion of these islands will affect the amount of flow entering the East Channel. As the island heads recede, the cuts between the main channel and the East Channel will become larger. This, in turn, will allow more flow down the East Channel.

4.1.4 SMITH SLOUGH

4.1.4.1 Existing Habitat Conditions

Smith Slough is about 1,200 meters long and flows from East Channel to French Slough. The width of Smith Slough varies from 20 to 50 meters. Water depths in the upper one-half of the slough range up to 3 meters, though depths of .5 to 2 meters are most typical. The lower one-half of the slough is much shallower, with many areas less than .5 feet deep.

The substrate type in Smith Slough appears to be primarily sand or silty sand. When compared to many other sloughs and side channels along the Mississippi River, Smith Slough does not have much instream cover in terms of snags or fallen trees.

Smith Slough is most suited as habitat for species preferring flowing water conditions such as walleye, smallmouth bass, and channel catfish. At present, the most limiting factors on the value of the slough as fish habitat appear to be a general lack of food producing habitat such as aquatic vegetation, rock, wood, or silt/detritus substrates, and a lack of cover such as deep water, snags, or fallen trees.

Downstream of Smith Slough on the East Channel side lies a heron rookery. There also is an eagle's nest approximately 800 meters below Smith Slough along the East Channel.

4.1.4.2 Historically Documented Changes in Habitat

Looking back to the Mississippi River Commission (MRC) surveys (1897), to the Brown surveys (1929-30), and through the more recent aerial photography, the basic configuration of Smith Slough has not changed appreciably.

The only bathymetric information currently available is soundings taken in 1897 (MRC) and 1989 (LTRM). Though the data is limited, it does not appear, from an overview perspective, that there has been any appreciable change in the bottom elevation of the upper portion of the slough during this time period. Undoubtedly, there have been shifts in substrate elevations up and down in response to high and low water events on the river. For the lower portion of Smith Slough, it appears that .3-.6 meters of accretion may have occurred since 1897.

A computer comparison of historic aerial photographs was conducted to compare changes in Smith Slough between 1938, 1973, and 1989 (plate 5). During the period 1938-1973, Smith Slough retained its basic position, but appeared to have widened from about an average width of 25 meters in 1938 to

an approximate average width of 60 meters in 1973. During this period, substantial erosion occurred on a long island present at the inlet to Smith Slough in 1938. In addition, an island in French Slough at the mouth of Smith Slough eroded away. In general, it appears that the period 1938-1973 was an era of erosion in the Smith Slough area as the river adjusted to the new water levels and flow regimes associated with the creation of the locks and dams system.

During the period 1973-1989, Smith Slough meandered slightly and narrowed. Average width in 1989 appeared to be about 40 meters. Deposition occurred on the insides of the bends and in the lower reaches of Smith Slough. Some of the deposition in the lower reaches recreated land that was eroded away during the 1938-1973 period.

Overall, given the dynamics of the Mississippi River and all of the changes induced by man, Smith Slough appears to have remained relatively stable over the last 90 years. The slight meanderings and periods of erosion and deposition are consistent with what would be expected in a riverine setting.

4.1.4.3 Factors Influencing Habitat Change

The most important factors affecting Smith Slough are flows passing through the slough and the sediments carried by these flows. Based on historical evidence, it would appear that, for the most part, Smith Slough is in relative equilibrium with the forces acting upon it.

The completion of L/D 7 in the 1930's altered the hydraulic regime of the entire area. Undoubtedly, this has had some impact on flows passing through Smith Slough. In addition, two notches were cut in the L/D 7 dike spillway in 1967. The additional flow this allowed through the Round Lake - French Slough system may also have had an impact on flows and sediment transport through Smith Slough.

4.1.4.4 Estimated Future Habitat Conditions

Based on the available historical information, the most probable future condition for Smith Slough is that it will continue to meander slightly and go through periods of erosion and deposition in response to river conditions. Extensive analysis would be required to determine if the historical evidence is an accurate predictor of future conditions. It is possible that the hydrologic regime created by the locks and dams system would, over the long term, result in changes in Smith Slough different from those exhibited historically.

4.1.5 UPPER FRENCH SLOUGH

4.1.5.1 Existing Habitat Conditions

French Slough above the mouth of Smith Slough runs along the shoreline of French Island up to the L/D 7 dike. For the first 760 meters above Smith Slough, French Slough is about 200 meters wide, with water depths in the 1-2 meter foot range. Based on observations of the Wisconsin DNR, dissolved oxygen in this area remains relatively good. It is believed that flows from Smith Slough circulate through this area during most periods.

The slough narrows in the 600-meter reach below I-90. In this reach, the slough is only about 60 meters wide. Water depths remain in the 1-2 meter range, though immediately below I-90 there is an area with water depths up to 3 meters.

Immediately above I-90 is the French Slough borrow hole, the origins of which are described earlier in this report. This hole extends approximately 460 meters above I-90. Table 4-5 shows the distribution of water depths in the 8-hectare area of the hole. Maximum water depth is greater than 11 meters.

Table 4-5
Distribution of Water Depths in the French Slough Borrow Hole

Depth Range	Hectares	Percent of Bay	Cumulative Percent
0.0 - 0.6 meters	1.8	22	22
0.6 - 1.2 meters	1.0	12	34
1.2 - 1.8 meters	0.3	4	38
1.8 - 3.0 meters	0.6	8	46
3.0 - 4.6 meters	0.4	5	51
4.6 - 6.1 meters	0.6	8	59
6.1 - 7.6 meters	1.2	15	74
7.6 - 9.1 meters	1.7	21	95
> 9.1 meters	0.4	5	100
	8.0		

source: LTRM bathymetric map

Wisconsin DNR winter water quality monitoring (Schellhaass and Sullivan, 1987; Rogala and Sullivan, 1988; Bartsch and Sullivan, 1989) during the winters of 1986-87, 1987-88, and 1988-89 indicate that the French Slough borrow hole rapidly stratifies during ice cover conditions. For the most part, waters below 1-2 meters become anoxic or nearly so. Surface dissolved oxygen levels ranged from less than 1 mg/l to 7 mg/l over the three winters. This was likely due to varying depths of snow cover and ice thickness which may or may not have permitted some photosynthesis to occur.

Because of a lack of bathymetric diversity and the water quality problems associated with stratification, this deep hole does not provide particularly valuable fish habitat.

From the borrow hole to the L/D 7 dike, French Slough is relatively shallow, with water depths less than 1 meter.

Fish species found in French Slough are likely to be similar to those found in French Lake. WDNR sampling showed a prevalence of bluegill and black crappie in French Lake in 1989 and 1990.

4.1.5.2 Historically Documented Changes in Habitat

Man's activities have had the greatest influence on upper French Slough. The construction of the L/D 7 dike in the 1930's cut off nearly all flow to the slough from upstream. The construction of I-90 in the 1960's resulted in the creation of the French Slough borrow hole. The French Island shoreline of French Slough has been substantially developed, though in most locations, a buffer strip of forest vegetation remains between the slough and the developments.

Sedimentation has likely occurred to some degree in the upper reaches of French Slough and the adjacent marshes since the completion of the locks and dams system. There is no historical data available to quantify to what extent this may have occurred.

4.1.5.3 Factors Influencing Habitat Change

The largest factor influencing the habitat in upper French Slough is its relative isolation from the rest of the river. Because it is in the upper reaches of a dead end slough, it receives little or no flow except for inputs from the Round Lake area via the L/D 7 spillway, from a newly installed culvert in the L/D 7 dike, and from eddy flow from Smith Slough. This area has a very small watershed that is wooded and wetland. Thus, sediment inputs are likely to be very small, save for those rare instances when large floods inundate the whole floodplain.

A culvert was installed in the lock and dam 7 dike at the head of French Slough in the fall of 1994. This culvert will have the capacity to provide flow up to 1 cms to upper French Slough.

4.1.5.4 Estimated Future Habitat Conditions

It is very likely that there will be little change to the upper French Slough area in the foreseeable future because the natural forces acting on this area will not cause significant erosion or sedimentation. The culvert installed in the lock and dam 7 dike will allow some flow from Lake Onalaska into upper French Slough. Post-construction monitoring will be required to determine the effects of these newly introduced flows on French Slough.

4.2 PROJECT OBJECTIVES

4.2.1 INSTITUTIONAL FISH AND WILDLIFE MANAGEMENT GOALS

Fish and wildlife management goals and objectives for the area fall under those defined more broadly for the Upper Mississippi River National Wildlife and Fish Refuge, and those designated specifically in the Refuge Master Plan.

The management objectives of the Upper Mississippi River National Wildlife and Fish Refuge which apply most directly to the study area include:

Environmental Quality

+ Reduce the adverse impacts of sedimentation and turbidity entering the river system.

+ Eliminate or reduce adverse impacts of water quality degradation.

Migratory Birds

+ Restore species that are in critical condition (such as canvasbacks) and achieve national population or distribution objectives.

+ Maintain or improve habitat of migrating waterfowl using the Upper Mississippi River.

+ Contribute to the achievement of national population and distribution objectives identified in the North American Waterfowl Management Plan and flyway management objectives.

Fisheries and Aquatic Resources

+ Maintain and enhance, in cooperation with the States, the habitat of fish and other aquatic life on the Upper Mississippi River.

Because the study area is within the Upper Mississippi River National Wildlife and Fish Refuge, these management objectives, together with input from State and Federal agency natural resource managers, were used to guide the development of specific project objectives. However, this study is only one part of a larger cooperative natural resource management effort on the river. The long-term effectiveness of any project will eventually be evaluated from such a system-wide perspective.

4.2.2 PROJECT GOALS AND OBJECTIVES

Each individual study area has its own unique set of goals and objectives. "Goals" are the general habitat or management goals for the study area, based on U.S. Fish and Wildlife Service/State DNR management goals. "Objectives" are the specific habitat parameters which the project will be designed to achieve, and which can be monitored to determine success of the project.

Later on in the study process, it was determined that no further study effort should take place for some of the individual study areas. However, the goals and objectives developed for those areas are retained for information purposes, to document the study process and to provide continuity.

4.2.2.1 Interstate 90 Bay

General Habitat Goals

The general habitat goals for the I-90 Bay are to maintain this bay as deepwater fish habitat directly connected to the main channel of the river and protected from the current; and to increase the amount of this habitat type if possible. Protected off-channel habitat is very important as staging areas for walleye and sauger during spawning migrations. These areas also provide habitat for young-of-the-year channel species and as refuges that channel species use for resting and feeding.

As documented by Wisconsin DNR fishery investigations, probably the most important use of the I-90 Bay is as a staging area for pre-spawning walleye, and as habitat for YOY walleye and sauger.

Specific Project Objectives

Objective (I90-1) - Maintain 3.2 hectares of bay habitat. The bay habitat should have 50 percent of the area with water depths greater than 2.5 meters.

Objective (I90-2) - Restore 1.3 hectares of bay habitat previously lost. The bay habitat should have 50 percent of the area with water depths greater than 2.5 meters feet.

Rationale - These objectives were established to meet the general habitat goal of maintaining and possibly increasing the amount of protected bay habitat at this site. Physical constraints would prevent enlarging the bay to a size greater than 4.4 hectares, as this would require extensive filling in deep water. The depth criterion was established based on observations of State and Federal fisheries biologists which indicate that the walleye and sauger prefer areas in the bay greater than 2.5 meters in depth.

Two separate objectives were developed because it was recognized that the first and most important step is to preserve the remaining deep protected bay habitat that exists at this site. Once that is accomplished, restoration of some or all of this type of habitat lost since creation of the bay in 1974 should be considered.

4.2.2.2 Head of East Channel

General Habitat Goals

The general habitat goal for the Head of East Channel is to maintain this area as deepwater overwintering habitat for a variety of fish species. Suitable overwintering habitat for backwater fish species is becoming increasingly scarce on the Upper Mississippi River as sedimentation fills backwater areas. As they shallow, these areas become prone to dissolved oxygen depletion problems. Those species of importance that make extensive use of the Head of East Channel during the winter are the largemouth bass and black crappie.

Specific Project Objectives

Objective (HEC) - Maintain aquatic habitat in the Head of East Channel meeting the following criteria:

a. 8 surface hectares.

b. 284,000 m^3 of volume.

c. Maintenance of the existing water exchange taking place between the Head of East Channel and areas below the I-90 bridge.

d. Access and egress routes under the I-90 bridge that are a minimum of 2 meters deep and total 15 meters in width at water elevation of 631.0.

Rationale - Wintering habitat is of critical importance to many fish species on the river. Deepwater habitat protected from current such as exists at the Head of East Channel is very unique and valuable. The objective was established first to maintain the acreage of this habitat that presently exists at this site. Secondly, maintaining water volume is important to insure a sufficient reservoir of dissolved oxygen to last through the entire winter. The Head of East Channel currently is able to maintain sufficient dissolved oxygen for fish throughout the winter with an approximate volume of 284,000 m^3.

Wisconsin DNR water quality monitoring and visual observations of current patterns indicate there is an exchange of water between the areas above and below the I-90 bridge. It is believed that this water exchange is an important contributor to the maintenance of adequate dissolved oxygen in the area above the bridge during the winter.

Access and egress from the Head of East Channel is important should a particularly severe winter result in dissolved oxygen depletion requiring fish to leave the area. Also, there should be adequate access to allow fish to enter this area throughout the winter. A depth of 2 meters would provide for 1.5 meters of water under the ice, while a total width of 15 meters is 10% of the width of the channel under the bridge. If 10% of the channel is 2 meters deep or greater, there should be adequate fish access and egress routes.

4.2.2.3 Lower Island 98 and Minnesota Island

General Habitat Goals

The general habitat goal for Lower Island 98 and Minnesota Island is to maintain these islands. These islands are integral in defining the East Channel as a separate habitat from the main channel. Without these islands, the East Channel would be a wide spot in the main channel. Secondly, the islands in and of themselves provide habitat for a variety of wildlife. Also, the shorelines of the islands and the shallow water adjacent to the islands provide habitat used by a wide variety of fish and wildlife. These islands are also relatively high islands supporting mature forest consisting of species that are more adapted to higher sites such as oaks. As such, they add diversity of habitat to the floodplain cooridor where most forested areas are more typically composed of bottomland species such as cottonwood, silver maple, and green ash.

Specific Project Objectives

Objective (Isl-1) - Maintain the upper shoreline of Lower Island 98 in its present location.

Objective (Isl-2) - Maintain the upper shoreline of Minnesota Island in its present location.

Rationale - Stabilization of these shorelines to maintain these islands is important for the reasons outlined in the general habitat goals. Maintaining the shorelines in their present location is the only practical objective. Restoration of the shorelines to a previous location would not be practical.

4.2.2.4 Smith Slough

General Habitat Goals

The general habitat goals for Smith Slough are to maintain the slough as a running slough and to improve the quality of fish habitat within the slough. Maintaining the slough as a running slough is important for a number of reasons. The first is that small running slough habitat of the type provided by Smith Slough is not very common in upper pool 8. Most of the other flowing sloughs in the immediate area are larger; e.g., East Channel. The closest running slough of comparable size is Running Slough located approximately 6 miles downriver.

Secondly, Smith Slough provides a direct, permanent water connection between French Slough and East Channel, allowing for easy fish passage between these two bodies of water.

Thirdly, Smith Slough provides a source of water for French Slough, contributing to the habitat values of that water body. Flows from Smith Slough help oxygenate portions of French Slough above their confluence, which is especially important as that area receives little other flow. Loss of Smith Slough flow could also lead to dissolved oxygen depletion problems in the lower portion of French Slough.

Specific Project Objectives

Objective (SS-1) - Maintain a flow volume of 2.25 m^3/s through Smith Slough at a Mississippi River flow of 700 m^3/s at L/D 7.

Rationale - Smith Slough currently carries sufficient flow to maintain itself. Maintaining these flows should meet the goal of maintaining Smith Slough as a running slough, and maintain its existing flow contribution to French Slough. The 50% flow duration at dam 7 is approximately 700 m^3/s. At a flow of 700 m^3/s at dam 7, approximately 2.25 m^3/s is flowing through Smith Slough. Maintaining this relationship should insure that Smith Slough continues to provide sufficient flow to French Slough.

Objective (SS-2) - Improve habitat quality for walleye, smallmouth bass, and channel catfish by increasing the percent cover (brush, snags, large rocks, deep water, aquatic vegetation) in Smith Slough to 25 - 50 percent.

Rationale - The most important limiting factors in Smith Slough relative to fish habitat quality appear to be cover and food resources. Water quality is not limiting. Food and cover are interrelated in lotic habitats such that if there is good structural cover, e.g., rock, snags, aquatic vegetation,

etc., then food organisms will also usually be present. Habitat models for the smallmouth bass and walleye indicate that percent cover in the range of 25-50 percent is optimum.

4.2.2.5 Upper French Slough

General Habitat Goals

The habitat goal for the upper French Slough area is to increase the diversity of aquatic habitat, primarily by increasing the amount of deeper backwater habitat. Currently, there is a preponderance of very shallow water and very deep water. In many instances, the deep water is unusable due to stratification and anoxia. There is a lack of water in the 1-3 meters range that is important to many backwater species, and most of the water of this depth range is concentrated in French Slough proper.

Specific Project Objectives

Objective (UFS-1) - Create an additional 5 hectares of backwater habitat with water depths in the range of 1-3 meters. These areas should be protected from current and should be connected to other areas of deep water.

Rationale - Given the ratio of shallow water to deep water in the upper French Slough area, it would be desirable from a fisheries perspective to create more than 5 hectares of water in the 1-3 meters range. However, 5 hectares appears to be an approximate upper limit of how much deeper habitat could be created, given accessibility constraints for dredging equipment. In addition, potential adverse impacts to habitat for other wildlife need to be minimized. Many of the shallow areas that could be improved from a fishery perspective by deepening currently provide valuable habitat for wildlife such as wading birds, furbearers, and waterfowl.

Areas deepened should be protected from currents as research is showing that backwater fish prefer areas in the winter with no current (Barko et al., 1993; Welke, 1993). The connection to other deep water is important to minimize the potential for anoxic conditions to develop in these areas, and to provide fish an avenue of escape should anoxia develop.

ALTERNATIVES

5.1 PLANNING OPPORTUNITIES

The deep holes that exist at the Head of East Channel and in French Slough above I-90 provide the opportunity to take advantage of the relatively unique habitat conditions uncommon to this area of the Upper Mississippi River, i.e. deep protected waters.

5.2 PLANNING CONSTRAINTS

The following planning constraints were identified during various stages of the planning process. As certain alternatives were eliminated from consideration, some of these constraints became moot. However, they are documented here for background information.

5.2.1 INSTITUTIONAL

The East Channel projects lie within the boundaries of the Upper Mississippi River National Wildlife and Fish Refuge. As such, Refuge management goals and objectives must be complied with, as well as the laws and regulations governing Refuge management.

5.2.2 ENGINEERING

Any measures to restore or improve habitat in the Head of East Channel area or the French Slough area could not affect the structural integrity of the I-90 bridges.

5.2.3 ENVIRONMENTAL

Any measures to restore or improve habitat in the I-90 Bay should not adversely affect adjacent deepwater aquatic habitat.

Any measures to control sand sediment inputs into the Head of East Channel should continue to allow annual high water to enter to replenish isolated wetlands in the area.

The Head of East Channel currently provides excellent overwintering habitat for fish, primarily because it provides a thermal refuge and maintains adequate dissolved oxygen throughout the winter. Care must be taken to insure

that winter hydraulics are not modified to the extent that this area does not lose its capacity to function as a thermal refuge.

Replenishing flows to the floodplain wetlands lying below Smith Slough need to be maintained.

Discharges down Smith Slough should not be reduced so as not to adversely affect habitat values in French Slough.

5.2.4 CULTURAL

Areas of the islands that would be affected by the project were surveyed for cultural resources. No evidence of cultural resources was found in the potential project areas. Therefore, no cultural resource constraints to project planning were identified.

5.2.5 SOCIOECONOMIC/RECREATIONAL

Any measures to restore or improve habitat in the I-90 Bay cannot adversely affect access to and use of the public boat landing located at the head of the bay.

Any measures to restore or improve habitat in any of the project areas will have to take into consideration the privately owned lands located adjacent to many of these areas.

5.3 ALTERNATIVES IDENTIFIED

5.3.1 NO ACTION

The no action alternative is defined as no implementation of a project to modify habitat conditions. The no action alternative would apply to each of the individual project areas.

5.3.2 INTERSTATE 90 BAY

The goals and objectives for the I-90 Bay are to maintain this bay as valuable deep protected fish habitat. The following measures were identified that would address these goals and objectives. They could be considered as stand alone options or in combination with each other.

5.3.2.1 Close the Breach in the Peninsula

The existing breach in the peninsula that forms the I-90 Bay would be closed using fill and/or rock. The purpose is to (1) maintain the peninsula which in turn maintains the I-90 Bay as a unique habitat, and (2) eliminate flows through the breach that create undesirable current velocities in the bay and carry sediment into the bay.

5.3.2.2 Stabilize the Peninsula Shoreline

The channel side shoreline of the peninsula would be stabilized. The purpose would be to stabilize the peninsula and maintain the I-90 Bay.

5.3.2.3 Restore the Lower End of the Peninsula

The lower end of the peninsula which has eroded away over the last two decades would be restored. The purpose would be to restore the I-90 Bay to its former size.

5.3.3 HEAD OF EAST CHANNEL

The following measures were identified for the Head of East Channel to meet the goals and objectives of maintaining this area as high quality overwintering habitat for fish. These measures could be considered as stand alone options or in combination with each other.

5.3.3.1 Closure of the Side Channel Opening

A partial or total closure structure would be placed across the remnant side channel opening at RM 702.0. The purpose would be to minimize future transport of sand into the Head of East Channel via this opening.

5.3.3.2 Dredging under the I-90 Bridge

Channels would be excavated under the I-90 bridge to provide for water exchange and for fish passage during the winter between the areas above and below the bridge.

5.3.4 LOWER ISLAND 98 and MINNESOTA ISLAND

The following measures were identified for Lower Island 98 and Minnesota Island to meet the goals and objectives of stabilizing the heads of these islands.

5.3.4.1 Stabilize the Head of Lower Island 98

The eroding bank at the head of this island would be stabilized using rock and/or other appropriate methods.

5.3.4.2 Stabilize the Head of Minnesota Island

The eroding bank at the head of this island would be stabilized using rock and/or other appropriate methods.

5.3.5 SMITH SLOUGH

The primary habitat goal for Smith Slough is to maintain the slough as a running slough connecting East Channel to French Slough. The estimated future condition for Smith Slough is that it will tend to maintain itself in the same general location and configuration that has existed as far back as historical records are available (1894). However, predicting future conditions for a dynamic water body such as a flowing slough on the Upper Mississippi River is a subjective process relying heavily on historic patterns and professional judgment. Therefore, measures were identified that could possibly increase the potential for Smith Slough to maintain itself. These measures could be considered as stand alone options or in combination with each other.

A second habitat goal and objective is to increase cover in Smith Slough for fish. Measures to increase cover in Smith Slough were also identified.

5.3.5.1 Partial Closure Structure

Construction of a partial closure structure at the upper end of Smith Slough would reduce bed load sediment inputs to the slough, which in turn could reduce the formation of shoals that would constrict flows through the slough.

5.3.5.2 Dredging

Dredging in Smith Slough would increase the flow carrying capacity of the slough. In addition, the deeper water created by the dredging would increase cover for fish.

5.3.5.3 Breakout Control Structures

A berm or small levee could be placed on the right descending bank of Smith Slough to reduce the amount of breakout flows during high flow conditions. Retaining these flows in Smith Slough could result in increased water depths in the slough due to scouring action.

5.3.5.4 Fish Structures

Structures could be placed in Smith Slough to improve cover for target fish species. Examples include fallen trees anchored to the banks, rock structures, and bank cover structures.

5.3.6 UPPER FRENCH SLOUGH

The following measure was identified for the upper French Slough area to meet the goal and objective of increasing habitat diversity.

5.3.6.1 Dredging

Shallow water areas adjacent to French Slough would be excavated to create water depths identified in the project objectives. The Wisconsin DNR has identified two general areas that could be considered for deepening. The first area is the shallow water located above the French Slough borrow hole. The second area is located adjacent to French Slough between I-90 and the mouth of Smith Slough.

5.4 ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

Alternatives or project features were eliminated throughout project planning once it became evident that their further pursuit was not warranted. Some plans were eliminated because they would not meet habitat goals and objectives, while others were too costly for the habitat benefits they would provide.

5.4.1 INTERSTATE 90 BAY

5.4.1.1 Close the Breach in the Peninsula; Stabilize the Peninsula Shoreline; and Restore the Lower End of the Peninsula

These three alternatives were not evaluated as stand alone alternatives. None of these measures by themselves would solve the erosion problems at the I-90 Bay peninsula, or meet the habitat objective of maintaining the peninsula and the bay it forms.

5.4.1.2 Stabilize the Peninsula Shoreline and Restore the Lower End of the Peninsula

This combination plan was not evaluated. These actions without closing the breach in the peninsula would not solve the habitat problems caused by the breach.

5.4.1.3 Close the Breach and Restore the Lower End of the Peninsula

This combination plan was not evaluated. Closing the breach without stabilizing the shoreline above and below would not meet the objective of maintaining the peninsula and the bay it forms.

5.4.1.4 Summary

Table 5-1 summarizes the various alternatives considered for the I-90 Bay, which ones were eliminated from detailed evaluation, and which ones were carried forward for detailed evaluation.

Table 5-1
Disposition of I-90 Bay Alternatives

Alternative	Disposition
Close breach	Eliminated
Stabilize shoreline	Eliminated
Restore peninsula	Eliminated
Close breach/Stabilize shoreline	Evaluated in detail
Close breach/Restore peninsula	Eliminated
Stabilize shoreline/Restore peninsula	Eliminated
Close breach/Stabilize shoreline/Restore peninsula	Evaluated in detail

5.4.2 HEAD OF EAST CHANNEL

5.4.2.1 Closure of the Side Channel Opening

Further evaluation indicated that there has been a natural closing of this side channel such that the amount of sand that now enters the Head of East Channel via this opening is probably minor. Initial cost estimates indicated that closure of this side channel with a rock berm would cost $20,000 - $25,000. The Federal and State agencies participating in the project planning felt that the habitat benefits associated with constructing this closure were insufficient to justify the costs. Therefore, this feature was eliminated from further evaluation.

5.4.2.2 Dredging under the I-90 Bridge

Based on bathymetric surveys taken in May 1994, it appears that there is sufficient water depth at this time for fish access and egress into the Head of East Channel. It would be very difficult to accurately predict future sedimentation patterns under the bridge. Because of the concern (see "Planning Constraints") that nothing be done to jeopardize the existing high quality winter fish habitat in the Head of East Channel, it was decided that the best course of action would be to do nothing and continue to monitor the situation. Therefore, this alternative was eliminated from detailed evaluation.

5.4.3 LOWER ISLAND 98 AND MINNESOTA ISLAND

None of the alternatives identified for Lower Island 98 and Minnesota Island were eliminated from detailed evaluation.

5.4.4 SMITH SLOUGH

5.4.4.1 Partial Closure Structure

Reducing sand inputs to Smith Slough through construction of a partial closure structure at its upper end would also reduce flows through Smith Slough. Reducing flows would not be compatible with the project goals and objectives of maintaining Smith Slough as a running slough with the capacity for passing flows that roughly exist at present. In addition, reducing flows would entail a substantial risk that sedimentation in Smith Slough could increase. For these reasons, structural measures to reduce sand inputs to Smith Slough were eliminated from detailed evaluation.

5.4.4.2 Dredging

Dredging in Smith Slough was eliminated from detailed evaluation for a number of reasons. They are as follows.

a. Preliminary cost estimates indicate that dredging in Smith Slough in the amount necessary to appreciably deepen the slough would cost about $400,000 (engineering and design costs included). There do not appear to be sufficient habitat benefits associated with dredging in Smith Slough to justify these costs.

b. Dredging is not a long-term solution. It would likely take a substantial modification to the basic hydraulics of Smith Slough for the dredged areas to maintain themselves.

c. Currently, the slough is passable only by small watercraft. Dredging the slough would increase boat passage through the slough because it offers a direct route between French Slough and the East Channel. Increased boat traffic would affect fish and wildlife species sensitive to human disturbances.

5.4.4.3 Breakout Control Structures

Construction of breakout controls would have adverse impacts on adjacent wetland habitats, both from construction related impacts and from cutting off replenishing flows. Because of these concerns, these structures were not considered for detailed evaluation.

5.4.4.4 Fish Structures

Because of construction access limitations, any fish structures constructed in Smith Slough would likely have to be of the size that could be constructed by hand labor assisted by whatever equipment could be transported by small watercraft. The capability to transport rock into the slough for construction purposes would be severely limited. Construction of small fish habitat structures of the type that could be built given the above noted access constraints would likely not provide any appreciable habitat benefits in Smith Slough. Therefore, the construction of fish structures in Smith Slough was not evaluated in detail.

5.4.4.5 Summary

Projections for Smith Slough are that in the foreseeable future it is not likely to change appreciably from current conditions, and that the slough should be able to maintain itself as a running slough. Alternative measures to increase the potential for the slough to maintain itself were identified. Preliminary evaluations indicated that none of these measures warranted detailed evaluation at this time. In addition, preliminary evaluations indicated that placing fish structures in Smith Slough to improve fish habitat did not warrant further consideration.

The consensus view of the participating Federal and State agencies involved in the study process was that any further consideration of habitat restoration or enhancement measures at Smith Slough should be deferred until there is a clear indication that Smith Slough may no longer be able to sustain itself as a running slough.

5.4.5 UPPER FRENCH SLOUGH

5.4.5.1 Dredging

A culvert has been placed in the lock and dam 7 earthen dike that is designed to alleviate dissolved oxygen depletion problems in the upper reaches of French Slough. Monitoring will be required for a few years to determine what impacts these added flows will have on upper French Slough and its habitat. The consensus view of the participating Federal and State agencies involved in the study process was that any further consideration of dredging in the upper reaches of French Slough should be deferred until the effects of the added flows can be monitored and evaluated.

5.5 ALTERNATIVES CONSIDERED IN DETAIL

After the initial evaluation and screening of alternatives, it was determined that no further study effort or detailed evaluation was warranted for the Head of East Channel, Smith Slough, and French Slough portions of the overall study area. Detailed evaluation of alternatives was undertaken for the I-90 Bay, Lower Island 98, and Minnesota Island sites.

5.5.1 NO ACTION

Under the no action alternative, no project would be implemented to modify habitat conditions under the UMRS-EMP. The no action alternative applies to each individual project site.

5.5.2 INTERSTATE 90 BAY

5.5.2.1 Plan I-90A

Under Plan I-90A, the breach in the peninsula would be filled and approximately 120 meters of the channel side shoreline of the peninsula would be stabilized using rock. The basic design for this alternative is to use a minimum of 0.8 meters of rock fill (plate 6) on the bank. To avoid having to shape the bank, the rock would terminate in a small rock berm adjacent to the bank. The area between the berm and the bank would be filled with sand to prevent high flows that overtop the berm from eroding the bank.

At the upstream end, the rock would be keyed into the bank approximately 5 meters. At two locations along the rock protection, two small tie-back dikes constructed of rock would be placed between the rock berm and the existing shoreline to control erosion of the sand fill. It is estimated that 750 cubic meters of sand fill would be required to close the breach and fill in between the rock berm and the shoreline. This alternative would require approximately 2,270 cubic meters of rock fill.

Initial design indicated that stabilizing 120 meters of this bank should be sufficient to protect the peninsula from erosion. This design was then evaluated using incremental analysis procedures to determine if there were any dramatic increases in the cost per linear foot of bank protected such that a minor reduction in the length of bank protected would result in appreciable cost savings (see discussion under "Incremental Analysis" for further details). This analysis indicated that the length of bank protected should remain at about 120 meters.

Plan I-90A would have an implementation cost of approximately $239,000. Table 5-2 summarizes the estimated costs of this plan. At the current discount rate of 7 3/4 percent, the average annual cost would be $18,977.

Table 5-2
Estimated Cost of Plan I-90A

Feature	Cost
Construction	
Mobilization	$ 50,000
Rock	121,000
Sand	19,000
Planning, Engineering and Design	35,000
Construction Management	14,000
Total	$239,000

5.5.2.2 Plan I-90B

Plan I-90B includes all of the features of Plan I-90A described above. In addition, this alternative would involve restoring approximately 105 meters of the peninsula using a rock breakwater design (plate 6). It was decided to use a rock breakwater design for peninsula restoration because this approach would be less costly than restoring the peninsula using earthen fill armored with rock.

The length of peninsula restoration was determined by using incremental analysis of potential benefits versus costs (see discussion under "Incremental Analysis" for further details).

Plan I-90B would require 750 cubic meters of sand fill and 4,475 cubic meters of rock. Table 5-3 summarizes the estimated costs of this plan. Plan I-90B would have an implementation cost of approximately $379,000 and an average annual cost of $30,093.

Table 5-3
Estimated Cost of Plan I-90B

Feature	Cost
Construction	
Mobilization	$ 50,000
Rock	245,000
Sand	19,000
Planning, Engineering and Design	46,000
Construction Management	19,000
Total	$379,000

5.5.3 LOWER ISLAND 98 AND MINNESOTA ISLAND

5.5.3.1 Plan L98

Under Plan L98, the head of Lower Island 98 would be stabilized using rock. The island would be stabilized using a combination of rock berm and rock layer designs, with a terminal groin on the river end of the bank protection (plate 7). The design is to use a 0.8-meter layer of rock from station 0+000 to station 0+076. This design was selected for this portion of the island because of the deep water depths in this area. It would not be practical to use a rock mound in this situation.

From station 0+091 to station 0+175, a rock mound design can be used because of the shallower water depths. The section from station 0+076 to station 0+091 would be the transition from the rock layer to the rock mound design. At station 0+178, a rock groin would be constructed that would extend out about 45 meters from shore. The purpose of the groin is to deflect flows away from the head of the island.

A total of 1,340 cubic meters of rock would be required to implement Plan L98. Table 5-4 summarizes the estimated costs of this plan. Plan L98 would have an implementation cost of approximately $92,000 and an average annual cost of $7,305.

Table 5-4
Estimated Cost of Plan L98

Feature	Cost
Construction	
Rock	$ 74,000
Planning, Engineering and Design	12,000
Construction Management	6,000
Total	$ 92,000

5.5.3.2 Plan MI

Under Plan MI, the head of Minnesota Island would be stabilized using rock. The design is shown on plate 8. The proposal is to use a 0.8-meter layer of rock from station 0+120 to station 0+275.

At station 0+120, a rock groin would be constructed on top of the old closing dam that ties into the island at this point. The groin would extend from the shoreline out about 40 meters to a high point on the closing dam. The purpose of this structure is to divert flows from the head of the island from station 0+000 to station 0+120. This would be much less costly than riprapping the bank in this lower 120-meter reach where the deep water would require a significant amount of rock.

A total of 1,270 cubic meters of rock would be required to implement Plan MI. Table 5-5 summarizes the estimated costs of this plan. Plan MI would have an implementation cost of approximately $82,000 and an average annual cost of $6,571.

Table 5-5
Estimated Cost of Plan MI

Feature	Cost
Construction	
Rock	$ 64,000
Planning, Engineering and Design	12,000
Construction Management	6,000
Total	$ 82,000

EVALUATION OF ALTERNATIVES

6.1 NO ACTION

By definition, no action would entail no expenditure of Federal funds under the UMRS-EMP HREP program to address habitat concerns in the East Channel area. If the habitat concerns are not addressed under the UMRS-EMP HREP program, it is unlikely that any substantive measures would be undertaken by the U.S. Fish and Wildlife Service or the affected States in the foreseeable future due to fiscal constraints.

The no action alternative would not satisfy any of the project objectives. Habitat conditions would change as described under earlier sections entitled "Estimated Future Habitat Conditions."

6.2 INTERSTATE 90 BAY

6.2.1 PLAN I-90A

Plan I-90A would maintain the I-90 Bay as deep protected habitat adjacent to the main channel of the river. The Wisconsin DNR has documented the value of this bay as pre-spawning staging habitat for walleye and as important habitat for YOY walleye and sauger (see previous discussion "4.1.1 Interstate 90 (I-90) Bay"). Walleye from as far away as the Goose Island area (over 13 km) of pool 8 were found to have moved into the I-90 Bay for pre-spawn staging (Holzer and Von Ruden, 1984). In addition, the bay provides protected off-channel habitat for a variety of other fish species. Studies in pool 5A (Anderson et al., 1983; Ecological Analysts, 1984) indicated that protected habitats adjacent to the main channel such as the I-90 Bay were very productive and received extensive use by both lotic and lentic species. Smallmouth bass, freshwater drum, channel and flathead catfish, redhorse, spotted sucker, bluegill, and black crappie are some of the species that make high use of these areas.

Detailed quantification of the habitat benefits of the I-90 Bay using cost/AAHU (average annual habitat unit) to evaluate the preservation of the I-90 Bay is not considered relevant because the most significant value of the bay is the seasonal and life stage habitat it provides for main channel species such as walleye, sauger, and others that spend much of their existence elsewhere in upper pool 8. The true value of the I-90 Bay to the fishery of upper pool 8 could not be quantified without doing extensive fisheries studies that could cost more than the cost of protecting the bay.

The cost/benefits of maintaining the I-90 Bay is best evaluated in a qualitative manner. The following all point to the importance of maintaining deepwater protected habitat, and the I-90 Bay in particular.

a. Wisconsin DNR studies have documented that the I-90 Bay is used by pre-spawn staging walleyes, and possibly by overwintering walleyes (Holzer and Von Ruden, 1984).

b. Wisconsin DNR studies have documented that the I-90 Bay is used extensively by YOY walleye and sauger (Wisconsin DNR, unpublished data).

c. Other studies have documented the importance of off-channel protected habitat for a variety of lotic and lentic species (Anderson et al., 1983; Ecological Analysts, 1984).

d. Deepwater protected habitats of the type provided by the I-90 Bay are not common. Few areas in upper pool 8 provide the unique combination of adjacency to the main channel, deep water depths, and protection from current that the I-90 Bay does.

6.2.2 PLAN I-90B

Plan I-90B would maintain the I-90 Bay and increase its size by about 1.25 hectares, restoring over 95% of the area of the bay that was lost during the period 1974-89. All of the benefits associated with maintaining the I-90 Bay as discussed above for Plan I-90A would occur with Plan I-90B. Restoring a portion of the bay would recoup some of the habitat value that has been lost over the last 20 years.

Another benefit associated with restoring a portion of the bay with a design that is relatively permanent is that it will serve to offset future unanticipated losses of similar habitat in upper pool 8 area which may occur due to natural events or man's activities. While the I-90 Bay was formed in the late 1960's by the construction of Interstate 90, the general trend on the Upper Mississippi River has been towards the loss of protected main channel border habitats due to erosion of protecting barriers, isolation for fish access through sandbar formation, and/or the actual filling of these protected areas by sediment.

6.3 LOWER ISLAND 98

Stabilizing the head of Lower Island 98 will reduce the rate of island loss such that approximately 2.75 hectares of island habitat will be maintained as compared to what is estimated would be lost to erosion over the next 50 years with no action. Habitat evaluation procedures were used to quantify the habitat benefits associated with protecting Lower Island 98 (see attachment 4, Habitat Evaluation appendix). It is estimated that stabilizing the head of Lower Island 98 will provide approximately 1.24 AAHU-H* of benefit. At an estimated average annual cost of $7,305, the cost would be $5,891/AAHU-H.

Average annual habitat units quantify only a portion of the habitat benefits associated with stabilization of the head of Lower Island 98. This island has other habitat values that can not be easily quantified. These other values can be summarized as follows:

1) Lower Island 98 helps define the East Channel as a separate habitat type and resource from the main channel. The lesser flows and variable water depths of the East Channel provide habitat types and niches for fish and other aquatic life not commonly found in the deeper main channel.

2) The shoreline of Lower Island 98 along the East Channel provides flowing water/land interface habitat that is valuable for wading birds, furbearers, and other birds and wildlife. This habitat is more valuable than similar habitat found along the main channel because there is less disturbance in the East Channel from passing boat and barge traffic.

3) Lower Island 98 is a "high" island in that it rises 4-6 meters above normal pool level. This allows the island to support forest vegetation more upland in character than the typical bottomland forest community of the surrounding floodplain. Mast producing species such as red and bur oaks are common to the island. Maintaining these islands would maintain the diversity of habitat they provide to the upper pool 8 floodplain.

4) The mature trees on the island are used as perching sites for bald eagles which concentrate in the area in late winter, presumably because of the availability of open water in this area.

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* Habitat evaluation procedures are traditionally based on the acre as the standard unit of measurement. The East Channel project planning uses the metric system, i.e., hectares instead of acres. The abbreviation AAHU-H is used in this report to distinguish average annual habitat units based on hectares from those based on acres.

6.4 MINNESOTA ISLAND

Stabilizing the head of Minnesota Island will reduce the rate of island loss such that approximately 1.7 hectares of island habitat will be maintained as compared to what is estimated would be lost to erosion with no action. Habitat evaluation procedures were used to quantify the habitat benefits associated with protecting Minnesota Island (see attachment 4, Habitat Evaluation appendix). It is estimated that stabilizing the head of Minnesota Island will provide .63 AAHU-H of benefit. At an estimated average annual cost of $6,571, the cost would be $10,335/AAHU-H.

As discussed above for Lower Island 98, habitat units cannot quantify all of the habitat benefits associated with preventing the erosion of a portion of Minnesota Island. All of the same habitat benefits associated with preserving Lower Island 98, as discussed above, would apply to Minnesota Island also. In addition, Minnesota Island is used by the Cerulean warbler, a neo-tropical migrant of concern. While it is thought that large forest tracts are required for neo-tropical migrants, the birds can be found in the smaller, fragmented tracts on the Upper Mississippi River, including Minnesota Island. The fact that these birds are seeking out these wooded islands in the naturally fragmented mosaic of habitat found in upper pool 8 indicates that these mature wooded habitats are important.

6.5 INCREMENTAL ANALYSIS

6.5.1 I-90 BAY

Incremental analysis was used both to evaluate the design of the I-90 Bay features and to compare Plans I90-A and I90-B.

6.5.1.1 Extent of Bank Stabilization

The initial design for the stabilization of the riverward side of the I-90 Bay peninsula was to stabilize approximately 120 meters of this shoreline. It was determined that this reach of bank was most sensitive to erosion due to deeper water and steeper banks. In addition, the FWS preferred that the bank protection not extend any further upstream to avoid potential conflicts with planned developments associated with the I-90 Bay boat landing. This design was then evaluated using incremental analysis to determine if a reduction in the length of bank protected would provide significant cost savings (recognizing that reducing the extent of protection would result in some increase in risk of failure).

The method used was to compare the cost/linear foot of bank stabilized for various reaches. The evaluation was conducted for 15-meter increments of the bank protection. Table 6-1 summarizes the analysis. Station 0+000 is the lower tip of the peninsula and the stationing increases proceeding upstream.

Table 6-1
Incremental Analysis of Peninsula Bank Protection

Increment (by station)	Cubic Meters of Rock	Estimated* Cost	Estimated Cost per Meter
0+000 to 0+015	128	$ 6,400	$ 427
0+015 to 0+030	151	$ 7,600	$ 507
0+030 to 0+045	131	$ 6,600	$ 440
0+045 to 0+060	219	$11,000	$ 733
0+060 to 0+075	349	$17,500	$1,167
0+075 to 0+090	358	$18,000	$1,200
0+090 to 0+105	338	$17,000	$1,133
0+105 to 0+120	357	$18,000	$1,200

* Cost of rock + contingencies

This analysis indicates that the largest incremental increases in cost per meter occurs between stations 0+045 and 0+075. To reduce the length of bank protection by 45 to 75 meters and still maintain the I-90 peninsula would not be possible. Therefore, it was decided that maintaining the bank protection up to station 0+120 was the most prudent course of action.

6.5.1.2 Peninsula Restoration

Incremental analysis was also used to evaluate the appropriate length of peninsula restoraton. Potential habitat benefits versus costs were used in this analysis. While habitat evaluation procedures were not used to quantify the habitat benefits associated with the I-90 Bay alternatives, they can still be used for incremental analysis using a "surrogate" HSI (habitat suitability index) value. The basic assumption made is that one hectare of deep protected bay habitat is as valuable as any other one hectare in terms of providing habitat for pre-spawn walleye, YOY walleye and sauger, and other fish species use.

For the purposes of conducting the incremental analysis, a surragate HSI value of 1.0 was used to simplify the mathematics. Table 6-2 shows the rock volumes associated with various lengths of peninsula extension, area of protected bay restored, AAHU-H gains using the surrogate HSI, and incremental costs.

Table 6-2
Incremental Analysis of Peninsula Extensions

Length	Rock Vol (m^3)	Incre. Cost*	Ave. An. Incre. Cost	Cumul. Hectares	Incre. AAHU-H Gain	Incremental Cost/AAHU-H
15 m	133	$ 7,698	$ 611	0.20	0.20	$ 3,056
30 m	383	$14,469	$1,149	0.40	0.20	$ 5,744
45 m	683	$17,363	$1,379	0.61	0.21	$ 6,565
60 m	988	$17,652	$1,402	0.77	0.16	$ 8,760
75 m	1,351	$21,009	$1,668	0.93	0.16	$10,426
90 m	1,760	$23,672	$1,880	1.09	0.16	$11,747
105 m	2,205	$25,755	$2,045	1.26	0.17	$12,029
120 m	2,765	$32,411	$2,573	1.42	0.16	$16,084
135 m	3,443	$39,241	$3,116	1.58	0.16	$19,473
150 m	4,146	$40,688	$3,231	1.70	0.12	$26,922

* fully funded level and includes cost of plans and specifications and construction management

The basic premise behind using the surragote HSI is that restored bay habitat is of equal value to the existing bay habitat on a per hectare basis. It is highly unlikely that restored bay habitat would be of greater value than existing bay habitat on a per hectare basis. Therefore, to be justified, restored bay habitat should cost the same or less on a per unit basis as preserving the existing bay habitat ($15,814/AAHU-H using the surrogate HSI (see table 6-4)). In looking at the last column on the right in table 6-2, the incremental cost of the peninsula restoration is less than $15,814/AAHU-H up to 105 meters. The 15-meter increment from station 0+105 to station 0+120 costs more than $15,814/AAHU-H, as do the following increments. Therefore, logically, the peninsula restoration should not extend past station 0+105, or 105 meters.

6.5.1.3 Incremental Analysis of Alternative Plans

Plan I-90A is the base plan for the I-90 Bay. Plan I-90B entails adding an increment to Plan I-90A. Therefore, the incremental analysis for I-90 Bay involves first evaluating the cost/benefits of the base plan and then the added costs and benefits associated with the next level of development (Plan I-90B).

Because the primary importance of the I-90 Bay is its value as seasonal and life stage habitat for the walleye and sauger populations in upper pool 8, it was not possible to quantify the benefits of maintaining the bay in habitat units (see discussion under section 6.2.1 above). However, it is still possible to use habitat units for incremental analysis by assigning a surrogate HSI value to the I-90 Bay. The assumption made is that one hectare of deep protected bay habitat is as valuable as any other one hectare in terms of providing habitat for pre-spawn walleye, YOY walleye and sauger, and other fish species use. As with the earlier analysis, a surrogate HSI value of 1.0 was used to simplify the mathematics. Table 6-3 is a summary of benefits using the surrogate HSI while table 6-4 displays the incremental analysis.

Table 6-3
Summary of I-90 Bay Benefits Using Surrogate HSI of 1.0

Future Without	Future with I-90A	Future with I-90B
98 HU-H	160 HU-H	223 HU-H
2.0 AAHU-H	3.2 AAHU-H	4.5 AAHU-H

Table 6-4
Incremental Analysis for I-90 Bay Alternatives Using Surrogate HSI

Alternative/ Increment	AAHU-H Gain	Total Cost	Ave An Cost	Cost/AAHU-H
Plan I-90A	1.2	$239,000	$18,977	$15,814
Plan I-90B	2.5	$379,000	$30,093	$12,037
"A increment"	1.2	$239,000	$18,977	$15,814
"B increment"	1.3	$140,000	$11,116	$ 8,551

The incremental analysis indicates that if Plan I-90A is justified, then Plan I-90B is also justified. The logic is as follows. Whatever the true cost of Plan I-90A, the cost of achieving the same benefits with the additional "B increment" is about 55% less on a per unit basis. This is based on the basic assumption that one hectare of protected habitat is as valuable as any other hectare acre of protected habitat. The basic assumption could not be proven without extensive research beyond the scope of this study. However, the cost difference is sufficient such that, even with some error in the basic assumption, the "B increment" would still be considered a prudent resource investment.

6.5.2 LOWER ISLAND 98

No incremental analysis was performed for the Lower Island 98 feature as only one alternative was evaluated. Planning and design efforts identified the lowest cost method for stabilizing the head of this island. There are no incremental options; the decisions is either stabilize the head of the island or not to, based on an evaluation of estimated costs versus estimated benefits.

6.5.3 MINNESOTA ISLAND

No incremental analysis was performed for the Minnesota Island feature for the same reasons discussed above for Lower Island 98.

6.6 SUMMARY COMPARISON OF ALTERNATIVES

6.6.1 MEETING PROJECT OBJECTIVES

Table 6-5 displays how the alternatives would meet the project objectives identified earlier in this report.

Table 6-5
Contribution of Alternatives towards Project Objectives

Objective	No Action	Plan I-90A	Plan I-90B	Plan L98	Plan MI
I90-1	doesn't meet	meets	meets	n.a.	n.a.
I90-2	doesn't meet	doesn't meet	95% meets	n.a.	n.a.
Isl-1	doesn't meet	n.a.	n.a.	meets	n.a.
Isl-2	doesn't meet	n.a.	n.a.	n.a.	meets

Project objective I90-1 was to maintain the I-90 Bay at its present size of 8 acres. Both Plans I-90A and I-90B would maintain the existing 3.2-hectare bay, meeting this objective. Project objective I90-2 was to restore 1.3 hectares of bay habitat. Plan I-90A would not meet this objective, while Plan I-90B would restore 1.25 hectares, accomplishing 95% of the objective.

Plans L98 and MI would meet the project objectives for Lower Island 98 and Minnesota Island, respectively.

6.6.2 COSTS AND BENEFITS

Table 6-6 displays a summary of the costs and benefits of each alternative plan.

Table 6-6
Summary of Costs and Benefits

Plan	Cost	Average Annual Cost	Benefits
No Action	$0	$0	negative benefits, i.e., loss of habitat value over time
I-90A	$239,000	$18,977	maintains walleye pre-spawn staging habitat maintains walleye/sauger YOY habitat maintains 3.2 hectares of bay habitat important to a wide variety of fish species
I-90B	$379,000	$30,093	maintains and increases walleye pre-spawn staging habitat maintains and increases walleye/sauger YOY habitat maintains 3.2 hectares and restores 1.25 hectares of bay habitat important to a wide variety of fish species
L98	$ 92,000	$ 7,305	saves 2.75 hectares of wooded island habitat provides 1.24 AAHU-H of quantifiable benefits provides unquantifiable benefits to adjacent nearshore habitats maintains bald eagle perching sites
MI	$ 82,000	$ 6,511	saves 1.7 hectares of wooded island habitat provides 0.63 AAHU-H of quantifiable benefits provides unquantifiable benefits to adjacent nearshore habitats maintains bald eagle perching sites maintains habitat for Cerulean warblers, a neo-tropical migrant of concern

6.7 PLAN SELECTION AND JUSTIFICATION

6.7.1 I-90 BAY

The first decision is whether or not to stabilize the I-90 Bay peninsula and maintain the bay as protected deepwater habitat (no action vs. Plan I-90A). As previously discussed under "Evaluation of Alternatives," protected deepwater habitat adjacent to the main channel is an important habitat type. This habitat type provides important seasonal and life stage habitat for a variety of fish species (Anderson et al., 1983; Ecological Analysts, 1984). Wisconsin DNR studies have documented that the I-90 Bay is used by pre-spawn staging walleyes, and possibly by overwintering walleyes (Holzer and Von Ruden, 1984), and that the I-90 Bay is used extensively by YOY walleye and sauger (Wisconsin DNR, unpublished data). Because of the importance of protected deepwater habitat, and this bay in particular, to the fishery resource of upper pool 8, maintaining the bay at a cost of $239,000 is considered a reasonable and prudent resource investment. Therefore, Plan I-90A was selected over the no action alternative.

The second decision is whether or not to restore a portion of the peninsula lost to erosion to restore additional deepwater protected habitat (Plan I-90A vs. Plan I-90B). Plan I-90B will provide an additional 1.25 hectares of protected bay habitat at an incrementally lower cost per unit of habitat than just maintaining the existing bay habitat with Plan I-90A (see Incremental Analysis). Therefore, Plan I-90B was selected over Plan I90-A.

6.7.2 LOWER ISLAND 98

The selected plan for Lower Island 98 is Plan L98, stabilization of the head of Lower Island 98. This plan was selected over the no action alternative. Plan L98 would meet the project objective established for Lower Island 98, while the no action alternative would not.

Plan L98 would have an estimated cost of $5,891/AAHU-H. When considering the additional unquantifiable habitat benefits associated with stabilizing this island, as enumerated and discussed previously under "EVALUATION OF ALTERNATIVES," stabilization of the head of this island at an estimated cost of $92,000 is considered a prudent resource investment.

6.7.3 MINNESOTA ISLAND

The selected plan for Minnesota Island is Plan MI, stabilization of the head of Minnesota Island. This plan was selected over the no action alternative. Plan MI would meet the project objective established for Minnesota Island, while the no action alternative would not.

Plan MI would have an estimated cost of $10,335/AAHU-H. When considering the additional unquantifiable habitat benefits associated with stabilizing this island, as discussed previously under "EVALUATION OF ALTERNATIVES," stabilization of the head of this island at an estimated cost of $82,000 is considered a prudent resource investment.

An added factor in the plan selection decision is the support for this course of action by the resource management agencies, primarily the U.S. Fish and Wildlife Service. This support is given in recognition that if stabilization of the head of Minnesota Island were not pursued, the $82,000 committed to this project would be available for use elsewhere within the UMRS-EMP on other habitat restoration efforts.

SELECTED PLAN WITH DETAILED DESCRIPTION/ DESIGN AND CONSTRUCTION CONSIDERATIONS

7.1 I-90 BAY

The selected plan for the I-90 Bay is Plan I-90B. This plan would involve the following features:

a) Plugging the breach in the peninsula.

b) Placing rock bank protection on the channel side of the peninsula.

c) Restoring approximately 105 meters of the peninsula with rock.

Plugging the breach in the peninsula would require approximately 300 cubic meters of material. It is expected that this material would be sand capped with fines dredged from the adjacent river and/or from within I-90 Bay. Because of the small amount of material required, a borrow site will be selected during the preparation of plans and specifications.

Approximately 120 meters of the channel side shoreline of the peninsula would be stabilized using rock. The basic design for this alternative is to use a minimum of 0.8 meters of rock fill on the eroding shoreline (plate 6). To avoid having to shape the bank, the rock would terminate in a small rock berm adjacent to the bank. The area between the berm and the bank would be filled with sand to prevent high flows that overtop the berm from eroding the bank.

At the upstream end, the rock would be keyed into the bank approximately 5 meters. At two locations along the rock protection, tie-back dikes of rock would be placed between the rock berm and the existing shoreline to control erosion of the sand fill.

It is estimated that 450 cubic meters of sand fill would be required to fill in between the rock berm and the shoreline. As with filling the breach in the peninsula, it is expected that this material would be sand capped with fines dredged from the adjacent river and/or from within I-90 Bay. Because of the small amount of material required, a borrow site will be selected during the preparation of plans and specifications.

Approximately 105 meters of the peninsula would be restored using a rock breakwater design (plate 6). It was decided to use a rock breakwater design for peninsula restoration because this approach would be less costly than restoring the peninsula using earthen fill armored with rock.

The top elevation of 634.0 was selected as the optimum elevation protection for the bay from river flows (see attachment 5, Hydraulics Appendix). An added consideration was that at elevation 634.0 the structure stood high enough above the water to insure visibility to small craft.

It is expected that the construction of the I-90 Bay features would be conducted primarily by marine equipment, i.e., a towboat, cranebarge, and material barges. Water depths are such that no access dredging would be required. Plan I-90B would require approximately 4,475 cubic meters of rock. This rock would most likely be loaded on barges at the Lock and Dam 7 loading dock.

7.2 LOWER ISLAND 98

The selected plan for Lower Island 98 is Plan L98. Under this plan, the head of Lower Island 98 would be stabilized using 1,340 cubic meters of rock. The island would be stabilized using a combination of rock berm and rock layer designs, with a terminal groin on the upstream end of the bank protection (plate 7). The design is to use a 0.8-meter layer of rock from station 0+000 to station 0+076. This design was selected for this portion of the island because of the deep water in this area. It would not be practical to use a rock mound in this situation.

From station 0+091 to station 0+175, a rock mound design can be used because of the shallower water depths. The section from station 0+076 to station 0+091 would be the transition from the rock layer to the rock mound design. At station 0+175, a rock groin would be constructed that would extend out about 45 meters from shore.

Placing the rock protection at Lower Island 98 would require marine equipment because there is no land access. Existing bathymetry indicates that constructing the rock protection for Lower Island 98 should not require any access dredging. The rock would most likely be loaded on barges at the Lock and Dam 7 loading dock.

7.3 MINNESOTA ISLAND

The selected plan for Minnesota Island is Plan MI. Under this plan, the head of Minnesota Island would be stabilized using 1,270 cubic meters of rock. The design is shown on plate 8. The proposal is to use a 0.8-meter layer of rock from station 0+120 to station 0+275.

At station 0+120, a rock groin would be constructed on top of the old closing dam that ties into the island at this point. The groin would extend out from the shoreline about 40 meters to an intersection with the closing dam. The purpose of this structure is to prevent scour due to a low spot in the closing dam and to divert flows away from the island from station 0+00 to station 0+120. This would be much less costly than riprapping the bank in this lower 120-meter reach where the deep water would require a significant amount of rock.

Placing the rock protection at Minnesota Island would require marine equipment because there is no land access. Existing bathymetry indicates that constructing the rock protection for Minnesota Island should not require any access dredging. The rock would most likely be loaded on barges at the Lock and Dam 7 loading dock.

ENVIRONMENTAL EFFECTS

An environmental assessment has been conducted for the proposed action, and a discussion of the impacts follows. As specified by Section 122 of the 1970 Rivers and Harbors Act, the categories of impacts listed in the Environmental Impacts Matrix (table 8-1) were reviewed and considered as part of the environmental assessment. In accordance with Corps of Engineers regulations (33 CFR 323.4(a)(2)), a Section 404(b)(1) evaluation was prepared and is included as attachment 3. Water quality certification under Section 401 of the Clean Water Act has been applied for from the States of Minnesota and Wisconsin.

8.1 RELATIONSHIP TO ENVIRONMENTAL REQUIREMENTS

The proposed project complies fully with applicable environmental statutes and Executive Orders for the current stage of planning. Among the more pertinent are the National Environmental Policy Act of 1969, as amended; the Fish and Wildlife Coordination Act of 1958, as amended; the Clean Water Act of 1977; the Clean Air Act, as amended; the National Historic Preservation Act of 1966, as amended; the National Wildlife Refuge System Administration Act; the Endangered Species Act of 1973, as amended; the Land and Water Conservation Fund Act of 1965, as amended; Executive Order 11990 - Protection of Wetlands; Executive Order 11988 - Floodplain Management; and USACE ER 1105-2-100.

8.2 NATURAL RESOURCE EFFECTS

The project would beneficially affect terrestrial habitat, wetlands, and aquatic habitat through beneficial effects in habitat diversity and interspersion and biological productivity. The stability of the islands and the peninsula would enable those habitats to provide known eagle perching sites and walleye staging areas as well as habitat for a variety of species including neo-tropical migrants. The protection of these different habitats helps maintain the great diversity of habitats found in the East Channel complex.

Detrimental effects would be limited to increased noise, turbidity and decreased air quality during construction.

ENVIRONMENTAL ASSESSMENT MATRIX

Section 122 of the River and Harbor and Flood Control Act of 1970 (P.L. 91-611)

Table 8.1

PARAMETER	MAGNITUDE OF PROBABLE EFFECTS						
	BENEFICIAL EFFECT			NO APPRECIABLE EFFECT	ADVERSE EFFECT		
	SIGNIFICANT	SUBSTANTIAL	MINOR		MINOR	SUBSTANTIAL	SIGNIFICANT
A. SOCIAL EFFECTS							
1. Noise Levels					X		
2. Aesthetic Values					X		
3. Recreational Opportunities					X		
4. Transportation				X			
5. Public Health and Safety				X			
6. Community Cohesion (Sense of Unity)				X			
7. Community Growth & Development				X			
8. Business and Home Relocations				X			
9. Existing/Potential Land Use				X			
10. Controversy				X			
B. ECONOMIC EFFECTS							
1. Property Values				X			
2. Tax Revenues				X			
3. Public Facilities and Services				X			
4. Regional Growth				X			
5. Employment				X			
6. Business Activity				X			
7. Farmland/Food Supply				X			
8. Commercial Navigation				X			
9. Flooding Effects				X			
10. Energy Needs and Resources				X			
C. NATURAL RESOURCE EFFECTS							
1. Air Quality				X			
2. Terrestrial Habitat				X			
3. Wetlands				X			
4. Aquatic Habitat				X			
5. Habitat Diversity and Interspersion				X			
6. Biological Productivity				X			
7. Surface Water Quality				X			
8. Water Supply				X			
9. Groundwater				X			
10. Soils				X			
11. Threatened or Endangered Species				X			
D. CULTURAL RESOURCE EFFECTS							
1. Historic Architectural Values				X			
2. Pre-Historic and Historic Archeological Values				X			

8.3 CULTURAL RESOURCE EFFECTS

Historic research and field survey demonstrate that no historic or archaeological sites exist in the immediate project area. Therefore, the project will have no impacts on any cultural resources. The project has been coordinated with the Regional Historic Preservation Office of the U.S. Fish and Wildlife Service, the Minnesota State Historic Preservation Office, and the Wisconsin State Historic Preservation Office. The agencies concur that no cultural resources eligible for inclusion on the National Register of Historic Places are within the project's area of effect (attachment 8).

8.4 SOCIOECONOMIC EFFECTS

The work would have no appreciable effects on transportation, public health and safety. Community cohesion, growth and development would not be affected as the projects are minor and non-controversial in nature. No businesses or homes would need to be relocated, and land use would not change with the project. Transportation would not be affected by this project.

Noise levels would increase during construction, and aesthetic values could be reduced because of the change from a natural shoreline to one protected by riprap. The proposal calls for the least amount of riprap possible and placement as close to the waterline as possible to allow some of the upper island slopes to remain as they are. Also the existing, stable sand beach at the upstream end of the peninsula would remain and would not be protected by rock; the rock would be tied into the bank downstream of that area and the sand placed between the existing shore and the rock would provide additional area from which to bank fish. Recreational opportunities would be limited during construction; however, the stabilization of the peninsula would afford visitors to the landing bank fishing opportunities.

SUMMARY OF PLAN ACCOMPLISHMENTS

The benefits of the various features of the selected plan have been discussed in detail earlier in this report in section 6, "Evaluation of Alternatives." They are summarized herein.

9.1 I-90 BAY

The selected plan will maintain 3.2 hectares and restore 1.25 hectares of deepwater protected habitat adjacent to the main channel. Studies have documented that this area is used by pre-spawn staging walleyes and is an important habitat for young-of-the-year walleye and sauger. Other studies have documented the importance of this type of habitat to a wide variety of fish species. Maintaining the I-90 Bay and the habitat values it provides is considered important to the maintenance of fish populations (especially walleye and sauger) in upper pool 8 of the Mississippi River.

9.2 LOWER ISLAND 98 AND MINNESOTA ISLAND

Stabilizing the heads of Lower Island 98 and Minnesota Island will preserve approximately 2.75 and 1.7 hectares, respectively, of wooded island habitat over the 50-year project life. Because these islands are "high" islands, they support vegetation different from that typically found in the bottomland forest habitats in upper pool 8. Maintaining these islands will preserve the relatively unique habitat type found on them and will help maintain habitat diversity in upper pool 8.

Another important function of these islands is that they help define the East Channel, a large side channel that provides habitat types and niches different from those found in the main channel or smaller side channels. Maintaining Lower Island 98 and the head of Minnesota Island will contribute to the maintenance of the East Channel as a unique habitat, and help maintain the diversity of aquatic habitat found in upper pool 8.

OPERATION, MAINTENANCE, AND REHABILITATION

10.1 GENERAL

Upon completion of construction, the U.S. Fish and Wildlife Service would accept responsibility for operation and maintenance of the East Channel project in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, and subsequent Annual Addendums. Specific operation and maintenance features would be defined in a project operation and maintenance manual which would be prepared by the Corps of Engineers and coordinated with the U.S. Fish and Wildlife Service.

10.2 OPERATION

The recommended plan would have no specific operational requirements. The U.S. Fish and Wildlife Service would be required to conduct periodic inspections of the project and submit annual reports of inspection activities and maintenance performed.

10.3 MAINTENANCE AND REPAIR

An operation and maintenance manual detailing maintenance and repair requirements would be prepared during the plans and specifications phase. Development of the manual would be coordinated with the U.S. Fish and Wildlife Service. Over the 50-year project life, the average annual operation and maintenance costs of the project are estimated to be $5,100. A breakdown of projected annual costs is contained in table 10-1.

Table 10-1
Estimated Average Annual Operation and Maintenance Costs

Item	Amount
a. Rock replacement	$2,370
b. Vegetation control	1,728
c. Inspection and Reporting	1,000
Total annual amount (rounded)	$5,100

PROJECT PERFORMANCE EVALUATION

A monitoring plan for project evaluation was designed to directly measure the degree of attainment of the selected project objectives. The plan is presented in tables 11-1 through 11-3. Monitoring activities would be coordinated with similar efforts by the Long-Term Resource Monitoring program. The estimated cost of project performance evaluation is $1,000 per effort (1995 dollars), with three efforts recommended over the 50-year project life. Because of the nature of the projects (essentially bank stabilization), little or no change is expected if the projects function as designed. Little or no change would be considered project success because the objectives are primarily to maintain existing conditions and prevent further resource degradation.

COST ESTIMATE

The total project cost for the selected plan is estimated to be $541,000 at the fully funded level. This cost does not include prior allocations of $160,000 for general design (planning). A detailed cost estimate is contained in attachment 2. A summary of costs is shown in table 12-1.

Table 12-1
Summary of Total Project Costs

Feature	Cost
Construction	
Mobilization	$ 50,000
Rock	383,000
Sand	19,000
Planning, Engineering, and Design	68,000[1]
Construction Management	31,000
Total	$551,000

[1] This does not include prior allocations of $160,000 for general design (planning).

TABLE 11–1
PROJECT OBJECTIVES AND ENHANCEMENT FEATURES

Objective	Project Accomplishment	Potential Enhancement Feature	Units	Enhancement Potential		
				Existing	Future Without	Future With
Maintain protected deep off–channel habitat	Prevent the loss of 1.6 hectares of protected deep off–channel habitat	rock bank protection	hectares of bay maintained	3.2 hectares	1.6 hectares	3.2 hectares
Restore protected deep off–channel habitat	Restore 1.25 hectares of protected deep off–channel habitat	rock berm	hectares of bay restored	3.2 hectares	1.6 hectares	4.45 hectares
Maintain head of Lower Island 98	Maintain wooded island habitat	rock bank protection	hectares of island maintained	4.5 hectares	1.75 hectares	4.5 hectares
Maintain head of Minnesota Island	Maintain wooded island habitat	rock bank protection	hectares of island maintained	30.8 hectares	29.1 hectares	30.8 hectares

TABLE 11–2
UMRS–EMP Monitoring and Performance Evaluation Matrix

Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Remarks
Problem Analysis	System–wide problem definition. Evaluate planning assumptions.	NBS	NBS (EMTC)	LTRM	Lead into pre–project monitoring; define desired conditions for plan formulation.
Pre–project Monitoring	Identify and define problems at specific sites.	Sponsor	Sponsor	Sponsor	Should attempt to begin defining baseline.
Baseline Monitoring	Establish baselines for performance evaluation.	Corps	Field stations or sponsors thru Cooperative Agreements, or Corps.*	LTRM ***	Should be over several years to reconcile pertubations.
Data Collection for Design	1. Identify project objectives. 2. Design of project. 3. Develop Performance Evaluation Plan.	Corps	Corps	HREP	After fact sheet. Data may aid in defining baseline.
Construction Monitoring	Assure permit conditions met.	Corps	Corps	HREP	
Performance Evaluation Monitoring	Determine success of projects.	Corps	Field stations or sponsors thru Cooperative Agreements, sponsor thru O&M**, or Corps.*	LTRM ***	After construction.
Analysis of Biological Responses to Projects	1. Determine critical impact levels, cause–effect relationships, and long–term losses of significant habitat.	NBS	NBS (EMTC)	LTRM	Biological Response Study tasks beyond scope of Performance Evaluation, Problem Analysis, and Trend Analysis.
	2. Demonstrate success or response of biota.	Corps	Corps/NBS (EMTC)/Others	HREP	

*Choice depends on logistics. When done by the States under a Cooperative Agreement, the role of the EMTC will be to: (1) advise and assist in assuring QA/QC consistency, (2) review and comment on reasonableness of cost estimates, and (3) be the financial manager. If a private firm or State is funded by contract, coordination with the EMTC is required to assure QA/QC consistency.

**Some limited reporting of information for some projects (e.g., waterfowl management areas) could be furnished by on–site personnel as part of O&M.

*** Requires a transfer of allocations from the Habitat Project account to the LTRM account.

TABLE 11–3
PRE – AND POST–CONSTRUCTION MEASUREMENTS

Goal	Project Objective	Enhancement Feature	Unit of Measure	Measurement Plan	Monitoring Interval	Projected Cost/Effort
Maintain I–90 Bay as protected deep off–channel fish habitat	Stabilize eroding peninsula	rock bank protection	hectares	Monitor hectares of protected deep off–channel fish habitat using aerial photography	10, 30, and 50 years post–construction	$250
	Restore peninsula lost to erosion	rock berm	hectares	Monitor hectares of protected deep off–channel fish habitat using aerial photography	10, 30, and 50 years post–construction	$250
Maintain wooded island habitat on Lower Island 98	Maintain head of island	rock bank protection	hectares	Monitor hectares of island maintained using aerial photography	10, 30, and 50 years post–construction	$250
Maintain wooded island habitat on Lower Island 98	Maintain head of island	rock bank protection	hectares	Monitor hectares of island maintained using aerial photography	10, 30, and 50 years post–construction	$250

REAL ESTATE REQUIREMENTS

This habitat rehabilitation and enhancement project is located in the upper portion of pool 8 of the Upper Mississippi River in La Crosse County, Wisconsin and Winona County, Minnesota. The project will be constructed entirely upon lands owned and operated by the United States of America and managed by the U.S. Department of the Interior's Fish and Wildlife Service as the Upper Mississippi River National Wildlife and Fish Refuge.

SCHEDULE FOR DESIGN AND CONSTRUCTION

A schedule for review and approval, major work tasks, and project construction follows.

Requirement	Scheduled Date
Submit final Definite Project Report to North Central Division, U.S. Army Corps of Engineers	Oct 1995
Obtain construction approval by North Central Division, U.S. Army Corps of Engineers	Jan 1996
Complete Plans and Specifications	Apr 1996
Advertise for bids	May 1996
Award Contract	Jul 1996
Complete Construction	Nov 1996

This schedule assumes the availability of funds to prepare plans and specifications and undertake construction will not be limiting.

IMPLEMENTATION RESPONSIBILITIES

The responsibilities of plan implementation and construction fall to the Corps of Engineers as the lead Federal agency. After construction of the project, project operation and maintenance would be required for features of the islands as outlined in the OPERATION, MAINTENANCE, AND REHABILITATION section of this report. These actions would be the responsibility of the U.S. Fish and Wildlife Service.

Should rehabilitation of the East Channel project which exceeds the annual maintenance requirements be needed (as a result of a specific storm or flood), the Federal share of rehabilitation would be the responsibility of the Corps of Engineers. Performance evaluation, which includes monitoring of physical/chemical conditions and some limited biological parameters, would be a Corps responsibility. Attachment 7 contains a draft copy of the formal agreement that would be entered into by the Corps of Engineers and the U.S. Fish and Wildlife Service. The Memorandum of Agreement formally establishes the relationships between the Department of the Army, represented by the Corps of Engineers, and the U.S. Fish and Wildlife Service in constructing, operating, and maintaining the proposed East Channel project.

COORDINATION, PUBLIC VIEWS, AND COMMENTS

A public meeting was held on November 2, 1994, in La Crosse, Wisconsin. The meeting was co-chaired by the Corps of Engineers, U.S. Fish and Wildlife Service, and the Wisconsin DNR. The meeting was attended by 10 members of the public.

At the time of the meeting, the study process had evolved to the point where the habitat concerns and the alternatives to address those concerns had been identified. The consensus view among the participating agencies had been developed that no further action at Smith Slough or upper French Slough appeared warranted at this time. This view was also presented to the public at the meeting. No objections were voiced by the public concerning the study findings to date or the future direction of the study process as presented by the St. Paul District and our partner Federal and State agencies.

A second public meeting was held on August 31, 1995, in LaCrescent, Minnesota. The meeting was attended by 3 members of the public. No objections were voiced concerning the proposed project.

The draft Definite Project Report/Environmental Assessment was sent to Congressional interests; Federal, State, and local agencies; special interest groups; interested citizens; and others listed in attachment 8.

CONCLUSIONS

The East Channel habitat rehabilitation and enhancement projects provide the opportunity to maintain and restore habitat for a variety of fish and wildlife in upper pool 8 of the Mississippi River. Maintaining the I-90 Bay will maintain 3.2 hectares and restore 1.25 hectares of deepwater protected habitat adjacent to the main channel. Studies have documented the value of this area as pre-spawn staging habitat for walleyes and as important habitat for young-of-the year walleye and sauger. Other studies have documented the importance of this type of habitat to a wide variety of fish species. Maintaining the I-90 Bay and the habitat values it provides is considered important to the maintenance of fish populations (especially walleye and sauger) in upper pool 8 of the Mississippi River.

Stabilizing the heads of Lower Island 98 and Minnesota Island will preserve 2.75 and 1.7 hectares, respectively, of wooded island habitat. These islands support vegetation different from that typically found in the bottomland forest habitats in upper pool 8. Maintaining these islands will preserve the relatively unique habitat type found on them and will help maintain habitat diversity in upper pool 8.

These islands also define the East Channel, a large side channel that provides habitat types and niches different from those found in the main channel or smaller side channels. Maintaining Lower Island 98 and the head of Minnesota Island will contribute to the maintenance of the East Channel as a unique habitat, and help maintain the diversity of aquatic habitat found in upper pool 8.

The habitat benefits that would be gained from implementation of the recommended project justify expenditure of public funds for preparation of plans and specifications and for construction.

RECOMMENDATION

I have weighed the accomplishments to be obtained from the East Channel habitat projects against their cost and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, the cost of the projects is a justified expenditure of Federal funds. I recommend that higher authority approve construction of the habitat rehabilitation and enhancement features of the East Channel projects at a total estimated cost of $551,000, which would be a 100-percent Federal cost according to Section 906(e)(3) of the 1986 Water Resource Development Act.

J.M. Wonsik
Colonel, Corps of Engineers
District Engineer

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ARMY CORPS OF ENGINEERS CENTRE
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

Management and Evaluation Branch
Engineering and Planning Divison

FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, the St. Paul District, Corps of Engineers has assessed the environmental impacts of the following project:

East Channel Habitat Rehabilitation and Enhancement Project
Pool 8, Upper Mississippi River
La Crosse County, Wisconsin and Winona County, Minnesota

The proposed project has three features. One requires the placement of rock and sand to fill a breach in a peninsula, rebuild 105 meters of the peninsula that has eroded, and protect the entire peninsula from future erosion. The other two projects require placement of rock to stabilize two eroding islands.

The proposed work would stabilize a peninsula that protects an important walleye spawning area; the island work would reduce the loss of forest habitat the island provides.

The environmental review indicates that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

2 Oct 95
Date

J.M. Wonsik
Colonel, Corps of Engineers
District Engineer

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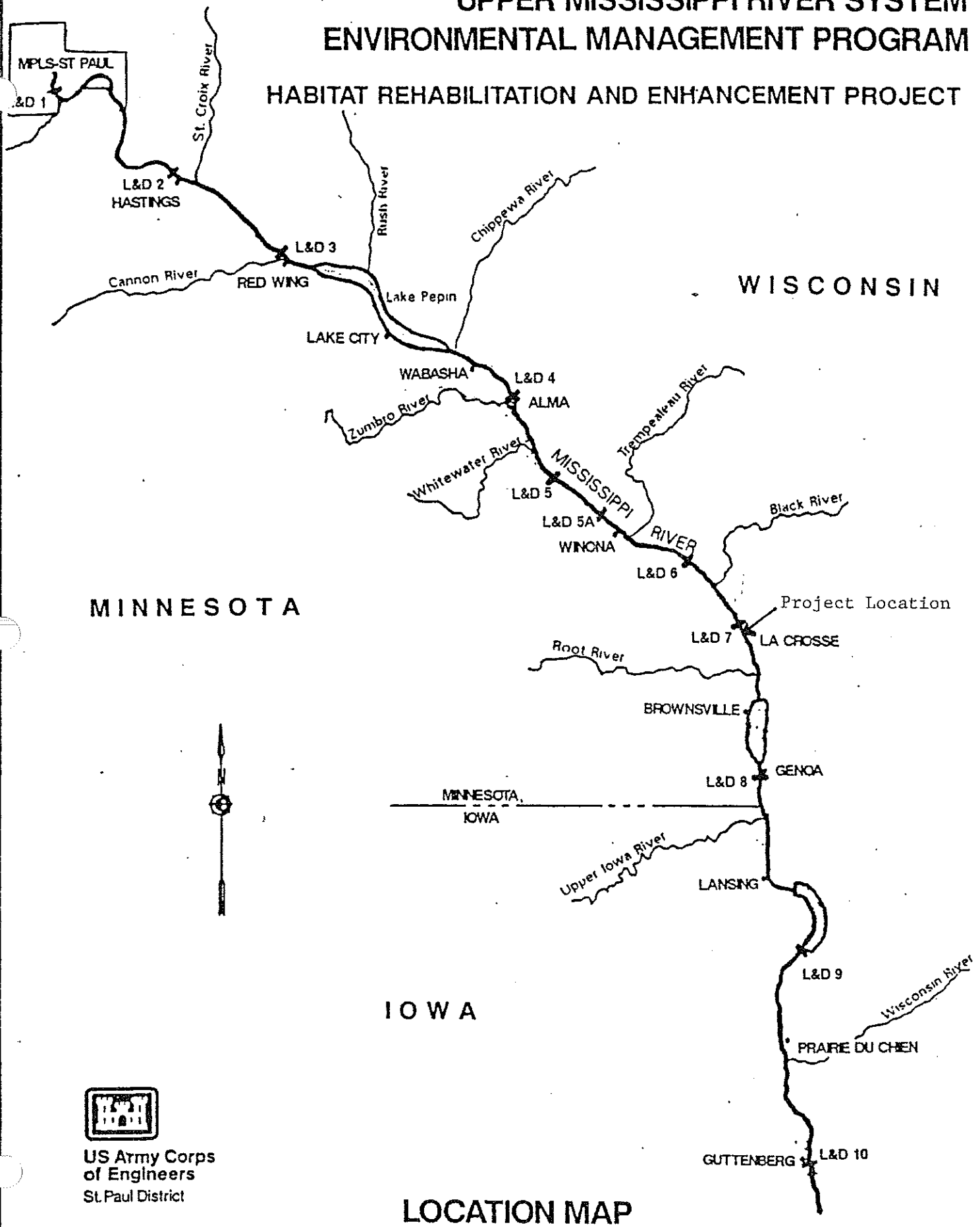
ATTACHMENT 1

PLATES

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM

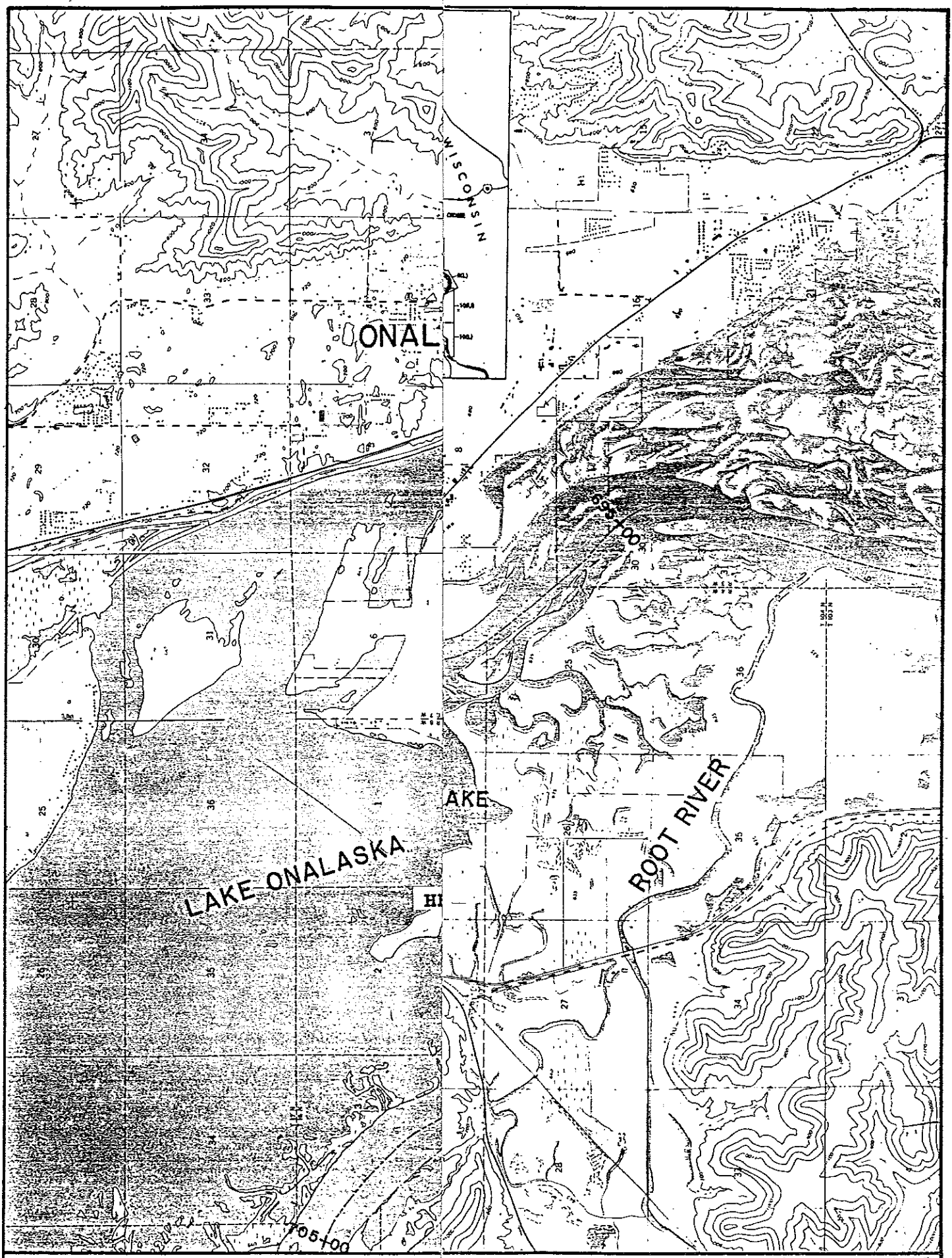
HABITAT REHABILITATION AND ENHANCEMENT PROJECT



US Army Corps of Engineers
St Paul District

LOCATION MAP

PLATE 1



LEGEND

---FLOODWAY DESIGNATED BY

VIRONMENTAL ACTION TEAM
MISSISSIPPI RIVER
U)-MILE 693 TO MILE 704)

PLATE 2

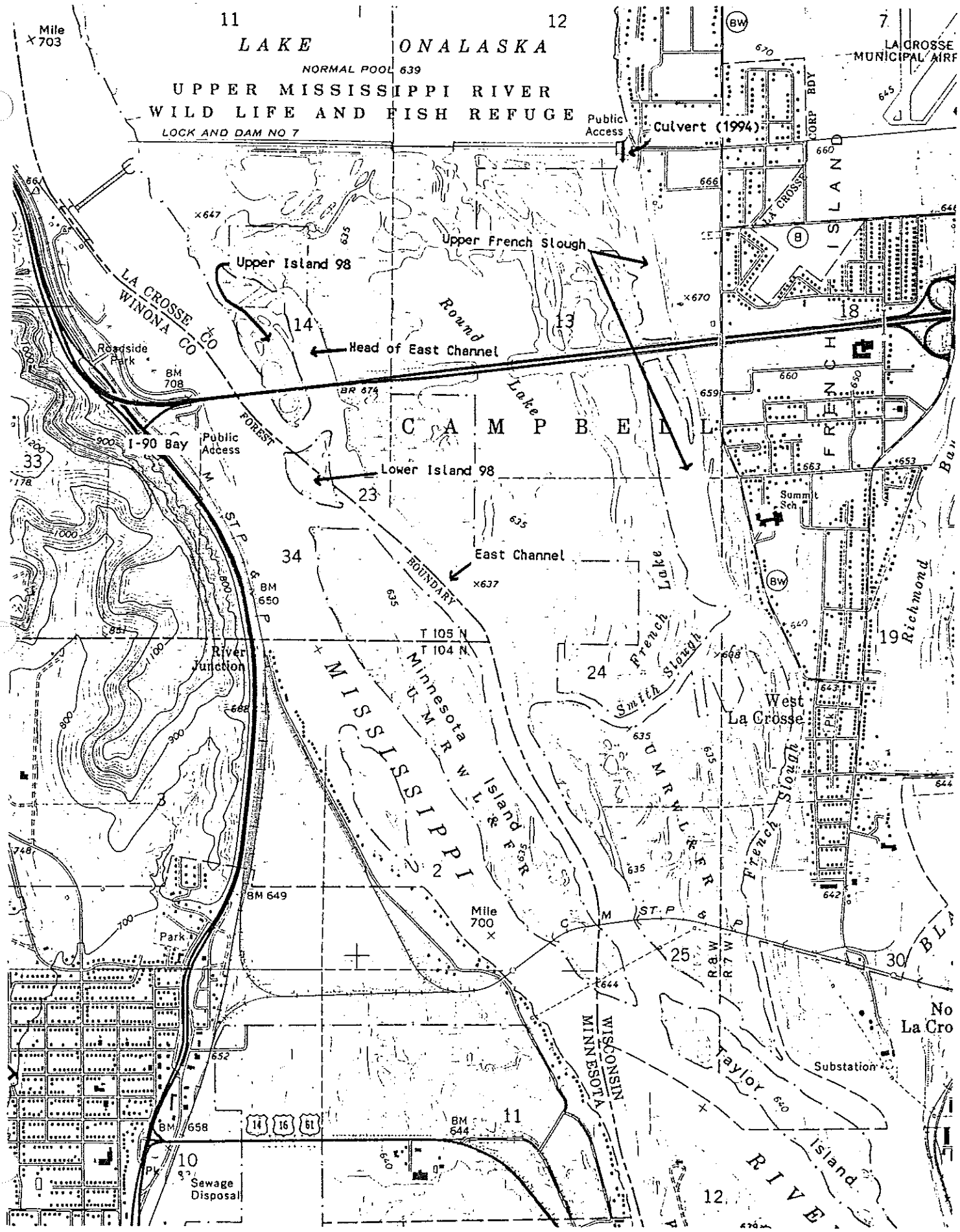


Plate 3. Upper Pool 8

2712000 ft

2716000 ft

0328000 ft

0324000 ft

0320000 ft

M.R.W. 04-21-94

1000 0 1000 2000 FEET

COORDINATE SYSTEM ..... STATE PLANE MINNESOTA SOUTH
GEODETIC DATUM ..... NORTH AMERICAN 1927
ELLIPSOID ..... CLARKE 1866

RECTIFIED PHOTO BASE : POOL 8 (41-10) 05 SEPTEMBER 1959
VECTOR OVERLAY (RED LINE) POOL 8 RECTIFIED PHOTO (WA-5-60) 04 AUGUST 1938
VECTOR OVERLAY (YELLOW LINE) POOL 8 RECTIFIED PHOTO (DQA-136) 22 NOVEMBER 1974

Produced by St. Paul District, GIS Center, U.S. Army Corps of Engineers April 1994.

Plate 4. Upper Pool 8 Land/Water Changes 1938-89

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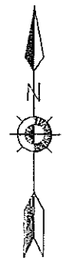
2718000 ft
2719000 ft
2720000 ft
2721000 ft

0322000 ft
0321000 ft
0320000 ft
0319000 ft



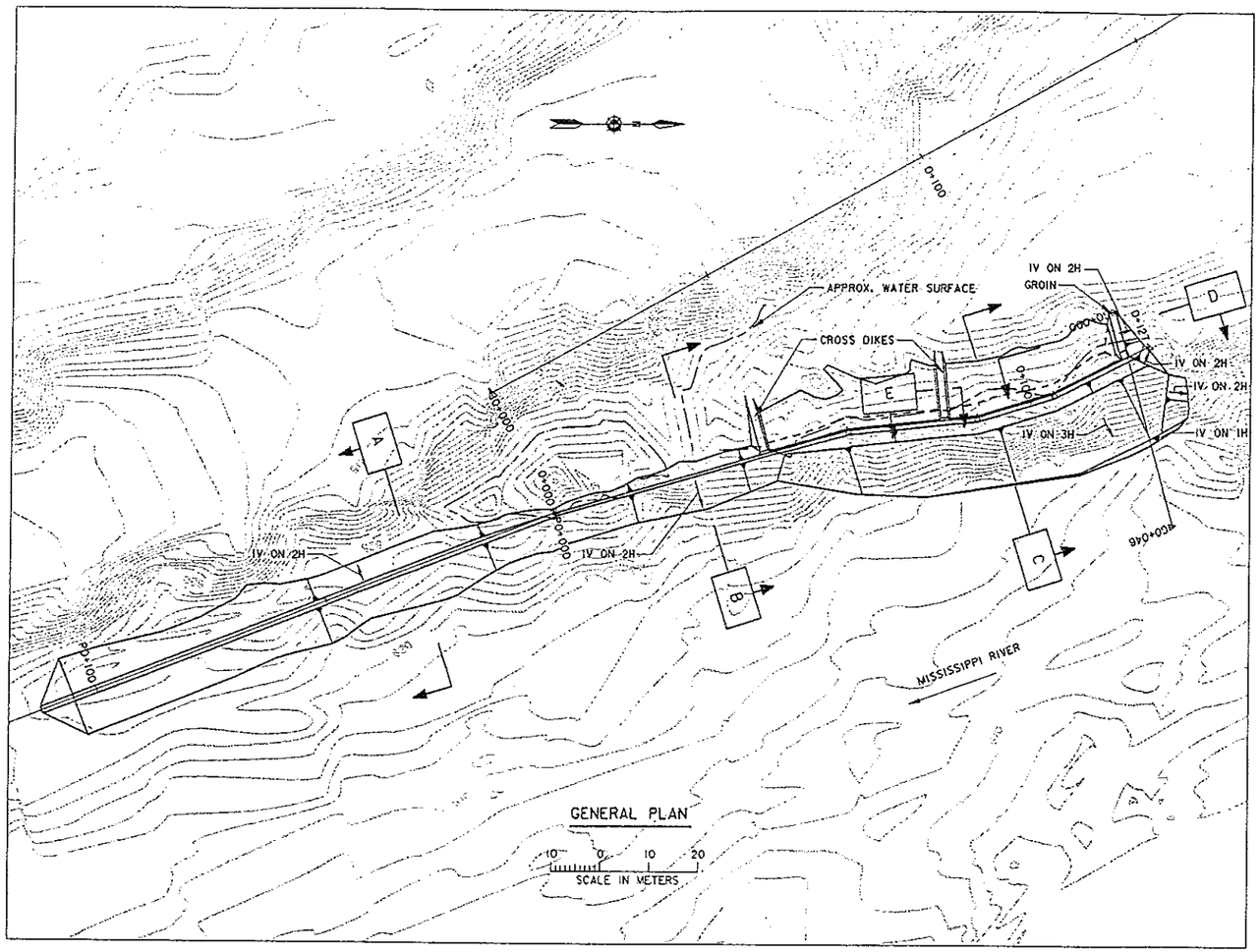
500 0 500 1000 FEET

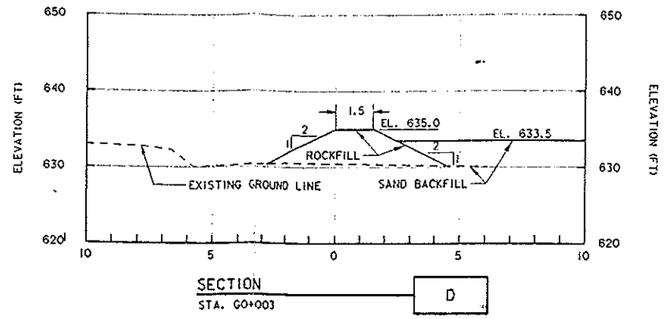
PHOTO BASE ..... POOL 8 (42-8) 9/15/89
LOCK & DAM 7 TAILWATER - 631.77
LACROSSE GAUGE - 631.66
VECTOR OVERLAY ..... YELLOW SHORELINE (4-021) 7/10/73
LOCK & DAM 7 TAILWATER - 631.25
LACROSSE GAUGE - 630.92
VECTOR OVERLAY ..... RED SHORELINE (WA-5-600) 8/4/38
LOCK & DAM 7 TAILWATER - 631.73
LACROSSE GAUGE - 631.01

COORDINATE SYSTEM ..... STATE PLANE MINNESOTA SOUTH
GEODETIC DATUM ..... NORTH AMERICAN 1927
ELLIPSOID ..... CLARKE 1866

Produced by St. Paul District GIS Center
U.S. Army Corps of Engineers, March 1994

Plate 5. Smith Slough Land/Water Changes 1938-89





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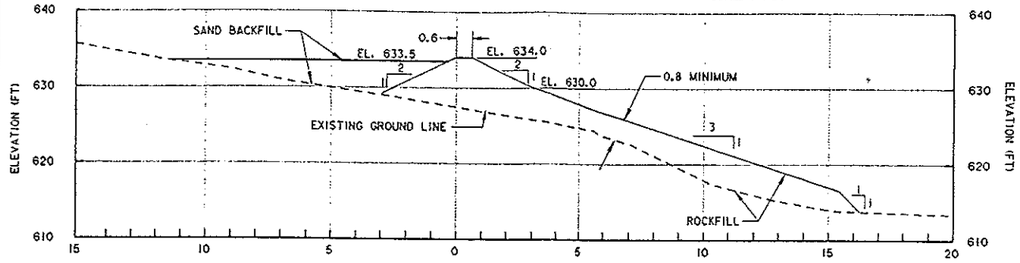

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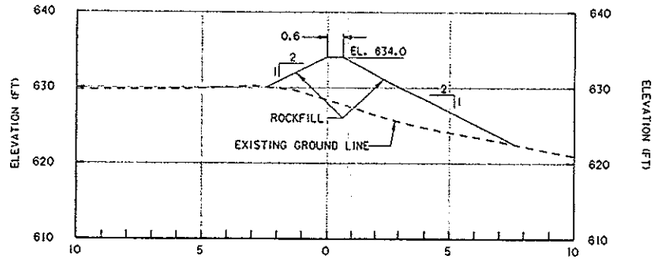

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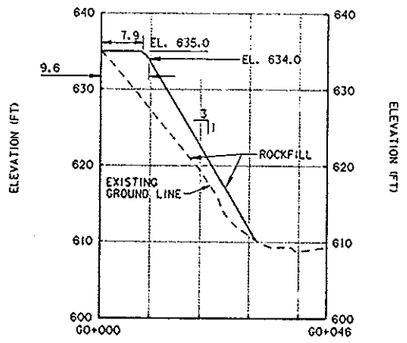
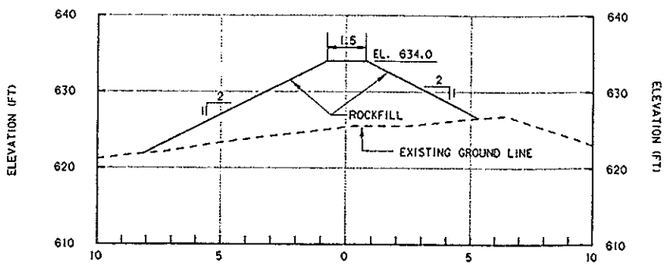


GROIN PROFILE



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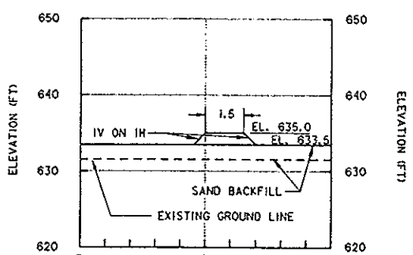

SECTION
CROSS DIKE E

NOTES:
1. ALL UNITS ARE IN METERS UNLESS INDICATED OTHERWISE.
2. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

AE APPROVING OFFICIAL:

REPORT
EAST CHANNEL
HREP - MISSISSIPPI RIVER
EAST CHANNEL LACROSSE, WISCONSIN
HABITAT REHABILITATION
I-90 BAY
PLAN, PROFILE AND SECTIONS

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CAD FILE NAME: M105R002.DGN
SPEC NO: DACW37-95-B-0000
DRAWING NUMBER: XXXXXXXX
SHT XX OF XX

Plate 6

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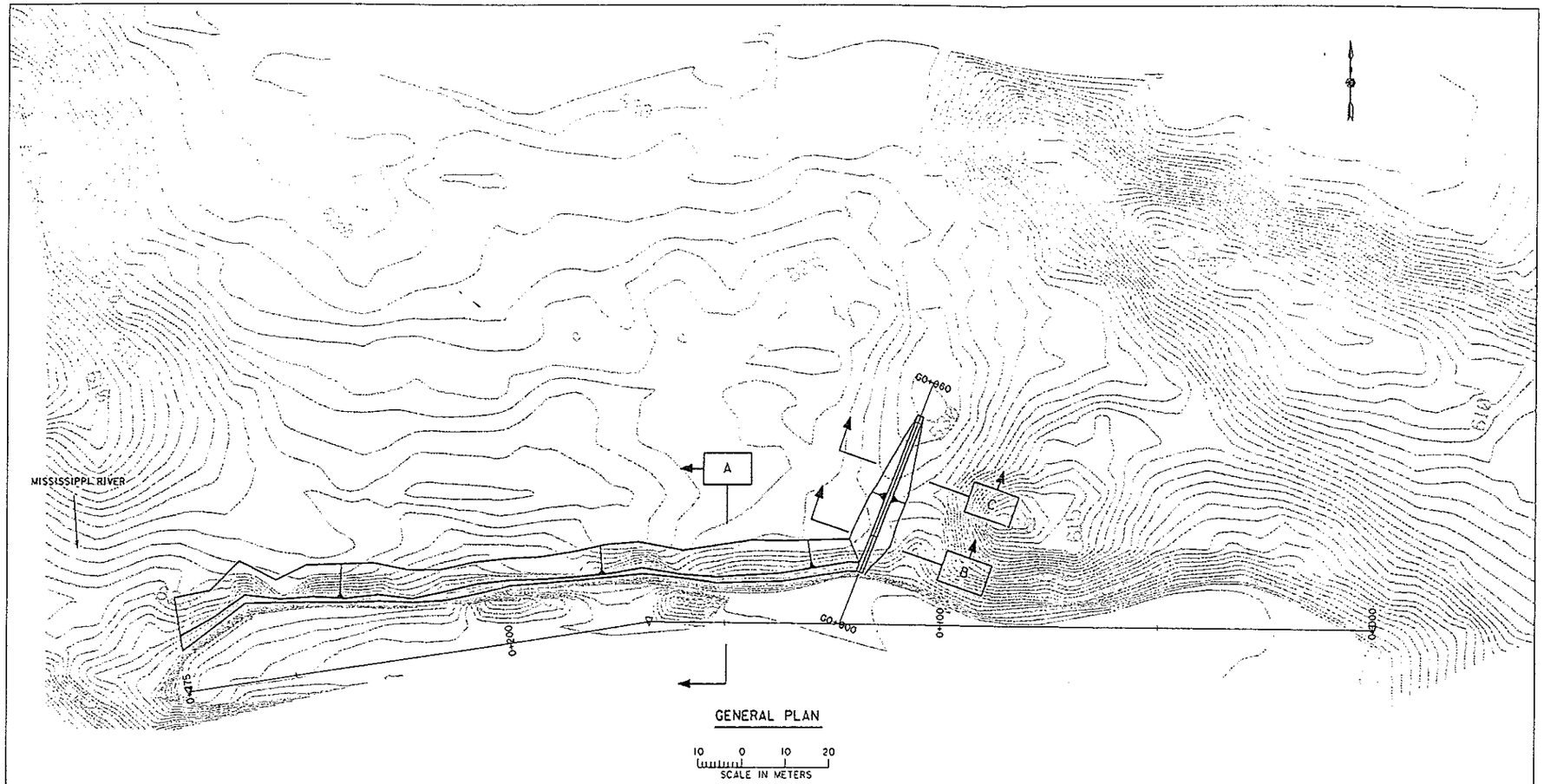
HYD
HYDR
EOTECH
IR ENG
MEA



GENERAL PLAN

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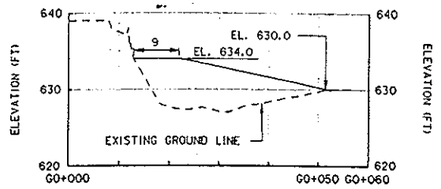
SCALE IN METERS



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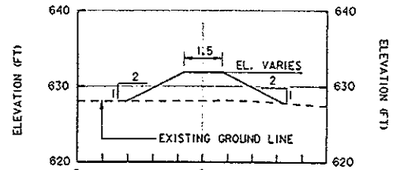

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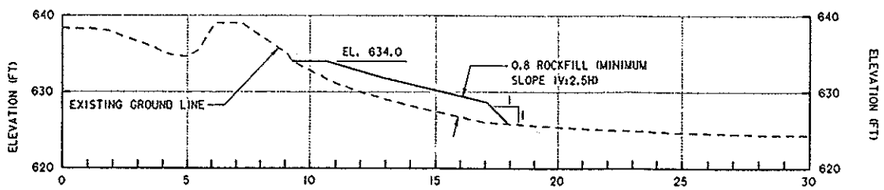

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2. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

AE APPROVING OFFICIAL:

REPORT
EAST CHANNEL
HREP - MISSISSIPPI RIVER
EAST CHANNEL LACROSSE, WISCONSIN
HABITAT REHABILITATION
MINNESOTA ISLAND
PLAN, PROFILE AND SECTIONS

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PE-H: DESIGNED:; CHECKED:
DATE: XXXX

CAD FILE NAME: MI05R000.DGN
SPEC NO: DACW37-95-B-0000
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GEN ENG
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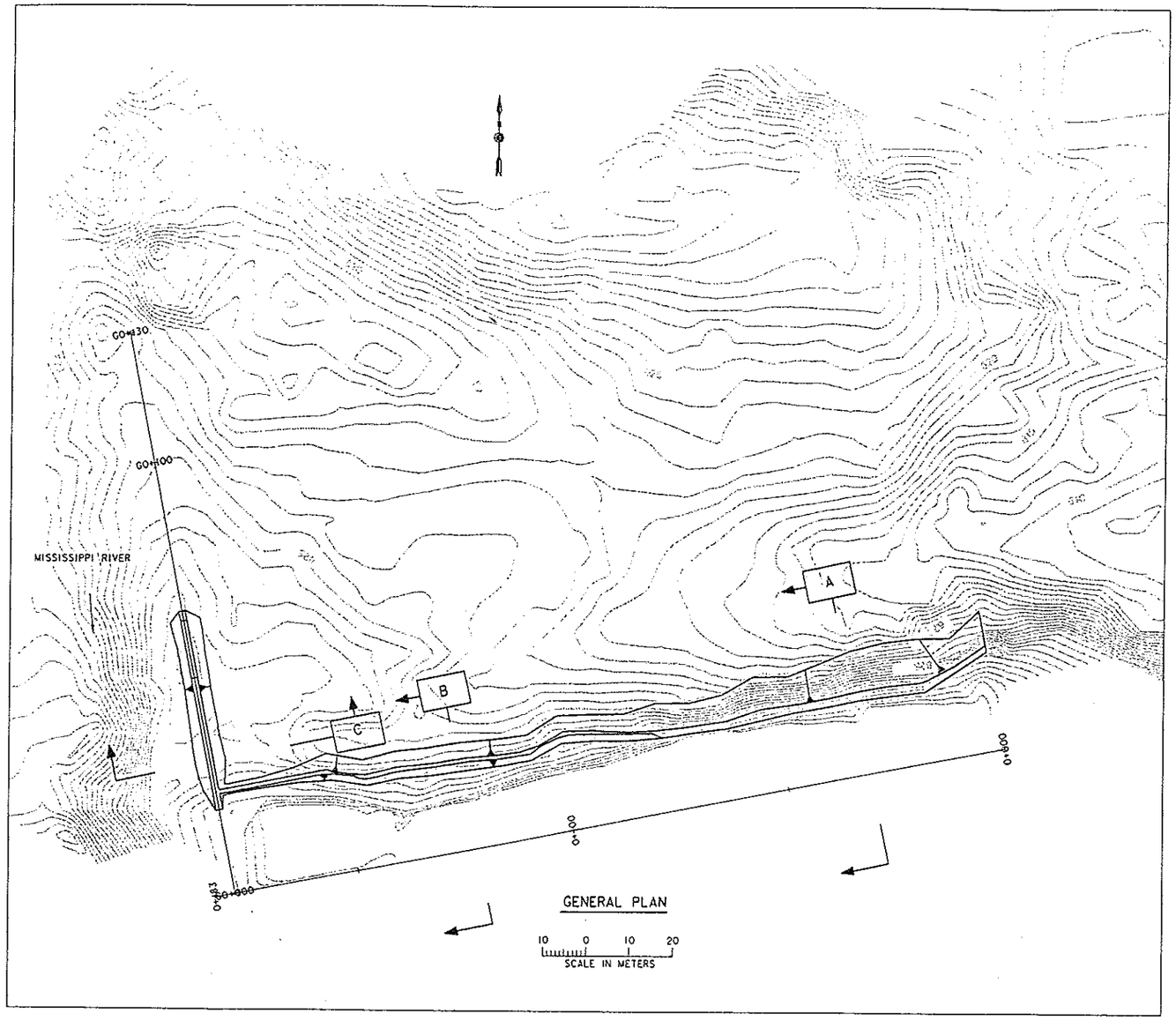
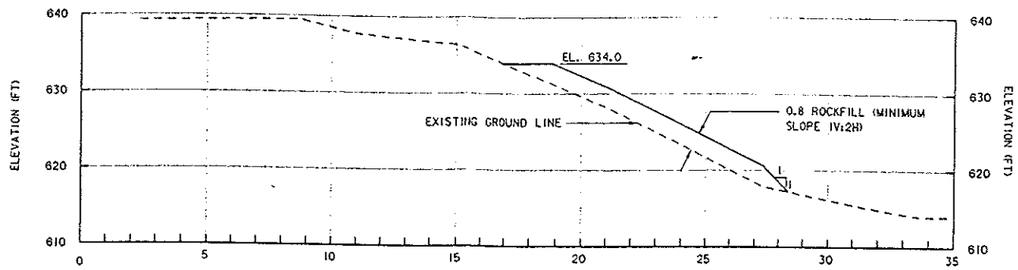
GEOTECH
STR ENG
MEA

Plate 7





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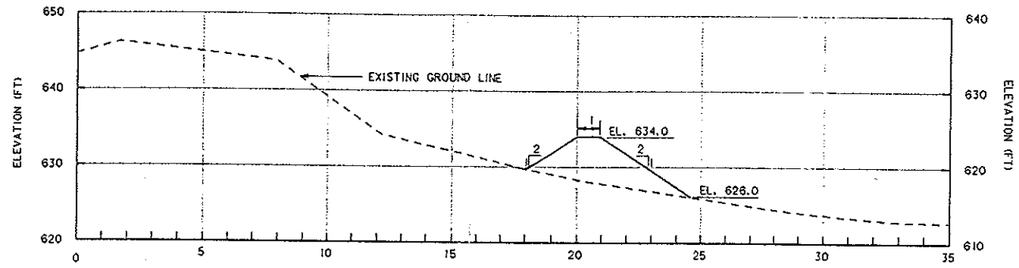

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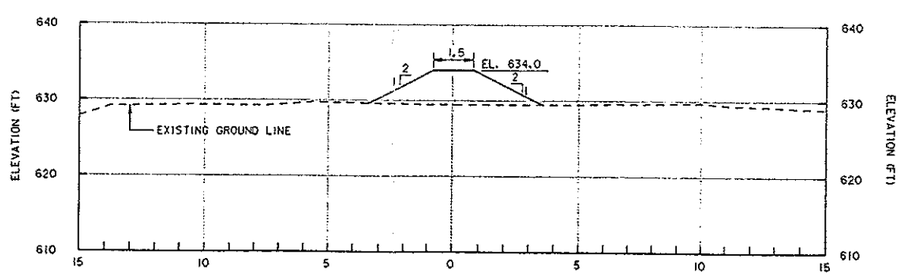

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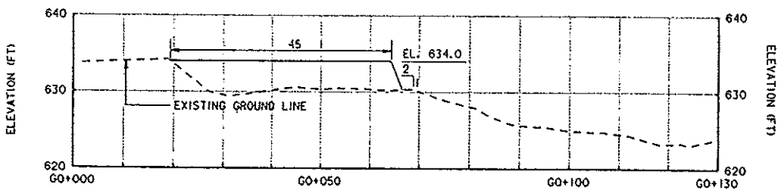

GROIN PROFILE

NOTES:
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2. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

AE APPROVING OFFICIAL:

REPORT
EAST CHANNEL
HREP - MISSISSIPPI RIVER
EAST CHANNEL — LACROSSE, WISCONSIN
HABITAT REHABILITATION
LOWER ISLAND 98
PLAN, PROFILE AND SECTIONS

PE-D	DESIGNED: GVF/CAS		
	CHECKED:		
	DRAWN: dae		
PE-H	DESIGNED:		
	CHECKED:	CAD FILE NAME: MI05ROO1.DGN	DRAWING NUMBER: XXXXXXXX — SHT XX OF XX
DATE: XXXX		SPEC NO: DACW37-95-B-0000	

Plate 8

ATTACHMENT 2

COST ESTIMATE

DETAILED COST ESTIMATE

TABLE OF CONTENTS

DETAILED COST ESTIMATE

E.1 GENERAL

1. This appendix contains the detailed project cost estimate prepared for the construction of the East Channel HREP project on the Mississippi River south of Interstate Highway 90 in Pool 8. The estimate has been prepared using the MCACES computer program. Results are presented on a spread sheet showing costs and contingencies. This write-up is prepared to explain cost relationships and development of the contingencies. Guidance for preparation of this appendix was obtained from ER 1110-2-1150, Engineering and Design for Civil Works Projects, and ER 1110-2-1302, Civil Works Cost Engineering. The estimate is in the Civil Works Breakdown Structure format as directed by ER 1110-2-1302.

E.2 PRICE LEVEL

1. Estimated costs are based on May 1995 price levels. Indirect costs including overhead, profit, and bond have been added to the prices to obtain the unit costs. These costs are considered fair and reasonable to a prudent and capable contractor. Estimated costs on the Total Project Cost Summary Sheet are rounded to the nearest $1,000.00.

E.3 PROJECT DESCRIPTION

1. The project consists of the placement of stone protection material to enhance and protect wildlife habitat. There are three separate work sites. All three are close together and about the same distance from the loading facility. All three have easy access from the water with no access dredging required. Stone protection material is placed in rock mounds or on the bank slopes in layers generally not less than 1 meter (34 inches) thick.

2. No shaping of the banks or clearing will be required. A small amount of mechanical dredging will be required to obtain sand fill for closure of a breach prior to placing the stone protection material.

E.4 CONSTRUCTION METHODS

1. There is a loading dock about 3.2 kilometers (2 miles) from the work sites on the downstream side of Dam 7. Stone protection materials can delivered to the loading dock by dump truck. It is assumed that the stone protection materials will be stockpiled. Front end loaders will be used to transport the material from the stockpiles to the empty barges. It is possible that the barges could be loaded directly from the dump trucks by backing the trucks onto the barge and end-dumping. Barges can be fully loaded and transported adjacent to the placement areas.

2. The project layout has been designed such that nearly all of the stone protection material can be readily placed with a hydraulic excavator setting on a barge adjacent to the material barge. Access to the site is readily available and normal construction procedures will be used.

E.5 COST RELATIONSHIPS

1. It is assumed that all of the major features of work will be accomplished by a general contractor. Costs for mobilization and demobilization are estimated and included as an item of work. All costs, except for the material purchase costs, are based on a specific crew and duration or productivity rate for each item of work.

2. The stone protection material for all three sites will have the same requirements. Access to each of the work sites and distance from the loading dock to each of the work sites are similar. Specific design requirements for rock placement are also similar for each of the placement sites. Therefore, the costs to purchase, transport and place stone protection materials at each of the sites is identical.

3. Discussions with local contractor has revealed that direct costs for the purchase of large quantities of material are generally marked up less than the other direct costs to the contractor such as labor and equipment costs. Therefore, in this estimate, the cost for the purchase of the stone protection materials is not marked up for field overhead and is marked up at a lessor rate for profit.

E.6 CONTINGENCIES

1. Generally contingencies are based on:

   a. 5% to 20% for unit pricing,

   b. 10% to 20% for unanticipated work,

   c. 5% to 10% for quantities.

2. Feature 06, Fish and Wildlife Facilities.

a. The cost for mobilization is based on the assumption that a local contractor would be awarded the contract. If a contractor had to mobilize from a location farther away, mobilization costs would be higher. To account for this, a contingency of 35% was assigned to this item of work.

b. The cost for the purchase of the stone protection material is based on two quotes obtained from suppliers who have supplied materials for this type of project in the past. A cost close to the higher quote is used in this estimate. Since the unit cost is reliable, the contingency assigned to this item of work is 10%.

c. The cost for the placement of the stone protection material is based on work analysis. Unknowns include the type and ownership cost of equipment, production rates and durations for the placement of the stone protection material, and actual site conditions. Contingencies for this item of work are generally assigned at 20%. There is one area, Minnesota Island, where the some of the stone protection material may need to be handled twice if the excavator can not reach to all of the placement area. To account for this, the contingency for this item is set at 30%.

3. Feature 30, Planning, Engineering and Design. Costs and contingencies are provided by each separate engineering function and are based on experience with similar type projects.

4. Feature 31, Construction Management. Costs and contingencies are based on experience with similar type projects.

E.7 ATTACHMENTS

1. The first attachment is the Total Project Cost Summary. This shows the fully funded project cost estimate. It is prepared in accordance with Project Management guidelines and includes costs for construction, engineering and design, and construction management along with the appropriate contingencies. All costs are indexed to the end of the fiscal year and then to the mid point of construction. For this project, there will be no Non-Federal costs and no real estate costs since the project will be constructed on federally owned property.

2. The second attachment is the backup to the Total Project Cost Summary. This show detailed unit costs and detailed contingencies. The unit costs have been determined by preparing a detailed estimated using the MCASES cost engineering software.

TOTAL - EAST CHANNEL HABITAT REHABILITATION ENHANCEMENT - DPR **** TOTAL PROJECT COST SUMMARIES ****

PROJECT: EAST CHANNEL - HREP PREPARED BY: GARY SMITH , CENCS-PE-D(EF)

LOCATION: MISSISSIPPI RIVER - POOL 8 SELECTED PLAN

DATE PREPARED: 05 MAY 1995 REVISED 13 SEPTEMBER 1995 REVIEWED AND APPROVED BY: ALLEN L. GEISEN , CHIEF, PE-D(EF)

ACCOUNT NUMBER	ITEM DESCRIPTION	ESTIMATED COST($) (EPD)	CONTINGENCY AMOUNT($)	%	TOTAL EST COST (EPD)	OMB INDEX TO %	SEPT 30,1995 AMOUNT	MID POINT OF FEATURE	OMB (%) INDEX (+/-)	INDEXED COST AMOUNT ($)	INDEXED CONTG. AMT. ($)	FULLY FUNDED COST
06---	FISH AND WILDLIFE FACILITIES	364,000	58,000	16%	422,000	1.5%	428,000	MAY 97	5.50%	390,000	62,000	452,000
	TOTAL CONSTRUCTION COSTS ======>	364,000	58,000	16%	422,000		428,000			390,000	62,000	452,000
01---	LANDS AND DAMAGES	0	0									
30---	PLANNING, ENGINEERING AND DESIGN	58,000	6,000	10%	64,000	2.2%	65,000	JUNE 96	3.80%	62,000	6,000	68,000
31---	CONSTRUCTION MANAGEMENT	25,000	3,000	12%	28,000	2.2%	29,000	MAY 97	8.00%	28,000	3,000	31,000
	TOTAL PROJECT COSTS =======>	447,000	67,000		514,000		522,000			480,000	71,000	551,000

NOTES:

1. Prices are at May 1995 price levels.

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
06.-.-.--	FISH AND WILDLIFE FACILITIES							
06.03.--.--	WILDLIFE FACILITIES AND HABITAT							
06.03.01.--	MOBILIZATION/DEMOBILIZATION							
06.03.01.--	MARINE MOBILIZATION	JOB	1	34,639	34,639	12,124	35.00%	3
06.03.73.--	HABITAT AND FEEDING FACILITIES							
06.03.73.02	1 INTERSTATE I-90B							
06.03.73.02	1 ROCK							
06.03.73.02	1 MATERIAL PURCHASE	M3	4,923	27.62	135,978	13,598	10.00%	1,3,4,8
06.03.73.02	2 LOAD, HAUL, PLACE	M3	4,923	12.83	63,160	12,632	20.00%	1,2,7
	TOTAL ROCK	M3	4,475	44.50				
06.03.73.02	2 SAND TO CLOSE BREACH							
06.03.73.02	1 LOAD, HAUL, PLACE	M3	750	19.25	14,440	2,888	20.00%	1,7
06.03.73.02	2 LOWER ISLAND 98							
06.03.73.02	1 ROCK							
06.03.73.02	1 MATERIAL PURCHASE	M3	1,474	27.62	40,717	4,072	10.00%	1,3,4,8
06.03.73.02	2 LOAD, HAUL, PLACE	M3	1,474	12.83	18,913	5,674	30.00%	1,2,7
	TOTAL ROCK	M3	1,340	44.50				
06.03.73.02	3 MINNESOTA ISLAND							
06.03.73.02	1 ROCK							
06.03.73.02	1 MATERIAL PURCHASE	M3	1,397	27.62	38,590	3,859	10.00%	1,3,4,8
06.03.73.02	2 LOAD, HAUL, PLACE	M3	1,397	12.83	17,925	3,585	20.00%	1,2,7
	TOTAL ROCK	M3	1,270	44.50				
	SUBTOTAL CONSTRUCTION COSTS				$364,362			
	SUBTOTAL CONTINGENCIES		16.0%			$58,431		
	TOTAL 06. FISH AND WILDLIFE FACILITIES					$422,793		

REASONS FOR CONTINGENCIES

1. QUANTITY UNKNOWNS
2. SITE CONDITIONS
3. HAUL DISTANCE
4. UNIT PRICES
5. LEGAL COSTS
6. LAND PRICES
7. PRODUCTION/DURATION
8. MATERIALS
9. INSIGNIFICANT AMOUNT
10. NOT APPLICABLE

NOTES

A. UNIT PRICES AT MAY 1995 PRICE LEVEL.
B. EARTHWORK QUANTITIES ARE INCREASED 15% TO ACCOUNT FOR LOOSE VOLUME.

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
30.-.-.-	PLANNING, ENGINEERING AND DESIGN							
	PREPARE PLANS AND SPECIFICATIONS	JOB	1	40,000	40,000	4,000	10.00%	7
	CONSTRUCTION ENGINEERING	JOB	1	18,000	18,000	1,800	10.00%	7
	SUBTOTAL CONSTRUCTION COSTS				$58,000			
	SUBTOTAL CONTINGENCIES		10.0%			$5,800		
	TOTAL 30. PLANNING, ENGINEERING AND DESIGN					$63,800		

REASONS FOR CONTINGENCIES

1. QUANTITY UNKNOWNS
2. SITE CONDITIONS
3. HAUL DISTANCE
4. UNIT PRICES
5. LEGAL COSTS
6. LAND PRICES
7. PRODUCTION/DURATION
8. MATERIALS
9. INSIGNIFICANT AMOUNT
10. NOT APPLICABLE

NOTES

A. UNIT PRICES AT MAY 1995 PRICE LEVEL.

*Life Cycle 100 Yrs
*Rate of Return 8.500%

ITEM	ESTIMATED O&M CYCLE	O&M and MAJOR REPLACEMENT COSTS QUANTIT	UNIT	UNIT PRICE	AMOUNT	EQUIVALENT AVERAGE ANNUAL O&M / MAJOR REPLACEMENT VALUE PRESENT VALUE	ANNUAL COST	COMMENTS
06.-.-.- Fish and Wildlife Facilities								
Interstate I90-B								
Riprap		4,475	M3	58.86				
Replace	10	448	M3	58.86	26,339	20,881	1,775	
Control Vegetation Growth	2	1	JOB	1,463	1,463	8,254	702	0.33 per M3
Clear Vegetation	10	1	JOB	8,780	8,780	6,960	592	1.96 per M3
Lower Island 98								
Riprap		1,340	M3	58.86				
Replace	10	134	M3	58.86	7,887	6,253	532	
Control Vegetation Growth	2	1	JOB	438	438	2,472	210	0.33 per M3
Clear Vegetation	10	1	JOB	2,629	2,629	2,084	177	1.96 per M3
Minnesota Island								
Riprap		1,270	M3	58.86				
Replace	10	127	M3	58.86	7,475	5,926	504	
Control Vegetation Growth	2	1	JOB	415	415	2,343	199	0.33 per M3
Clear Vegetation	10	1	JOB	2,492	2,492	1,975	168	1.96 per M3
TOTAL ESTIMATED O&M COSTS						57,149	4,859	
						57,149	4,859	

ACCOUNT CODE	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES AMOUNT	CONTINGENCIES PERCENT	REASON
31.-.-.-	CONSTRUCTION MANAGEMENT (S&I)							
31.23.-.--	CONSTRUCTION CONTRACTS							
31.23.11.--	SUPERVISION AND ADMN	JOB	1	25,000	25,000	2,500	10.00%	7
	SUBTOTAL CONSTRUCTION COSTS				$25,000			
	SUBTOTAL CONTINGENCIES		10.0%			$2,500		
	TOTAL 31. CONSTRUCTION MANAGEMENT (S&I)					$27,500		

REASONS FOR CONTINGENCIES

1. QUANTITY UNKNOWNS
2. SITE CONDITIONS
3. HAUL DISTANCE
4. UNIT PRICES
5. LEGAL COSTS
6. LAND PRICES
7. PRODUCTION/DURATION
8. MATERIALS
9. INSIGNIFICANT AMOUNT
10. NOT APPLICABLE

NOTES

A. UNIT PRICES AT MAY 1995 PRICE LEVEL.

East Channel, I90, L98, MI
Habitat Rehabilitation
Enhancement Project
Pool 8, Mississippi River

Designed By: St. Paul District
Estimated By: St. Paul District

Prepared By: St. Paul District

Preparation Date: 03/29/95
Effective Date of Pricing: 03/29/95

Sales Tax: 6.50%

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

This estimate was originally prepared on 3/29/95. An update was requested by Gary Palesh based on new quantities and index factors provided on 4/13/95. The unit cost of the rock purchase price is changed from $16.20 per cy to $19.00 per cy based on the quotes. From this estimate, Lotus summary sheets will be prepared for the selected plan.

This project includes several features designed to enhance habitat near I90 in the Mississippi River. Previous estimates were done for dredging features called Smith Slough and French Slough. These features have been deleted from the project.

The current project includes 3 features, all mainly rock placement. One feature has an alternative. Consequently, the prepared estimate includes both alternatives to the I90 plan. From this information, the selected plan can be determined.

A description of each feature and plans and sections have been provided. All features have common characteristics. All are close together and about the same distance from the loading facility. All have easy access from the water with no access dredging required. All have rocks in relatively thick sections, 32" or more.

Rock will be loaded at the Lock 7 loading dock, located about 2 miles upstream. Due to deep water, barges can be fully loaded, assume 220 tons per barge. At 4 miles each way, barge can deliver 81 cy/hr. Placement rate will be less than this.

Placement rate. From field data collected by Jeff Gulan regarding Polander Lake, placement rate under ideal condition is 54 to 77 cy/hr. For this job, placement is generally very easy and may be as high as 77 cy/hr. For this estimate, assume a rate of 60 cy/hr which include time to travel and set up at the next site. Also, some of the quantities for some sites is small. Assume this rate for all sites, since they are all similar.

Assume that the rock is stockpiled at the site and loaded onto barges by a loader. At Polander Lake, the stockpile had consolidated to the point where the Contractor was having difficulty getting his loader scoop loaded. They had to have a dozer on top of the pile pushing rock into the loader bucket. Assume that this doesn't happen here. In fact, it is possible that much of the rock can be loaded onto the barges by backing the trucks onto the barges and dumping.

Quantities. Past experience has shown that when the foundation is very soft, the actual quantity of rock placed can increase dramatically due to displacement of the foundation by the rock at the base of the section. Gary Palesh indicated that this would not be the case here since much of the rock in the groins is placed on an old dam structures, much of the rock is placed on the slope. Assume a sand solid bottom with 10% lost due to out of section.

Regarding the groin for Island 98, it appears that the groin is to far away from deep water to reach by excavator. Gary Palesh indicated that the groin would be moved to deeper water if this was a problem. The same is true for the bank protectio near the 6+00 end. Therefore, assume no access dredging,

no light loads.

I-90 includes filling in an area on the bank with sand. The sand would come from the river bottom near the site. In plans and specs, a specific site will be determined. Assume for now that it is less than 1 mile away. The quantity for the sand is 1000 cy. That is only 6 barge loads.

Rock Material Prices. Prices could be as low as $8.50 per ton (Brennan paid for Dakota in pool 7) or as high as $15.50 per ton (Brennan paid for Polander, in Pool 5A). On 3-30-95, the following 2 quotes were received:
Tom at Wilber Lime, 608-323 3308, $9.00/ton material
$6.00/ton haul

$15.00/ton deliverded to Lock No. 7

Scott Mathey at Mathey, 608-783-6411, $10.00 to $11.00 per ton delivered.

For now assume $12.00 per ton, $16.20 per cubic yard.

Since this estimate was prepared, this project has been selected to be converted to metric. The quantities, units, and unit costs in the Cost Engineering Appendix have been converted to metric. This MCACES estimate will not be converted to metric.

	QUANTITY	UOM	DIRECT	DISTRIBU	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
04 Mob/Demob	1.00	JB	27,552	0	1,378	2,314	3,124	271	34,638	34638.36
20 Interstate Bay, I-90A										
20.10 Rock										
20.10.10 Material Purchase	3008.50	CY	57,162	0	0	4,573	1,235	561	63,531	21.12
20.10.20 Load, Haul , Place	3008.50	CY	23,485	0	1,174	1,973	2,663	231	29,526	9.81
TOTAL Rock	2735.00	CY	80,647	0	1,174	6,546	3,898	792	93,057	34.02
20.20 Sand to Close the Breach	1000.00	CY	11,709	0	585	984	1,328	115	14,721	14.72
TOTAL Interstate Bay, I-90A	1.00	JB	92,356	0	1,760	7,529	5,226	907	107,778	107777.87
30 Interstate Bay, I-90B										
30.10 Rock										
30.10.10 Material Purchase	5060.00	CY	96,140	0	0	7,691	2,077	944	106,852	21.12
30.10.20 Load, Haul , Place	5060.00	CY	39,500	0	1,975	3,318	4,479	388	49,660	9.81
TOTAL Rock	4600.00	CY	135,640	0	1,975	11,009	6,556	1,332	156,512	34.02
30.20 Sand to Close the Breach	1000.00	CY	11,709	0	585	984	1,328	115	14,721	14.72
TOTAL Interstate Bay, I-90B	1.00	JB	147,349	0	2,560	11,993	7,884	1,447	171,233	171233.21
40 Lower Island 98										
40.10 Rock										
40.10.10 Material Purchase	1842.50	CY	35,008	0	0	2,801	756	344	38,908	21.12
40.10.20 Load, Haul , Place	1842.50	CY	14,383	0	719	1,208	1,631	141	18,083	9.81
TOTAL Rock	1675.00	CY	49,391	0	719	4,009	2,387	485	56,991	34.02
TOTAL Lower Island 98	1.00	JB	49,391	0	719	4,009	2,387	485	56,991	56990.74
50 Minnesota Island										
50.10 Rock										
50.10.10 Material Purchase	1694.00	CY	32,186	0	0	2,575	695	316	35,772	21.12
50.10.20 Load, Haul , Place	1694.00	CY	13,224	0	661	1,111	1,500	130	16,625	9.81
TOTAL Rock	1540.00	CY	45,410	0	661	3,686	2,195	446	52,397	34.02

	QUANTITY	UOM	DIRECT	DISTRIBU	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
TOTAL Minnesota Island	1.00	JB	45,410	0	661	3,686	2,195	446	52,397	52397.45
TOTAL East Channel, I90, L98, MI	1.00	EA	362,057	0	7,078	29,531	20,816	3,556	423,038	423037.63

ATTACHMENT 3

SECTION 404 (b) (1) EVALUATION

SECTION 404(b)(1) EVALUATION
EAST CHANNEL HABITAT REHABILITATION AND ENHANCEMENT PROJECT
POOL 8, UPPER MISSISSIPPI RIVER
LA CROSSE COUNTY, WISCONSIN AND WINONA COUNTY, MINNESOTA

I. PROJECT DESCRIPTION

a. Location

The project is in the upper five kilometers of pool 8 on the Upper Mississippi River (Plate 1, Main Report). Five separate small projects were combined because they are similar in nature and close together. Considering them as one project is a more efficient use of planning and construction funds. Two of the project features were dropped from the project because it was found they were unnecessary at this time for rehabilitation or enhancement of the resource.

b. General Description

The proposed action is part of the Habitat Rehabilitation Program being implemented on the Upper Mississippi River. The proposal includes three separate features, rehabilitation and extension of an eroding peninsula at I-90 Bay and stabilization of the eroding upstream ends of Lower Island 98 and Minnesota Island. Sand and rock fill would be used to complete the work.

I-90 Bay

During the construction of I-90, a channel between an island and the right descending bank of the Upper Mississippi River was filled creating a peninsula and bay. The bay has been shown to be used by walleye for staging. This project feature includes placement of sand and rock fill to plug a breach in the peninsula, extend it 105 meters and protect it from erosion.

Lower Island 98

Lower Island 98 was created sometime between 1915 and 1930 when a breach occurred downstream of a closing dam between what was Island 98 and the left bank of the East Channel. That closing dam is presently beneath the I-90 bridge where it crosses the East Channel. The upper portion of East Channel has rapidly accreted, making the upper portion of Island 98 more a peninsula than an island. The densely-wooded Lower Island 98 is eroding at the upstream end where the breach first began. A small sandy peninsula is forming on the East Channel side of the island.

Minnesota Island

Prior to the construction of the locks and dams, Minnesota Island was armored with rock riprap along its main channel shore. The 1894 Mississippi River Commission Survey shows a rock-lined Minnesota Island with wing dams protruding towards the main channel. The riprap protection continued upstream as a closing dam across East Channel and farther upstream as rock armor along the left bank of the East Channel, across from Island 98. This rock work was done as part of the 4- and 6-foot Channel Projects (work authorized by Congress to ensure 1.3- and 2-meter channel depths respectively). Comparing maps between 1915 and 1930, Minnesota Island shows an increase in width, expanding towards the channel beyond its rock armoring.

The two small islands that appear west of the upstream tip of Minnesota Island on the 1914 map are part of the island on the 1930 Brown Survey. The channelward side of the island reaches nearly 215 meters beyond the rock protection that was placed in the late 1800's. Accretion between the wing dams could have accounted for the expansion of Minnesota Island. However, the 9-Foot ChannelEnvironmental Impact Statement[1] shows regular dredging activity at river mile 701 from records kept between 1935 through the early 1950's (river mile 701 is 1,128 kilometers above the confluence of the Mississippi and Ohio Rivers near Cairo, Illinois). It is possible that between 1915 and 1930, dredged material was placed on Minnesota Island, increasing the breadth of its upstream end. This upstream end is eroding and, coupled with the height of the island, has resulted in the development of steep, unstable sandy banks.

c. Authority and Purpose

The authority for this report is in Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The East Channel area provides diverse habitats for a variety of wildlife and fish species.

Over the 50-year life of the project, the action would preserve about 4.45 hectares of aquatic habitat and about 4.45 hectares of wooded island habitat.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material

Sand and stone fill material would be used. The sand would be a medium-to coarse-grained material. The stone would be quarried limestone with a minimum size of 7 kilograms and a maximum size of 180 kilograms. The gradation curve developed calls for the heaviest rock to be between 45 and 135 kilograms, 50 percent of the rock finer than between 20 and 55 kilograms pounds and the lightest 5 percent between 2.25 and 7 kilograms.

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[1]The 9-Foot Channel is a Congressionally-authorized project requiring the Corps of Engineers to ensure water depths of about 3 meters for uninterrupted navigation.

(2) Quantity and Source of Material

About 7,085 cubic meters of rock and 750 cubic meters of main channel or backwater sand would be used for the project. Table 404-1 is a list of the sites, quantities and the area of channel filled for each of the project features. Preparatory dredging to gain access to the construction sites will not be required.

e. Description of Proposed Fill Placement Sites

The placement sites are along the main channel in upper pool 8 of the Upper Mississippi River.

Table 404-1 Project Features and Quantities

Site	Quantity of Fill	Area
I-90 Bay		
Protection	2,269 cubic meters	1,400 square meters
Extension	2,206 cubic meters	1,487 square meters
Lower Island 98	1,340 cubic meters	2,045 square meters
Minnesota Island	1,270 cubic meters	2,045 square meters

f. Timing and Duration of Fill Activities

The construction would take place during the 1998 construction season.

g. Description of Disposal Method

The material will be hauled in and placed mechanically. Marine equipment would be used for each of the project features including a towboat, cranebarge, and material barges.

II. FACTUAL DETERMINATIONS

a. Physical Substrate Determination

(1) Substrate Elevation, Slope and Composition

The peninsula forming the I-90 Bay rapidly drops off at about a 1-meter vertical to 2-meter horizontal slope; the 6-meter-deep main channel is immediately adjacent. The slope face

would be stabilized by rock riprap, but the shoreline would not be graded to provide a consistent slope. Instead, sand would be placed between the shore and the rock berm along the upstream end where the berm does not meet the shoreline. The upstream end of the rock berm would be keyed into the bank; a rock groin would extend from the berm back into the island to prevent erosion around the backside of the rock.

The two islands have relatively steep slopes along the eroding sand face. A combination of rock riprap and groins would also be used to stabilize the islands.

(2) Dredged/Fill Material Movement

The rock and sand fill that will be used is not expected to move after placement.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) General Water Chemistry

The rock fill would have a minimal effect on the area's water chemistry.

(2) Current Patterns and Circulation

The rock and sand fill placed to plug the breach in the peninsula would directly affect current patterns and circulation in the bay. The main channel water that is now flowing into the bay would be cut off; only discharges that allowed the peninsula to be overtopped (634 feet above mean sea level (msl), 1912 adjustment (193 meters)) would reach the bay over the peninsula. Eddy flow in the bay would continue. The rock placed to protect the islands would not affect current patterns and circulation.

(3) Sedimentation Patterns

The proposed repair of the breached peninsula would reduce the amount of sediment introduced into the I-90 Bay, thereby reducing sedimentation there. The island and peninsula bank protection project features would not change sedimentation patterns, but would reduce erosion and stabilize those landforms. The amount of erosion reduction is not significant when compared to the sediment load of the Upper Mississippi River, but is important when considering the loss of island and protected bay habitat.

c. Suspended Particulate/Turbidity Determination

(1) Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

The placement of the rock and sand would temporarily increase the turbidity and suspended particulates in the immediate project area. Any increase that would occur would be

small and quickly dissipate because of the coarse fill material and mechanical placement techniques.

(2) Effects on Chemical and Physical Properties of the Water Column

Because of the use of clean, coarse material and mechanical placement techniques, only temporary and minimal impacts are expected on the physical and chemical properties of the water column.

(3) Actions Taken to Minimize Impacts

Marine mechanical placement would be used so construction roads and grading of the existing wooded bank would not be necessary.

d. Contaminant Determinations

Clean rock and coarse sand fill with mechanical placement techniques will minimize the introduction, relocation or increase of the contaminants in the river.

e. Aquatic Ecosystem and Organism Determinations

1. Aquatic Ecosystem

The proposed action would convert the peninsula and island banks from sand to rock. This would cause the permanent displacement of benthic organisms currently found in the project area. The rock would provide a different habitat for benthic macroinvertebrates, increasing the habitat diversity in the project area.

2. Threatened and Endangered Species

Because the sites are all on the Upper Mississippi River, they are within the range of the following Federally-listed threatened and endangered species:

Species	Status
Bald eagle (*Haliaeetus leucocephalus*)	Threatened
Peregrine falcon (*Falco peregrinus*)	Endangered
Higgins' eye pearly mussel (*Lampsilis higginsi*)	Endangered

The East Channel area provides important habitat for bald eagles. While the area is not designated as critical habitat, eagles do congregate there in the winter, presumably because of the quantity of prey found in the open water. There are two known nests between 1.5 and 3 kilometers of the Minnesota Island project feature; neither nest would be directly affected by the work. The islands that would be protected provide mature trees which are important perch sites.

Peregrine falcon reintroduction has been attempted in the La Crosse area but is no longer being aggressively pursued. Peregrine falcons can be seen in the area during spring and fall migrations.

Mussel surveys done in the late 1970's did not show this section of the river to have the Higgens' eye pearly mussel present, nor were high numbers of individuals found. The work would be done in areas where erosion is occurring and where the conditions are not conducive to supporting the Higgens' eye pearly mussel.

f. Proposed Disposal Site Determinations

(1) Mixing Zone

The proposed fill activities would result in a minimal amount of resuspension because of the use of rock, coarse sand material, and mechanical placement techniques. No further analysis of the mixing zone has been done for this project.

(2) Determination of Compliance with Applicable Water Quality Standards

The clean fill material and mechanical placement once again combine to ensure that water quality standards will be met.

(3) Potential Effects on Human Use Characteristics

The proposed action might reduce the use of the islands as beaching areas as the rock riprap would provide a less hospitable landing. The areas are not heavily used now because of the active erosion and steep banks.

g. Cumulative Effects on the Aquatic Ecosystem

Implementation of the proposed action would cause no significant cumulative impacts on the aquatic system. There would be a change in the diversity of benthic habitat with the addition of rock riprap.

h. Secondary Effects on the Aquatic Ecosystem

The secondary effects to the aquatic ecosystem would be the protection offered the I-90 Bay and the continued habitat diversity provided by the bay and the wooded islands.

III. FINDING OF COMPLIANCE FOR THE EAST CHANNEL HABITAT REHABILITATION AND ENHANCEMENT PROJECT

The proposed fill activity presently complies with procedural requirements of the Section 404(b)(1) guidelines of the Clean Water Act. The proposed plan was chosen because it offered a solution that was feasible in terms of both engineering and economics, and had the most positive environmental impacts. The proposed fill activities would also comply with Section 307 of the Clean Water Act and the Endangered Species Act, as amended.

The proposed fill activities would have no adverse impacts on human health and welfare. The use of clean fill and mechanical placement techniques will minimize negative impacts. The proposed action would directly protect up to 4.45 hectares of valuable open water habitat and 4.45 hectares of forested island habitat. In addition, the fish and wildlife using the habitat that would be protected are known to move throughout pool 8; the island and bay are important types of habitat available in pool 8. On the basis of this evaluation, the proposed placement of fill would comply with the requirements of the guidelines for the discharge of fill material.

20 OCT 95
Date

J.M. Wonsik
Colonel, Corps of Engineers
District Engineer

ATTACHMENT 4

HEP APPENDIX

Habitat Evaluation
East Channel Rehabilitation and Enhancement Project

The purpose of this habitat evaluation is to quantify the habitat benefits that could be achieved for the various alternatives and designs of the island protection features of the East Channel project. As noted in the main report, Head of East Channel, Smith Slough, and Upper French Slough will not be evaluated further. Lower Island 98 and Minnesota Island will be evaluated using U.S. Fish and Wildlife Habitat Suitability Information Models and information provided by the U.S. Fish and Wildlife Service. The habitat benefits of the I-90 Bay were not evaluated using numerical habitat evaluation procedures, but are described more fully in the main report.

Model Selection

The habitat goals and objectives for I-90 Bay are to maintain the area as valuable off-channel fish habitat. As noted above, HEP (habitat evaluation procedures, a method developed by the U.S. Fish and Wildlife Service) was not used for the I-90 Bay project features. The habitat objective for the Lower Island 98 and Minnesota Island features is to maintain the upper shorelines of these islands in their present locations. The wooded habitat present is unique in that it is relatively high and mature when compared to other islands. The black-capped chickadee model was chosen to provide an index of value of this habitat. In addition to the model, the U.S. Fish and Wildlife Service and National Biological Service noted the importance of the habitat to neo-tropical migrants, eagles and the separation of the East Channel and its backwaters from the main channel of the Upper Mississippi.

The Black-capped chickadee model measure the mature forest habitat characteristics that are important to neotropical migrants, namely the forest canopy structure in terms of height and crown area or canopy closure. Tree height is also an important factor describe perching sites for eagles.

I-90 Bay

The Wisconsin Department of Natural Resources provided specific information on use of the I-90 Bay by walleye for overwintering and pre-spawning staging.

A series of index stations has been established by the Wisconsin Department of Natural Resources (WDNR) to assess walleye and sauger recruitment in pool 8. Two of these electro-shocking stations are in I-90 Bay. For the past ten years, these two sites have regularly shown the highest concentrations of young of the year (YOY) sauger and are in the top three for YOY walleye concentrations (WNDR unpublished). The I-90 Bay was also shown to be a staging area for walleye. Radio-tagged females would stage in the I-90 Bay before going to spawn in the tailwaters of dam 7 or the vegetated backwaters of upper pool 8 such as the Round Lake area. Some of the walleye using the I-90 Bay were found over 8 miles downstream, indicating that the I-90 Bay contributes habitat benefits for the species throughout much of upper pool 8. As noted previously no HEP analysis was completed for this project feature. The project feature benefits

the fishery of the entire upper pool 8 area; a detailed study would be necessary to fully evaluate the feature's effects on habitat. The study would likely cost more the protection of the peninsula proposed.

Lower Island 98 and Minnesota Island

"Lower" Island 98 was created sometime between 1915 and 1930 when a breach was created through Island 98. The breach was located downstream of a closing dam between the island and the left bank of the East Channel. That closing dam now corresponds with the alignment of the I-90 bridge discussed in the Head of East Channel project features. The East Channel along "Upper" Island 98 has accreted until it is nearly closed off, making the island more of a peninsula. The densely-wooded Lower Island 98 is at the new Head of East Channel. The island is eroding at the upstream end. A small sandy peninsula is forming on the East Channel side of the island.

Prior to the construction of the locks and dams, Minnesota Island was armored with rock riprap along the main channel that continued upstream as a closing dam across East Channel and farther upstream as rock armor along the left bank of the East Channel, across from Island 98. This rock work was done as part of the 4- and 6-foot Channel Projects (work authorized by Congress to ensure 1.3- and 2-meter channel depths respectively). Comparing maps between 1915 and 1930, Minnesota Island shows an increase in width, expanding channelward beyond its rock armoring.

The 1894 Mississippi River Commission Surveys show a rock-lined Minnesota Island with wingdams protruding towards the main channel; a 1915 map shows a similar situation. The Brown Surveys done in the early 1930's show a much wider Minnesota Island. The two small islands that appear west of the upstream tip of Minnesota prior to 1930 have become part of the island. The channelward side of the island reaches nearly 700 feet beyond the rock protection. The 9-Foot Channel[1] Environmental Impact Statement shows regular dredging activity at river mile 701 from records kept between 1935 through the early 1950's (river mile 701 is 1,128 kilometers above the confluence of the Mississippi and Ohio Rivers near Cairo, Illinois). It is possible that between 1915 and 1930, dredged material was placed on Minnesota Island, increasing the breadth of its upstream end. While Island 98 seems to be affected primarily by erosion and deposition typical of a riverine system, some of the habitat value of Minnesota island could be attributed the placement of dredged material.

Habitat Benefits

The wooded islands provide an unusual habitat type in the river floodplain because of their height and the maturity of the forest. Cerulean warblers, a neo-tropical migrant of concern, have

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[1]The 9-Foot Channel is a Congressionally-authorized project requiring the Corps of Engineers to ensure water depths of about 3 meters for uninterrupted navigation.

been found on one of the islands. While it is thought that large forest tracts are required for neo-tropical migrants, the birds can be found in the smaller, fragmented tracts on the Upper Mississippi River, including Minnesota Island. The fact that these birds are seeking out these wooded islands in the naturally fragmented mosaic of habitats found in upper pool 8 indicates that these mature wooded habitats are important (Eileen Kirsch, U.S. Fish and Wildlife Service, personal communication).

Equally important to the wooded habitat the islands provide, they are a barrier between the East and Main Channels. The East Channel, according to the U.S. Fish and Wildlife Service, supports a diverse population of wildlife including wading birds, migrating eagles, a great blue heron and great egret rookery. Aerial photography of the islands show them to provide a dense, mature stand of hardwood trees with some small openings. There are steep banks and deep water near the island shore and little beach area. Beach habitat was not measured for this habitat analysis. Many of these benefits are impossible to quantify without detailed study of the entire East Channel backwater area and its interrelated habitats. Habitat benefits that could be quantified include the suitability of the area as a forest and what habitat gains would occur if the project were implemented. The proposed work would not increase the acreage of wooded habitat, but would protect what is there.

The U.S. Fish and Wildlife Service black-capped chickadee habitat suitability index model describes a deciduous woods habitat. The model measures percent tree canopy closure (V_1), average height of overstory (V_2), and number of snags. The number of snags indicates the suitability of the area to provide reproductive habitat for chickadees. Because it is specific to chickadees and because snags have not been counted that value was not used for this analysis.

To determine the importance of the complex of which the islands are a part, the Minnesota Wetland Evaluation Methodology, Wildlife Section was used (U.S. Army Corps of Engineers, 1988). This section is an adaptation of procedures developed by Golet (1978) and measures the richness of wetland area using its size, number of different wetland types, interspersion, and the amount of open water present.

Model Application

Black-Capped Chickadee Model

V_1 Percent tree canopy closure - A 1989 air photo shows Lower Island 98 to be about 82 percent canopy. This translates to a suitability index value of 0.9. The air photo shows Minnesota Island to be about 99 percent canopy, which corresponds to a suitability index value of 0.61.

V_2 Average height of overstory - The tree height on both Island 98 and Minnesota Island is about 14 meters with the taller trees nearer the water. This corresponds to a suitability index value of 0.9 for each island.

The following equation uses the variables to determine the areas suitability fulfill the life requisite of food for the black-capped chickadee: $(V_1 \times V_2)^{1/2}$. Given this equation, the habitat suitability index (HSI) value for Island 98 is 0.9 and the HSI value for Minnesota Island is 0.74. A maximum HSI value is 1.0; the high values derived for these islands are consistent with the position asserted by the U.S. Fish and Wildlife Service that the islands support important mature forest habitats.

Habitat Unit Calculations

Multiplying the HSI value by the acres present for each island with and without the project will show the change in habitat units that would occur if the project were not done. The main report shows a loss of 0.05 hectares/year (0.13 acres/year) over the last 50 years at Lower Island 98. With the project the existing 4.45 hectares of Island 98 would be protected. Without the project, 2.8 hectares would be lost over the next 50 years. The table below shows the total habitat units over the 50 year project life, and the difference between the "with" and "without project" predictions. The difference, or gain with the project, annualized over the 50 year period is 1.24 average annual habitat units (in hectares; 3.15 AAHU in acres).

While the main report notes that Minnesota Island has been relatively stable with little erosion occurring between 1974 and 1989, it was cut back 70 meters between 1938 and 1974. The initial erosion could have been due to raised water levels and a change in the amount of wave- and navigation-induced erosion. It is possible that the island erosion has reached some sort of equilibrium. Because this is a dynamic system, and the island is located in the upper pool where conditions most resemble those found before the locks and dams were built, it is possible that the islands could begin eroding again . At worst case a similar situation could occur again over the next 50 years and another 70 meters or about 1.7 hectares could be lost from Minnesota Island. The difference of total habitat units over 50 years with and without the project is 31.4 habitat units. Annualized over 50 years there would be a gain of 0.63 average annual habitat units (1.55 AAHU in acres) if the project were completed.

Table 1

HSI Annualized Benefit Calculations

	Lower Island 98			Minnesota Island		
Future Without Project	Hectares	HSI	HU[2]	Hectares	HSI	HU
Target Year 0[1]	4.45	.90	4.0	30.8	.74	22.8
Target Year 1	4.45	.90	4.0	30.8	.74	22.8
Target Year 50	1.7	.90	1.53	29.1	.74	21.53
Future With Project						
Target Year 0	4.45	.90	4.0	30.8	.74	22.8
Target Year 1	4.45	.90	4.0	30.8	.74	22.8
Target Year 50	4.45	.90	4.0	30.8	.74	22.8
Total habitat units (HU) without project (50 yrs)	138.35			1,108.2		
Total HU with project	200.25			1,139.6		
Net HU gain	61.9			31.4		
Average annual HU gain (AAHU)	1.24			0.63		

[1] Target Year 0 is immediately pre-project, year 1 is immediately post project and year 50 is considered the project life.

[2] Habitat units (HU) are in hectares as opposed to acres.

Wetland Evaluation Methodology

To describe the islands' importance to the habitat complex, the Minnesota Wetland Evaluation Methodology (WEM) was used. The following criteria and scores were assigned to the entire East Channel backwater complex; the maximum score is 12.

Table 2

Criteria	Description	Score
Wetland Class Richness	5+ classes	12
Dominant Wetland Class	Deep marsh	12
Size Category	Over 500 acres	12
Subclass Richness	10+ subclasses	12
Site Type	Riverine	12
Surrounding Habitat	Forest/ag present	12
Cover category*	*(based on figures	12
Vegetative interspersion*	3 and 4)	12
Wetland's hydrologic relationship	Perm. connections within 1 mile	12

The islands affect the subclass richness, surrounding habitat, cover, and interspersion criteria and are part of the reason these scores are 12 out of 12 possible points. Because of the great variety of wetland classes and sub-classes in the area, the reduction in acreage of these wetlands would not greatly affect the score. In concert, the HEP analysis, information from the agencies and the WEM wildlife description indicate that the islands are an important part of what is a very good quality wetland complex.

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ATTACHMENT 5

HYDRAULICS APPENDIX

East Channel Habitat Rehabilitation and Enhancement Project
Hydraulic Appendix

INTRODUCTION

The East Channel HREP project consists of three features which are still under consideration. These are the I90 Bay, the Head of Island 98, and the Head of Minnesota Island. The considerations involved with each of these features will be detailed below. The considerations involved in the design of the rock gradation will also be discussed.

PROJECT FEATURES

I90 Bay

I90 Bay is located on the right decending bank (west side) of the navigation channel at River Mile 701.7. It is isolated from the channel by a peninsula which has eroded and has been breached. This erosion is causing a loss of habitat within the bay. The goal of the I90 Bay portion of project is to provide a more sheltered area for fish staging in the spring, and to maintain a slow velocity environment in the winter months. Maintaining low velocities in the bay during the winter was determined to be the most critical criteria in the effectiveness of this feature.

Rock is being used to stabilize the remaining channel-side shoreline of the peninsula. A rock mound will be used to extend the peninsula downstream of its existing tip. The crest height of the bank protection is at the elevation where flow begins to cross the peninsula into the I90 Bay. The height of rock was chosen to prevent overtopping of the structure during December, January and February. A stage duration table was used to determine the best top elevation of the bank protection. Using the December, January and February stage duration values it was determined that a top elevation of 634.0 (NGVD, 1912 adj.) feet would be adequate for the bank protection and the peninsula extension. The percent of time at or above this value for December, January, and February, were 0.54%, 2.30%, and 5.57% respectively. The Bay will continue to be sheltered during spring staging periods even though the rock will be overtopped more frequently.

The 634.0 ft elevation should be effective at protecting the base of the slopes thereby stabilizing higher areas which will still be exposed to river currents.

A terminal groin will be placed at the upstream end of the rock bank protection at an elevation of 635. Sand fill is used from station 0+00 to 4+10 to build out the shoreline. The elevation of the sand would be 633.5 feet. Additionally, tie-back groins will be placed on top of the sand berm to prevent erosion during high

water conditions. The tie back groins will connect the existing bank to the crest of the rock protection. The tie back groins will be placed to an elevation of 635.0 feet. They will be oriented perpendicular to the existing shoreline and will be spaced at approximate 125 to 150 foot intervals along the sand berm.

Head of Lower Island 98

The head of Lower Island 98 will be stabilized with rock revetment including a groin at the western end. The crest of the bank protection and groin will be 634.0 feet. The groin will be placed over existing bank protection which remains as a spit of shallow water. Due to the shallow depth of water the groin can be constructed to an elevation of 634.0 for very little additional cost. The groin will deflect currents away from high protions of the island when river flows and elevations are high.

Head of Minnesota Island

A rock reventment at the head of Minnesota Island will have a top elevation of 634.0 feet. An old closing dam meets Minnesota Island near East Channel. The closing dam has degraded somewhat near the island and has caused a scour hole near the shoreline. Placing a rock revetment along this area would be costly due to the depth of water. A rebuilding of the nearshore end of the closing dam is recommended as a less expensive option for reducing erosion downstream of the closing dam. The bank protection will terminate at the closing dam. The closing dam will be rebuilt to a top elevation of 634.0 at the bank sloping about 100 feet till intersecting with the existing closing dam at an elevation of 630. Boat traffic will no longer be able to use the closing dam notch. The soundings indicate that they will still be able to cross the closing dam at an elevation of 628 feet.

DESIGN of RIPRAP

Riprap will be required for the bank protection at the East Channel HREP. Experience obtained from previous studies done on the river indicate that velocities seldom rise to 6 ft/sec on the river. A velocity of 8 ft/sec was used to design the riprap. This should be very conservative.

Riprap was designed using EM-1110-2-1601 "Hydraulic Design of Flood Control Channels". The following table shows riprap gradation dictated by the procedures in the EM.

Table A-1 Minimum Riprap Gradation for Erosion due to Current

	Weight Limits (lbs)	
	Maximum	Minimum
W100	86	35
W50	26	17
W15	13	5

A riprap layer thickness of 12 inches is required for this gradation. This thickness would be increased by fifty percent (18 inches) for underwater placement.

Considering velocities alone, the above gradation and thicknesses would be adequate. However, considering the punishing environment of the Mississippi River with the possibility of ice moving the stones and the freeze-thaw cycles weathering the stone, and the possibility of saving money by reducing the processing of the stone; the minimum weights of the gradation were increased and the band of acceptable stone was widened. Table A-2 shows the gradation recommended for the project to reduce costs, increase resistance to ice action, and increase the useful life of the stone. EM-1110-2-1601 allows the use of this type of "quarry run" stone but it recommends increasing the layer thickness by 1.5 to 2.0 times. This increases the thicknesses to 18 inches and 27 inches for above and below water placement, respectively. The filter was then considered. Because of the velocities in these areas, placing a filter whether granular or geotextile, would be difficult and increase construction costs. For these reasons, it was decided to eliminate the need for a filter by having a layer thickness that is two times the diameter of the maximum W100 or two times 16 inches. The final layer thickness of 32 inches for all placement of this gradation has been adopted.

Table A-2 Proposed Riprap Gradation for Bank Protection

	Weight Limits (lbs)	
	Maximum	Minimum
W100	300	100
W50	120	40
W5	15	5

This gradation was also studied to see how it would hold up to the wave action and prop scour associated with tows.

Adequacy of Preliminary Gradation for Tow Effects

The adequacy of this gradation was studied to determine how it would stand up to jet scour and waves caused bye tows. The impacts of propeller induced flow jets oriented parallel to the shoreline, and angled at the shoreline were studied.

Methods from two references were used to determine acceptable stone sizes due to tangential prop wash. First, the equations from HL-84-3 "Riprap Protection on Navigable Waterways" were used to determine the adequacy of the above sized stone for scour due tow prop wash. These equations relate the velocity of the jet with the related velocity at a water depth directly below the propeller.

$Vo = 1.48(Pd/(D*D))^{.33333}$

Vo = jet velocity
Pd = installed engine power in kw (1 horsepower = 0.746kw)
D = Propeller Diameter in meters

$Vb,max = Vo * E * (hp/D)^{-1}$

Vb,max - maximum bottom velocity at zero ship speed, m/sec
E= 0.25 coefficient for inland ship
hp = distance from center of propeller to bottom, m
D= propeller diameter, m

$d50 = Vb,max^2 / (B^2*g*1.64)$

d50 = average stone diameter, m
B= coefficient, 0.9
g= acceleration due to gravity, 9.81 m/sec^2

A 5000 horse power tow with a 5 foot diameter prop is representative of the larger tows which navigate Pool 10 (Pers. Com. Mark Edlund CENCS-CO-NV). Using the HL-84-3 equations the following table was produced.

Table A-3 Calculations for Sizing Rock with respect to Parallel Jet Orientation - HL-84-3 Equations

Channel Depth D (ft)	Jet Velocity Vo (ft/s)	Bottom Vel. VB (ft/s)	d50 (ft)	w50 (lbs)	With Safety Factor *1.2 (lbs)
6	57	20.3	1.6	476	571
7	57	15.8	1.2	224	269
8	57	12.9	1.0	123	147
9	57	10.9	0.8	74	89
10	57	9.5	0.7	48	58
11	57	8.4	0.6	33	40
12	57	7.5	0.6	24	29
20	57	4.1	0.3	4	5

A second method using the equations supplied in the "Gallipolis Locks and Dam Replacement, Ohio River, Appendix J, Volume Phase I GDM" were used. This reference contains the following equation for determining propeller jet velocity.

$V(D) = 2.03(Dp\ Pe)^{0.333} / (D-(Dp/2))$

V(D)= propeller jet velocity at bottom
D= channel depth at sailing line (ft)
Dp = Propeller Diameter (5ft.)
Pe = Power of Towboat (horse power)

Using this Gallipolis velocity equation, the following table was constructed.

Table A-4 Calculations for Sizing Rock with respect to Parallel Jet Orientation - Gallipolis Equations

Channel Depth D ft	Prop Diam. Dp ft	Horse Power Pe	V(D) ft/s	V(D) m/s	d50 m	d50 ft	w50 - avg	*1.2
6	5	5000	17	5	0.4	1.3	277	332
7	5	5000	13	4	0.3	1.0	130	156
8	5	5000	11	3	0.3	0.8	71	86
9	5	5000	9	3	0.2	0.7	43	52
10	5	5000	8	2	0.2	0.6	28	34
20	5	5000	3	1	0.1	0.3	2	3

The Gallipolis equations are less conservative than those given in HL-84-3. The gradation shown in Table A-2 with a w50 of 40 pounds would be adequate for water depths greater than 11 feet according to HL-84-3 or 9 feet according to Gallipolis. Plate A-1 shows embankment cross section 14 with an end view of a tow superimposed. The upper section of the figure shows how close the propeller is to the embankment when the tow is pushing a single width barge loaded to a 9 foot draft. The lower section of the figure shows the tow without any barges.

Under this scenario the prop would be the closest distance from the embankment but would not be using full horsepower. In fact the design tow may only use full horsepower when pushing a width of three tows. This would greatly increase the distance of the propeller from the embankment. The figure shows that the 11 foot prop distance from the embankment should be adequate.

The above calculations were done for embankment erosion due to a propeller jet aligned parallel to the embankment. Erosion can also be caused when the prop jet is angled toward the embankment. Calculations for velocity dissipation of the jet on the jet axis have also been done to determine if the current rock design is adequate for "in line" prop jet velocities:

The PIANC 1988 No 62 "The Scouring Action of the Propeller Jet Produced by a slowly Maneuvering Ship" states that the propeller Jet has a 14 degree angle of diffusion. This angle was used to determine jet velocities at various distances from the propeller. The discharge through the propeller was taken to be the prop velocity multiplied by the area of a circle with the diameter of the propeller. The dissipated velocities at various distances

from the propeller were calculated using the 14 degree dissipation angle to determine the circular flow area of the jet. The following equation was used in the computations.

$$Vx = Q/(pi*(5/2 + (d*\tan(14))^2)$$

d=distance from prop

Table A-5 shows the calculations for the jet velocity and for sizing the w50 stone weight. This weight is the w50 necessary to resist movement by the propeller jet.

Table A-5 Calculations for Sizing Rock with respect to Direct Impact of Jet

Vo ft/s	Vo m/s	Dist from prop	Area sqft	Disch. cuft/s	Vel. ft/s	Vel. m/s	d50 m	d50 ft	w50 lbs	*1.2
57	17	0	20	1119	57	17	1.3	4.4	10519	12622
		1	24		47	14	1.1	3.6	5947	7136
		2	28		40	12	0.9	3.0	3533	4239
		3	33		34	10	0.8	2.6	2188	2625
		4	38		29	9	0.7	2.2	1404	1684
		5	44		25	8	0.6	1.9	929	1114
		6	50		22	7	0.5	1.7	631	757
		7	57		20	6	0.5	1.5	439	527
		8	63		18	5	0.4	1.4	312	374
		9	71		16	5	0.4	1.2	225	270
		10	78		14	4	0.3	1.1	166	199
		11	86		13	4	0.3	1.0	124	148
		12	95		12	4	0.3	0.9	94	112
		13	104		11	3	0.3	0.8	72	86
		14	113		10	3	0.2	0.8	56	67
		15	122		9	3	0.2	0.7	44	52
		16	132		8	3	0.2	0.6	34	41
		17	143		8	2	0.2	0.6	27	33
		18	153		7	2	0.2	0.6	22	26
		19	165		7	2	0.2	0.5	18	21
		20	176		6	2	0.1	0.5	15	18
		21	188		6	2	0.1	0.5	12	14
		22	200		6	2	0.1	0.4	10	12
		23	213		5	2	0.1	0.4	8	10
		24	226		5	2	0.1	0.4	7	8
		25	240		5	1	0.1	0.4	6	7

Using the above table, the current rock gradation (w50=40) is adequate for distances greater than 16 feet from the embankment. The width of a single tow is 35 feet. The tow would have to be backed up to the embankment at a very steep angle to get less than 16 feet from the jet. This is not a likely scenario. The table also shows that if the tow jet is even a few feet closer than 16 feet to the prop, that rock weights would need to become much larger at an exponential rate. Designing for these implausible conditions would not be economical. Larger rock sizes would require larger rock thicknesses over the entire embankment. Should erosion of this type occur, it would likely be localized. It would be less expensive to repair such a portion of riprap than to over design the entire project. The current rock gradation is adequate.

Rock Adequacy for Withstanding Wave Attack

The adequacy of the proposed rock gradation was tested to determine if it could withstand waves from tows and recreational boats. The first step in determining adequacy is to estimate design wave heights.

The Vergey and Bogaerts (1989) equation as described in HL-92-3 "Riprap Design for Towboat-Induced Forces in Lock Approaches" was used to determine wave height caused by tows.

$$H = alpha1 * h * (S/h)^{-.33} * Fh^{alpha3}$$

where:

alpha1 = 1.43
alpha3 = 4
S = distance between ship's side and bank.

Fh = Vs/sqrt(gh)
h = water depth
Vs= ship speed

Table A-6 shows a range of input parameters and resulting wave heights.

Table A-6 Wave Height using Vergey & Bogaerts Equations

h	S	Vs		H
		mph	ft/s	ft
9	25	8	11.7	2.1
9	50	8	11.7	1.7
9	100	8	11.7	1.3
9	150	8	11.7	1.1
10	25	8	11.7	1.9
10	50	8	11.7	1.5
10	100	8	11.7	1.2
10	150	8	11.7	1.1
10	25	7	10.3	1.1
10	50	7	10.3	0.9
10	100	7	10.3	0.7
10	150	7	10.3	0.6

HL-92-3 indicates that "equations for drawdown better reflect the model conditions as the vessel speed approaches the limiting speed. Curves were developed in HL-92-3 to relate the blockage ratio to wave height. The specific blockage ratio (cross sectional area of channel / cross sectional area of submerged tow) at the project location was 99. The figures in HL-92-3 only go up to a blockage ratio of 16.4. This graph would indicate conservative rock sizes than would be necessary for a blockage ratio of 99. Using figure 11 for N = 16.4, wave heights of approximately 1.0 ft would be encountered for velocities < 10 mph.

A wave height of 1.75 was chosen as a reasonable tow induced wave height in this portion of the Mississippi River. A study of boat waves (Bhowmik 1992) on the Mississippi River near Red Wing Minnesota showed wave heights caused by recreational boats and tows rarely exceeded 1.5 feet. This supports the chosen design wave height.

The Hudson Equation from the "Shore Protection Manual (SPM 1984)" was used to determine the W50 stone size necessary to withstand waves 1.75 feet in height. The Hudson Equation is as follows:

$$W50 = (Wr*H^3)/Krr\ (Sr-1)^3\ \cot\ theta$$

Wr = unit weight of stone (165-pcf)
H = wave height (2.0 ft)
Krr = stability coefficient for riprap (2.2)
Sr - specific gravity of stone (Sr = Wr/Ww)
theta= angle of slope from horizontal (1V:2H)

For a wave height of 1.75 feet a W50 of 45 pounds should be adequate. The proposed gradation shown in Table A-2 should be adequate for tows on this portion of the Mississippi River.

HL-92-3 also supplies test results from a physical model of a channel with a riprapped bank. A scale model tow was used to produce waves to determine when rock of various mean weights would fail. Using Figure 12 in HL-92-3 it appears that W50 > 15 lb is OK for vessel speeds less than 9 mph with an embankment slope of 2 horizontal to 1 vertical. The figure also indicates that riprap fails at least up to W50 = 70 lb when tows go faster than 9 mph. Tows in this portion of the Mississippi River move at about 5 miles per hour upstream and about 9 miles per hour (maximum) downstream (Pers. Com. Mark Edlund CENCS-CO-NV). The maximum speed relative to the moving water would be less than 9 miles per hour. This is the speed that would relate to wave height. The tows will not be moving fast enough cause wave induced riprap failure. The rock gradation displayed in Table A-2 is appropriate for the waves and velocities encountered in this area.

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ATTACHMENT 6

GEOTECHNICAL APPENDIX

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
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ATTACHMENT NO. 6
GEOTECHNICAL DESIGN

1. **GENERAL:** This Appendix presents the geologic and Geotechnical descriptions and assumptions for the East Channel Project. The geologic information was taken from the U.S.G.S. Hydrologic Investigations Atlas HA-474 and the Wisconsin Geologic and Natural History Survey Bulletin No. XXXVI. The Geotechnical assumptions were made from the geologic information and experience with projects in the Mississippi River valley. No borings have been obtained for this project.

2. **PHYSIOGRAPHY AND GEOLOGY:** In the La Crosse Wisconsin area the Mississippi River flows in a broad valley approximately four miles wide. The region, known as the western upland physiographic province of Wisconsin, is dominated by two major topographic features. The uplands of the province consist of Cambrian and Ordovician aged sandstone, siltstone, and carbonate bedrock that towers 120 to 150 meters above the present river. This upland is characterized by high bluffs, rugged cliffs, and highly dissected stream drainages. The second major feature is the Mississippi River valley which is partially filled with alluvial sediments over a 45 meter thickness. The cities of La Crosse and Onalaska are built on the surface of a large sand terrace which stands 6 to 12 meters above pool 8. This area is in the region referred to as the "driftless" area; which means that the area was not overridden by glaciers during the last major glacial period. The rugged terrain and the lack of glacial deposits in southeast Minnesota, northeast Iowa, and southwest Wisconsin support this. Although the ancient Mississippi Valley has existed approximately 180 million years, the major geologic event relevant to this project occurred at the end of the Pleistocene glaciation, approximately 10,000 years ago. Tremendous volumes of glacial meltwater from Glacial Lake Agassiz and other northern sources scoured and deepened the preexisting Mississippi River valley. As melt water diminished, the deeply eroded valley filled with sands, gravels, clays and silts. The large supply of sediment from tributaries, coupled with a diminished water supply, led to the development of a braided stream characterized by numerous channels, swampy depressions, natural levees, islands, and shallow lakes. Completion of the Lock and Dam No. 8, in the 1930's flooded the low areas and obscured the braided stream characteristics. In the channel areas the surface soils consist of deposits of peat, soft clay and stratified silts, sands and clays that vary in thickness from a few centimeters to 15 meters.

3. **GEOTECHNICAL DESIGN:** Subsurface exploration and testing were not done for this project. For this reason, to assure stability of the rock mounds both their trapezoidal sections and their alignments are slightly conservative in the side slopes and the distance they maintain from the existing steeper drop offs. Other projects that have been constructed in the Mississippi River valley like the Onalaska Islands constructed in 1989, have settled very little if at all. The East Channel project is expected to settle the same amount or less than the Onalaska Islands. The amount of soil that will be displaced by the addition of rock, however, is not known and may be substantial.

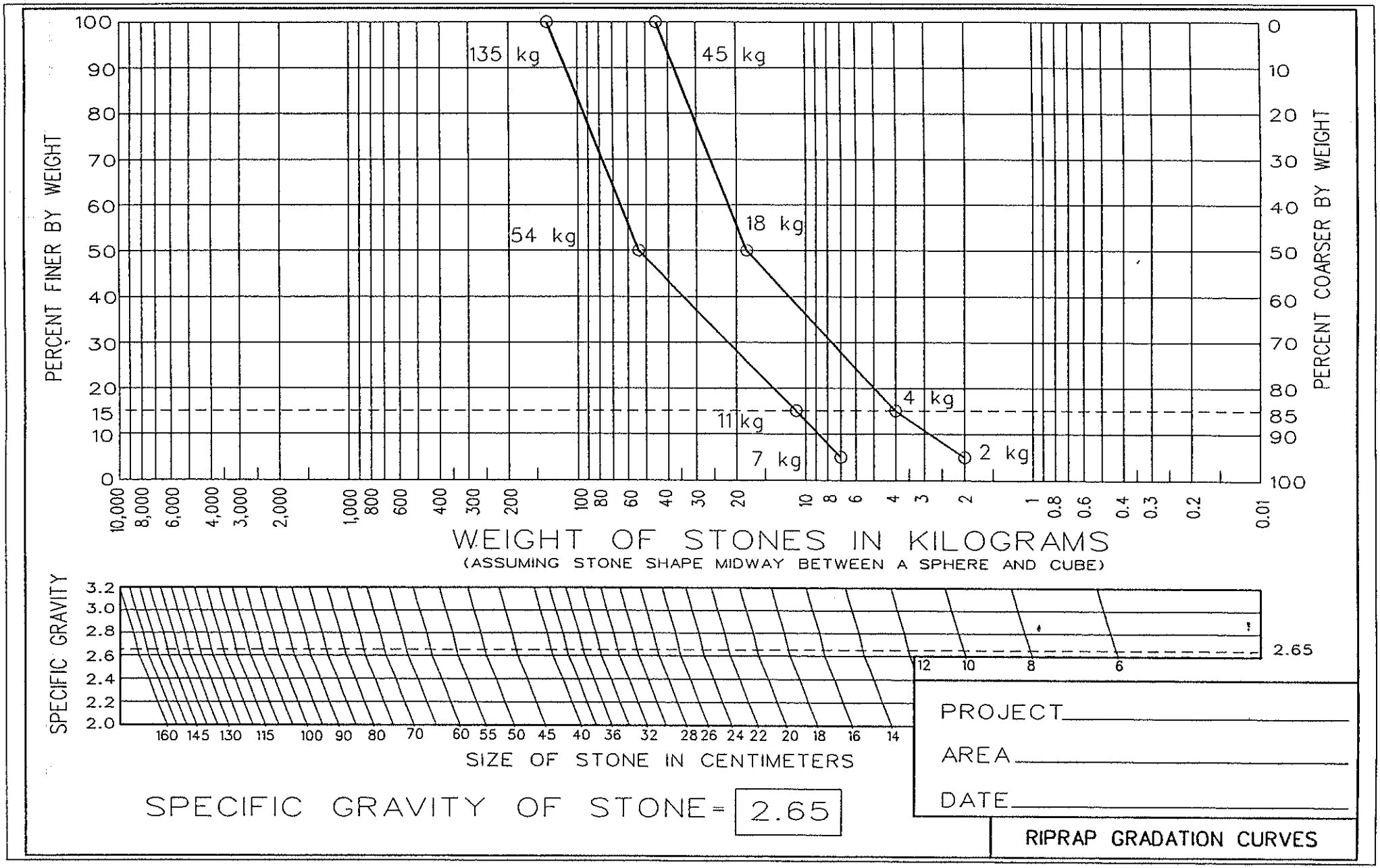
4. **ROCK SOURCES:** Both rockfill and riprap are available locally. Numerous limestone and dolomite quarries have been developed in the bluffs adjacent to the Mississippi River valley. Acceptable quality rock for this project is available within a 6 to 12 kilometer radius of the East Channel project.

5. **ROCK GRADATION:** The calculation of the minimum weight of the W50 for the rockfill is explained in the Hydraulic Appendix. The gradation as shown on Plate 6-1 and in the table below was designed from that weight.

Table: Rock Gradation

Percent Less then by Weight:	Maximum (kg):	Minimum (kg):
100	135	45
50	54	18
15	11	4
5	7	2

6. **FUTURE WORK:** Borings should be taken in areas where rock is proposed to be placed. Borings will improve the estimate of the amount of displacement that will occur during rock placement. Also, a stability analysis should be completed on the proposed slopes to see if steeper side slopes would be adequate.


PERCENT FINER BY WEIGHT
PERCENT COARSER BY WEIGHT
135 kg
45 kg
54 kg
18 kg
4 kg
11 kg
7 kg
2 kg
WEIGHT OF STONES IN KILOGRAMS
(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)
SPECIFIC GRAVITY
2.65
SIZE OF STONE IN CENTIMETERS
SPECIFIC GRAVITY OF STONE = 2.65
PROJECT
AREA
DATE
RIPRAP GRADATION CURVES

ATTACHMENT 7

REFUGE COMPATABILITY DETERMINATION

AND

MEMORANDUM OF AGREEMENT

Upper Mississippi River National
Wildlife and Fish Refuge
Established 1924
Compatibility Determination
East Channel Habitat
Rehabilitation and Enhancement Project

Establishment Authority:

Public Law No. 268, 68th Congress, The Upper Mississippi River Wild Life and Fish Refuge Act.

Purposes for Which the Refuge was Established:

"... (a) as a refuge and breeding place for migratory birds... (b)...as a refuge and breeding place for other wild birds, game animals, fur-bearing animals, and for the conservation of wild flowers and aquatic plants, and (c)...as a refuge and breeding place for fish and other aquatic animal life." 43 Stat. 650, dated June 7, 1924

"... shall be administered by him (Secretary of the Interior) directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon, ... "16 U.S.C. 664 (Fish and Wildlife Coordination Act)

"... suitable for--(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. 460k-1 "...the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors..." 16 U.S.C. 460k-2 [Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended]

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)

Description of Proposed Use:

The proposal is a Habitat Rehabilitation and Enhancement project authorized by the Water Resource Development Act of 1986 (Pub. L. 99-662). The proposed project includes three separate features, rehabilitation and extension of an eroding peninsula at I-90 Bay and stabilization of the eroding upstream ends of Lower Island 98 and Minnesota Island.

More details of the project, including maps and engineering drawings, are contained in the draft report entitled, "Upper Mississippi River System Environmental Management Program Definite Project Report With Integrated Environmental Assessment (SP-19) East Channel Habitat Rehabilitation and Enhancement, Upper Mississippi River, Wisconsin, and Minnesota," prepared by the St. Paul District, Corps of Engineers.

Anticipated Impacts on Refuge Purposes:

As a result of the project fish and wildlife populations should increase which will be a direct benefit toward maintaining and accomplishing refuge purposes. A summary of impacts to the natural resources of the Refuge are as follows:

I-90 BAY

The restoration of I-90 Bay will maintain 8 acres and restore 2.3 acres of deepwater protected habitat adjacent to the main channel. Studies have documented that this area issued by pre-spawn staging walleyes and is an important habitat for young-of-the-year walleye and sauger. Other studies have documented the importance of this type of habitat to a wide variety of fish species. Maintaining the I-90 Bay and the habitat values it provides is considered important to the maintenance of fish populations (especially walleye and sauger) in upper pool 8 of the Mississippi River.

LOWER ISLAND 98 AND MINNESOTA ISLAND

Stabilizing the heads of Lower Island 98 and Minnesota Island will preserve approximately 7 and 4 acres, respectively, of wooded island habitat over the 50-year project life. Because these islands are "high" islands, they support vegetation different from that typically found in the bottomland forest habitats in upper pool 8. Maintaining these islands will preserve the relatively unique habitat type found on them and will help maintain habitat diversity in upper pool 8.

Another important function of these islands is that they help define the East Channel, a large side channel that provides habitat types and niches different from those found in the main channel or smaller side channels. Maintaining Lower Island 98 and the head of Minnesota Island will contribute to the maintenance of the East Channel as a unique habitat, and help maintain the diversity of aquatic habitat found in upper pool 8.

Justification:

The proposed project works toward the accomplishment of the stated objectives of the refuge by stabilizing the shoreline of existing islands and protecting backwater habitat of the Upper Mississippi River. Severe erosion is occurring at many locations, affecting backwater areas and habitat because of the loss of landmass and the associated increases in flow and/or sedimentation. Aquatic habitat is being lost and becoming shallower in the adjacent backwaters. Adverse effects to circulation patterns and water quality in the backwaters are also occurring. The general overall purpose of the proposed project is to preserve, restore and enhance fish and wildlife habitat on the refuge by reducing shoreline erosion and protecting backwater habitat.

Determination: The proposed use is ✓ is not ___ compatible with the purposes for which the refuge was established.

Determined by: James F. Fisher Date: 6/20/95
Complex Manager

Reviewed by: William Hutchinson Date: 6/22/95
Wildlife Associate Manager

Concurred by: John Rhymer Date: 6/23/95
Assistant Regional Director

DRAFT

MEMORANDUM OF AGREEMENT

BETWEEN

THE UNITED STATES FISH AND WILDLIFE SERVICE

AND

THE DEPARTMENT OF THE ARMY

FOR

ENHANCING FISH AND WILDLIFE RESOURCES

OF THE

UPPER MISSISSIPPI RIVER SYSTEM

EAST CHANNEL PROJECTS

LA CROSSE COUNTY, WISCONSIN AND WINONA COUNTY, MINNESOTA

I. PURPOSE

The purpose of this memorandum of agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (USFWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the East Channel Projects separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

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. The project area is managed by the USFWS and is on land managed as a national wildlife refuge. 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 for the East Channel projects are 100 percent Federal, and pursuant to Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, all costs of operation and maintenance for the East Channel projects are 100 percent Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of rehabilitating and improving the fish and wildlife habitat at three locations in upper pool 8 of the Mississippi River. The peninsula forming the I-90 Bay would be stabilized using rock bank protection. In addition a former portion of the peninsula would be restored using a rock berm. The heads of Lower Island 98 and Minnesota Island would be stabilized using a variety of rock bank protection designs.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: Construction of the project which consists of stabilizing 120 meters and restoring 105 meters of the peninsula protecting the I-90 Bay using rock. Stabilizing the heads of Lower Island 98 and Minnesota Island using rock.

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, and in accordance with Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, DOA will construct the East Channel projects as described in the Definite Project Report/Environmental Assessment, East Channel Habitat Rehabilitation and Enhancement Projects, dated xxxxxx 1995, 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 DOA encounters potential delays related to construction of the project, DOA will promptly notify USFWS of such delays.

4. Maintenance of Records. The DOA 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 DOA shall maintain such books, records, documents, and other evidence for a minimum of three 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. USFWS is responsible for operation, maintenance, and repair: Upon completion of construction as determined by the District Engineer, St. Paul, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report/Environmental Assessment entitled "East Channel Habitat Rehabilitation and Enhancement Project," dated xx xxxxxxxx 1995, in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580.

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
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, Minnesota 55111-4056

DOA: District Engineer
U.S. Army Corps of Engineers, St. Paul District
Army Corps of Engineers Centre
190 Fifth Street East
St. Paul, Minnesota 55101-1638

VII. EFFECTIVE DATE OF MOA

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

THE DEPARTMENT OF THE ARMY

BY: _____
(signature)
J. M. WONSIK
Colonel, Corps of Engineers
St. Paul District

DATE: _____

THE U.S. FISH AND WILDLIFE SERVICE

BY: _____
(signature)
WILLIAM F. HARTWIG
Regional Director
U.S. Fish and Wildlife Service

DATE: _____

ATTACHMENT 8

COORDINATION/CORRESPONDENCE

The draft Definite Project Report/Environmental Assessment and/or Public Notice was sent to the following agencies, interests, and individuals:

Congressional
Sen. Russell Feingold (Middleton Office)
Sen. Rod Grams (Anoka Office)
Sen. Herbert Kohl (Madison Office)
Sen. Paul Wellstone (St. Paul Office)
Rep. Steve Gunderson (Black River Falls Office)
Rep. Gil Gutknecht (Rochester Office)

Federal
Environmental Protection Agency (Chicago)
Department of Transportation (Chicago, Des Plains)
U.S. Coast Guard (St. Louis)
U.S. Geological Survey (Twin Cities)
National Park Service (Omaha)
National Resource Conservation Service (St. Paul, Madison)
Advisory Council on Historic Preservation (Wash DC)
U.S. Fish and Wildlife Service - (Twin Cities - Marler, Gibbons, Lewis, Dobrovolny; Winona - Fisher, Beseke; Onalaska - Nissen)
National Biological Survey (Onalaska)

State of Minnesota

Department of Natural Resources (St. Paul - Balcom, Johnson; Lake City - Davis, Johnson, Schlagenhaft; Winona - Gulden)
Pollution Control Agency
Department of Administration
Department of Transportation
State Historic Preservation Office
State Planning Agency
Water and Soil Resources Board

State of Wisconsin

Department of Natural Resources (La Crosse - Moe, Janvrin; Eau Claire - Bourget)
Department of Administration
Department of Transportation
State Historic Preservation Office

State of Iowa

Department of Natural Resources (Des Moines - Szcodronski)

Local

Winona County Commissioners
La Crosse County Commissioners
City of La Crosse
Campbell Township
Dresbach Township

Other Interests

Minnesota-Wisconsin Boundary Area Commission (Hudson)
Upper Mississippi River Conservation Committee (Rock Island)
Sierra Club (Minneapolis, Madison)
Izaak Walton League (Edina)
Upper Mississippi River Basin Association (St. Paul)
Mississippi River Regional Planning Commission (La Crosse)
Ducks Unlimited (La Crosse)
Nature Conservancy
Winona Daily News
La Crosse Tribune
Prairie du Chien Courier Press
La Crosse Public Library
Winona Public Library
Badger State Sportsman's Club
Gopher State Sportsman's Club

Individuals

Wally Becker
M.J. Blankenship
John Engh
Janice Hoeschler
Bob Mullally
John Noyes
Anthony Reed
Marc Schultz

State Historical Society of Wisconsin
Division of Historic Preservation
816 State Street • Madison, Wisconsin 53706-1488
☎ (608) 264-6500 • FAX (608) 264-6404

December 22, 1994

Mr. Robert J. Whiting
Department of the Army
St. Paul District, Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

IN REPLY PLEASE REFER TO SHSW: #94-1041/LC
RE: Wildlife Enhancement Project (EMP) On Pool 8, Mississippi River

Dear Mr. Whiting:

We have reviewed the archeological report titled, "Phase I Cultural Resources Survey East Channel Environmental Management Project Mississippi River, La Crosse" prepared by Sissel Johannessen.

The survey procedures utilized were sufficiently thorough to justify the conclusion that there are no archeological resources eligible for inclusion on the National Register of Historic Places within the areas surveyed.

It is always possible that deeply buried archeological sites may be found during construction. If such finds are made, please contact our office at (608) 264-6507. Should burials be discovered during construction, you must contact our office immediately for compliance with Wis. Stat. §157.70 (1991), which provides for the protection of human burial sites.

Should you have any questions, please contact me at, at (608) 264-6507.

Sincerely,

Sherman Banker

Sherman J. Banker
Compliance Archeologist

RWD:lks
cc: Sissel Johannessen

United States Department of the Interior

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

IN REPLY REFER TO:
FWS/ARW-SS

JAN 05 1995

Mr. Robert J. Whiting
Chief
Environmental Resources Section
Army Corps of Engineers Centre
190 Fifth Street East
Saint Paul, Minnesota 55101-1638

Dear Mr. Whiting:

Thank you for providing us with a copy of the draft report "Phase I Cultural Resources Survey, East Channel Environmental Management Project, Mississippi River, La Crosse," by Sissel Johannessen (December 1994: Saint Paul; 11 pages). We understand the investigation covered proposed shoreline stabilization and habitat improvement, part of an Environmental Management Program project on the Upper Mississippi River National Fish and Wildlife Refuge. Based on the copy from the quadrangle map provided in the report, we estimate the investigation covered 40 acres of U.S. Fish and Wildlife Service fee title land:

N/2 NW/4 NW/4 SE/4 and W/2 SW/4 SE/4 SE/4, Section 14, and N/2 SE/4, Section 24, T.16N., R.8W., La Crosse County, Wisconsin;

W/2 SW/4 NW/4, SW/4 SW/4 SE/4 NW/4, and S/2 NE/4 SW/4, Section 34, T.105N., R.4W., Winona County, Minnesota.

This investigation found no evidence of archeological sites. The report is a complete description of an appropriately executed field survey. No cultural resources being found, curation is not a concern.

The general area description on page 3 could be misleading. At least, no evidence is presented that "the upper portion of Pool 8 saw relatively intense prehistoric occupations...."

In the event this report is prepared in a final version, we would appreciate receiving five copies of the final report for our own distribution requirements.

Sincerely,

H. John Dobrovolny
Regional Historic Preservation Officer

MINNESOTA HISTORICAL SOCIETY

January 20, 1995

Mr. Robert J. Whiting
Corps of Engineers, Environmental Resources
190 Fifth Street East
St. Paul, Minnesota 55101

Dear Mr. Whiting:

Re: Environmental Management Program on Mississippi River in upper part of Pool 8 near La Crescent, S33 & 34, T104, R8, Houston County
SHPO Number: 94-3462

Thank you for the opportunity to review and comment on the above project. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

We have reviewed the results of your survey of the project area. Based on the results of this survey, we feel that the probability of any unreported properties being located in the area of potential effect for the Minnesota project areas is low. Therefore, we conclude that no properties eligible for or listed on the National Register of Historic Places are within the area of potential effect for the portions of the project in Minnesota.

Please contact Dennis Gimmestad at 612-296-5462 if you have any questions on our review of this project.

Sincerely,

Britta L. Bloomberg
Deputy State Historic Preservation Officer

BLB:dmb

345 KELLOGG BOULEVARD WEST / SAINT PAUL, MINNESOTA 55102-1906 / TELEPHONE: 612-296-6126

United States Department of the Interior

NATIONAL BIOLOGICAL SERVICE
Environmental Management Technical Center
575 Lester Avenue
Onalaska, Wisconsin 54650-8552

IN REPLY REFER TO:

June 21, 1995

Mr. Charles Crist
Chief, Management and Evaluation Branch
Engineering and Planning Division
St. Paul District, Corps of Engineers
Army Corps of Engineers Centre
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Dear Mr. Crist:

In accordance with your request, we have reviewed the Preliminary Draft Definite Project Report for the proposed East Channel Habitat Project. We have no significant comments to forward, and view present plans as very reasonable. The project design has been much improved from earlier versions, and we are very pleased to see that the most significant recommendations made earlier by EMTC scientists have been adopted. We support this project, and look forward to assisting you in monitoring project performance.

Thank you for the opportunity to review this document.

Sincerely,

John W. Barko, PhD
Science Advisor

WISCONSIN
DEPT. OF NATURAL RESOURCES
George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

State Office Building
3550 Mormon Coulee Road
La Crosse, WI 54601
TELEPHONE 608-785-9000
TELEFAX 608-785-9990

June 29, 1995

St. Paul District, Corps of Engineers
Floodplain Management and Small Projects, Planning Division
ATTN: Mr. Gary Palesh
190 Fifth Street East
St. Paul, MN 55101-1638

Dear Mr. Palesh:

We have completed review of the draft Definite Project Report/Environmental Assessment for the East Channel Habitat Rehabilitation and Enhancement Project dated May 1995. Following are our comments for inclusion in the next draft of the DPR.

Page 6: 3.1.2. The area in the East Channel dredged for I-90 construction is mentioned later in the DPR. However, this feature should also be included in this section to describe existing conditions.

Page 48: 6.2.1. A walleye telemetry study conducted in Pool 8 by the WDNR documented that walleye from the Goose Island area of Pool 8 moved to the I-90 Bay area. This information is important to include to demonstrate that the unique habitat found within the I-90 bay area is utilized by walleye from a much larger portion of Pool 8 than the project area. Please include a reference to further document the importance of I-90 Bay to the fisheries community of Pool 8. This information is presented in the habitat analysis appendix and should also be included in this section of the report.

Page 404-2: I.d.(2). The DPR mentions that the source of borrow material will be determined during preparation of plans and specifications. This section, as written, implies that the location of borrow material source will be the main channel. We request this section be amended to state, "...main channel or backwater sand..."

We commend you and everyone else for a well written and complete report. Please contact me at (608) 785-9005 if you have any question regarding our comments.

Sincerely,

Jeffrey A. Janvrin
Mississippi River Habitat Specialist

c: Keith Beseke, USFWS
Mike Davis, MN DNR
Jim Nissen, USFWS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Upper Mississippi River Refuge Complex
51 East 4th Street
Winona, Minnesota 55987

IN REPLY REFER TO:

July 12, 1995

Mr. Gary Palesh
St. Paul District, Corps of Engineers
NCS-PE-M
190 Fifth Street East
St. Paul, Minnesota 55101

Dear Mr. Palesh:

This provides U.S. Fish and Wildlife Service (Service) comments on the draft Definite Project Report and Environmental Documentation (SP-19) for the East Channel Habitat Rehabilitation and Enhancement Project. This project will benefit the biological resources of the Upper Mississippi River National Wildlife and Fish Refuge (Refuge).

The project is being built on federal lands managed as part of the Refuge. Therefore, a Refuge compatibility determination and Refuge approval is required before the project can be constructed. Enclosed is a signed compatibility determination for the alternative discussed in this draft report. Approval of the project will be formally provided by the Regional Director after completion of the final project report.

The final draft definite project report must include a copy of the draft Memorandum of Agreement for the operation, maintenance, and rehabilitation. The Service will cover operation and maintenance costs as discussed in this report for the selected sites. The Regional Director's letter on the final draft definite project report will include the certification of support for operation and maintenance.

FWS should be a cooperating agency as defined in 40 DC 1501.6, considering all of the project areas appear to be on land owned by FWS. This situation needs to be addressed, perhaps in Section 1.2. The DIR should describe how FWS has participated in the development of this project, rather than just providing a copy of the August 29, 1994, letter in the appendix. Since the project is located on FWS land, FWS should be an equal partner in this project, and FWS participation should be adequately presented.

The following federally-listed (T) and endangered (E) species are listed for this reach of the Upper Mississippi River:

SPECIES	SCIENTIFIC NAME	HABITAT
Bald eagle (T)	*Haliaeetus leucocephalus*	Breeding/Wintering
Peregrine falcon (E)	*Falco peregrinus*	Breeding
Higgins' eye pearly mussel (E)	*Lampsilis higginsi*	Mississippi & St. Croix Rivers

There is no designated critical habitat for the above species.

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, it is the responsibility of the Federal agency to determine if its actions "may affect" listed species or critical habitat. The District routinely requests endangered Species Act comments from the Service's Twin Cities Field Office. The Service will provide official Endangered Species Act comments on this project at that time.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4327), the Endangered Species Act of 1973, (16 U.S.C. 1531-1543), as amended, and the U.S. Fish and Wildlife Service's Mitigation Policy.

This report illustrates the cooperation evident between the Corps and the Service. The cooperative efforts on this project and the Environmental Management Program as a whole ensure that progress in this area will continue on the Upper Mississippi River System.

Sincerely,

James R. Fisher

James Fisher
Complex Manager

Enclosures

cc: TCFO
La Crosse FRO
MN DNR/ WI DNR
La Crosse District
RO -- SS

STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

PHONE NO. (612) 345-3331

FILE NO.

Section of Ecological Services
1801 S. Oak St.
Lake City, MN 55041

July 14, 1995

Robert F. Post, P.E.
Chief, Engineering and Planning Division
St. Paul District, Corps of Engineers
190 fifth St. East
St. Paul, MN 55101-1638

Dear Mr. Post:

We have completed review of the draft DPR for the East Channel Habitat Rehabilitation and Enhancement Project (HREP).

We would like to remind the Corps that Protected Waters Permits may be needed prior to constructing this project. If the total acreage of protected water being filled exceeds 1 acre, an EAW will need to be prepared prior to us issuing a permit.

We have no further comments on this document.

Sincerely,

Mike Davis, HREP Coordinator

cc: Jim Nissen
Keith Beseke
Jeff Janvrin
Nick Gulden
Steve Johnson

United States Department of the Interior

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

IN REPLY REFER TO:
FWS/ARW-SS

AUG 1 8 1995

Colonel J.M. Wonsik
District Engineer
Saint Paul District, U.S. Army Corps of Engineers
Army Corps of Engineers Center
190 Fifth Street East
Saint Paul, Minnesota 55101-1638

Dear Colonel Wonsik:

Based on the revised draft Definite Project Report/Environmental Assessment (SP-19), "East Channel Habitat Rehabilitation and Enhancement Project" dated July 1995, the U.S. Fish and Wildlife Service (Service) will assure operation and maintenance requirements of the project will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986. In accordance with the policies stated in the Fourth Annual Addendum, the Service will perform the operation and maintenance requirements for this project as listed on page 70.

This project is located on Refuge lands. Therefore, the Service will complete its finding of no significant impact upon learning from you that the public review period produced no substantive changes in the Definite Project Report/ Environmental Assessment.

We look forward to continued cooperative efforts in developing habitat rehabilitation and enhancement projects under the Environmental Management Program.

Sincerely,

Marvin E. Moriarty
Acting Regional Director

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

State Office Building
3550 Mormon Coulee Road
La Crosse, WI 54601
TELEPHONE 608-785-9000
TELEFAX 608-785-9990

September 20, 1995

St. Paul District, Corps of Engineers
Floodplain Management and Small Projects, Planning Division
ATTN: Mr. Gary Palesh
190 Fifth Street East
St. Paul, MN 55101-1638

Dear Mr. Palesh:

We have completed review of the draft Definite Project Report/Environmental Assessment for the East Channel Habitat Rehabilitation and Enhancement Project dated July 1995. The comments we provided to you in a letter dated June 29, 1995, were incorporated into the report or addressed at the coordination meetings. We have no additional comments.

Once again, we commend you and everyone else for a well written and complete report.

Sincerely,

Jeffrey A. Janvrin
Mississippi River Habitat Specialist

c: Keith Beseke, USFWS
Mike Davis, MN DNR
Jim Nissen, USFWS

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40__

September 21, 1995

Charles E. Crist
Chief, Management and Evaluation Branch
Engineering and Planning Division
Department of the Army
Army Corps of Engineers
190 Fifth Street East
St. Paul, MN 55101-1638

Re: The East Channel Habitat Rehabilitation and Enhancement Project, LaCrosse County, Wisconsin and Winona County Minnesota

Dear Mr. Crist:

The Minnesota Department of Natural Resources (DNR) has completed a review of the Draft Definite Project Report/Environmental Assessment for the East Channel Habitat Rehabilitation and Enhancement Project, Pool 8, Upper Mississippi River. We offer the following comments for your consideration.

The Natural Heritage Program has reviewed the above mentioned project. We recommend that impacts to vegetation on Minnesota Island be minimized during construction of rock banks for stabilization. For your information we have attached a copy of the Heritage printout and fact sheets on listed fish species that occur in the area.

A DNR Protected Waters Permit is needed for the I-90 Bay and Minnesota Island. Lower Island 98 work may also need to be included in the permit if the work is located in Minnesota. We believe an environmental assessment worksheet (EAW) would be required for the I-90 project feature because it would change or diminish greater than one acre of protected waters (approximately 76,000 square feet just by fill).

The Minnesota DNR supports this project as described in this draft definite project report.

Thank you for your early coordination efforts and the opportunity review this proposed rehabilitation project. If you require additional information from the DNR in regard to the project, please contact Gail Fox from my staff at (612) 296-0731.

Sincerely,

Thomas W. Balcom

Thomas W. Balcom, Supervisor
Natural Resources Planning and Review Services

c: Bill Johnson
Pete Otterson
Ellen Heneghan
Lynn Lewis - USFWS
Steve Colvin
Brian McCann
Steve Johnson

990043-01 ER4:COEEASTC.doc

Responses to Minnesota DNR Comments Dtd 9/21/95

1. The impacts to existing vegetation on Minnesota Island will be minimized as recommended. Because the proposed bank stabilization design does not require any bank shaping, impacts to vegetation should be negligible.

2. We have reviewed the information provided by the Natural Heritage Program. The proposed bank stabilization should not have any adverse impact on any of the fish species of concern known to occur in this reach of the Mississippi River. None of the records of the plant species of concern show occurence in the project area. It is unlikely that any of these species would be found in the area affected by the project as the project sites are eroding banks with little or no vegetation present.

3. A Protected Waters permit will be applied for during the preparation of plans and specifications. We will provide information to assist in the preparation of the EAW.

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

September 22, 1995

Colonel J. M. Wonsik
St. Paul District, U.S. Army Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Colonel

Dear Colonel Wonsik:

The Wisconsin Department of Natural Resources supports construction of the East Channel Habitat Rehabilitation and Enhancement Project, Pool 8, Upper Mississippi River.

Upon completion and final acceptance of the project by the Corps of Engineers and the U. S. Fish and Wildlife Service, the Wisconsin Department of Natural Resources will cooperate with the U. S. Fish and Wildlife Service to assure that operation and maintenance, and any mutually agreed upon rehabilitation, will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986 and the current guidance contained in the Sixth Annual Addendum, May 1991, Appendix D, Section III.A.9 (pp. 21-22).

I look forward to completion of the East Channel Habitat Rehabilitation and Enhancement Project and the benefits it will provide to the Upper Mississippi River System.

Sincerely,

George

George E. Meyer
Secretary

Thank you for your attention to this important project.

c: William Hartwig, Regional Director, USFWS
Terry Moe, Wisconsin DNR, La Crosse
Steve Johnson, Minnesota DNR