



**US Army Corps  
of Engineers**

St. Paul District



**East Channel  
Pool 8 Mississippi River  
Habitat Rehabilitation and Enhancement Project  
Project Evaluation Report**

**Environmental Management Program  
for the Upper Mississippi River System**



(WDNR, September 2006)

U.S. Army Corps of Engineers  
St. Paul District  
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*Note: All water elevations in this report are in feet above mean sea level, 1912 adjustment.*

## **1.0 Introduction**

### **1.1 UMRS EMP**

The Upper Mississippi River System Environmental Management Program (UMRS-EMP) is a federal-state partnership to manage, restore and monitor the UMRS ecosystem. The UMRS-EMP was authorized by Congress in Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662).

### **1.2 Habitat Rehabilitation and Enhancement Projects**

Habitat Rehabilitation and Enhancement Project (HREP) construction is one element of the UMRS-EMP. The projects provide site-specific ecosystem restoration. They are intended and designed to counteract the adverse ecological effects of impoundment and river regulation through a variety of modifications, including flow introductions, modification of channel training structures, dredging, island construction, and water level management.

### **1.3 Purpose of Habitat Project Evaluation Reports**

The purposes of this habitat project evaluation report for the East Channel HREP are to:

- Document the pre and post-construction monitoring activities for the East Channel project.
- Evaluate project performance on the basis of project objectives and goals.
- Evaluate the project relative to other issues such as operation and maintenance.
- Make recommendations concerning future project performance evaluation.
- Make recommendations concerning the planning and design of future HREP projects.

This report summarizes available monitoring data, operation and maintenance information, and project observations made by the U.S. Army Corps of Engineers (USACE), Minnesota and Wisconsin Department of Natural Resources (MNDNR and WDNR), and the U.S. Fish and Wildlife Service (FWS). It also includes other agency and public input.

### **1.4 Project Team**

Project team members for this evaluation report included representatives from the Corps of Engineers, the U.S. Fish and Wildlife Service, and the Wisconsin and

Minnesota Departments of Natural Resources, as listed below. Some of these members were also involved in the planning and construction phases of this project.

Much of the information in this report has been gathered from the project team members and others familiar with the project. This was accomplished through the use of subsequent review and revisions of this report by the project team.

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Mike Davis	Minnesota DNR
Sharonne Baylor	U.S. Fish and Wildlife Service
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## **2.0 Project Background**

### **2.1 Location**

The project area for the East Channel Project is upper Pool 8 of the Mississippi River. The project is bounded by U.S. Interstate 90 on the upstream side at river mile 701.7. The downstream end of the project is the northern portion of Minnesota Island near river mile 700.6. On the western streambank of the project lies the town of La Crescent in Winona County, Minnesota. The eastern bank of the project is bordered by the town of La Crosse, in La Crosse County, Wisconsin (Figure 1). The project lies entirely within the Upper Mississippi National Wildlife and Fish Refuge.

### **2.2 Project Area**

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 but has filled in as a result of sedimentation. 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.

The East Channel project is a collection of smaller individual projects. These project areas initially included Interstate 90 Bay, Lower Island 98, Minnesota Island, Head of East Channel, Smith Slough, and Upper French Slough. Head of East Channel, Smith Slough, and Upper French Slough were later dismissed from the project as they were determined to be functional systems in the foreseeable future. For further information on those areas see the East Channel HREP DPR/EA (USACE 1995) and the East Channel HREP O&M Manual (USACE 1997). Descriptions of the remaining project area are found on the following page.



**Figure 1.** The East Channel HREP project area near La Crescent, MN and La Crosse, WI.

### 2.2.1 Interstate 90 Bay

The Interstate 90 (I-90) Bay is a small bay located below I-90 on the Minnesota bank of the river at river mile 701.6 (Figure 1). Prior to the project, the bay encompassed about 3.2 hectares and was separated from the river by a narrow peninsula. The mainland shoreline of the bay consisted of a narrow strip of land lying between the

river and the U.S. Highway 61 transportation corridor. At the head of the bay is a public boat landing managed by the U.S. Fish and Wildlife Service.

### **2.2.2 Lower Island 98**

Prior to the project, Lower Island 98 was a 4.5 hectare island. It was once part of the original Island 98 but has separated from the upper portion due to the constant river forces. For purposes of this report, this island will be referred to as "Lower Island 98." The interstate boundary bisects Lower Island 98 diagonally such that the northeastern portion lies in Wisconsin and the southwest portion lies in Minnesota. It is the first major island separating the East Channel from the main channel and is located at river mile 701.5 (Figure 1).

### **2.2.3 Minnesota Island**

Minnesota Island is the primary land mass separating the East Channel from the main channel (Figure 1). Nearly all of Minnesota Island lies within Minnesota, with the exception of the lower tip. The island extends from river mile 699.5 to river mile 701.3. Only the upper portion of Minnesota Island was evaluated in this project.

## **2.3 Pre-Project Habitat Conditions**

### **2.3.1 Interstate 90 Bay**

Prior to the project, I-90 Bay was a 3.2-hectare embayment off the main channel of the river. Maximum depths in the bay exceeded 6 meters with 25 percent of the area being greater than 3 meters in depth.

Navigation charts showed wing dams along the right descending bank extending across the bay. However, bathymetric data prior to the project did not indicate the presence of these wing dams. It was believed that the structures may have become buried by sediments.

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 (Holzer and Von Ruden, 1984).

#### **2.3.1.1 Habitat Changes**

The I-90 Bay was created in the mid-1960's. Fill was excavated from the bay for construction of Interstate 90 crossing the Mississippi River. Before the construction the area was a minor side channel. Erosion to the peninsula that forms the bay had occurred since its construction. By comparing aerial photos from 1974 and 1989 it was estimated that 190 meters of the peninsula had been

lost to erosion. The erosion of this area resulted in the reduction of I-90 Bay's size from 4.5 hectares to 3.2 from 1974 to 1989 (USACE 1995).

Approximately 57 meters upstream of the tip of the peninsula there was a breach between the main channel and the I-90 Bay. The breach resulted in a 9 meter opening. The flow through the opening created a current in the bay and also allowed a conveyance for sediment to enter the area.

If no action were taken it was believed that the remaining 67 meters of peninsula below the breach would be completely eroded in 10 years; leaving the bay reduced to roughly 2.4 hectares. Another 60 meters above the breach was also thought to have a high likelihood of eroding away in 10-15 years. This erosion would have reduced the bay to 1.6 hectares.

### **2.3.2 Lower Island 98**

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.

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.

#### **2.3.2.1 Habitat Changes**

Once a part of the larger Island 98, Lower Island 98 has become smaller over time due to the erosive forces of the Mississippi River. From 1938-1989 the island had decreased in size from 7.3 hectares to 4.7 hectares (USACE 1995).

A computer analysis of aerial photographs indicates that on average 73 meters of island were lost off the head of Lower Island 98 from 1938-74. During 1974-89 rates of erosion varied across the island. Portions of the island head remained relatively stable, while other areas experienced up to 70 meters of island erosion.

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 had grown wider. Based on aerial photographs, Lower Island 98 had been forested since 1940 except for a sandbar on the East Channel side of the island. During the period of 1974-89 the sandbar appeared to have shifted downstream approximately 75 meters and grown in length by about 40 meters.

### **2.3.3 Minnesota Island**

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.

The flora and fauna supported by the island is similar to that of Lower Island 98. The island terrain has provided a unique niche within the forest floodplain of the Upper Mississippi River by providing uncommon habitat for the area.

#### **2.3.3.1 Habitat Changes**

The 1894 Mississippi River Commission Surveys show a rock-lined Minnesota Island with wing dams. A map of the area in 1915 shows the island to be relatively unchanged. In 1931, however, the Brown Survey map shows Minnesota Island to be larger laterally. This could be due to sand accretion caused by the wing dams. During the period from 1935-1952, 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 from 1938-1989. 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.

Approximately 53 meters eroded off the head of Minnesota Island during the period 1938-1974. During 1974 to 1989 the head of the island remained



relatively stationary. It was believed that long term the island would continue to recede and flows down the East Channel would increase as a result.

## **2.4 Fish and Wildlife**

The DPR/EA for the East Channel HREP (USACE 1995) described the project area as providing valuable habitats for wildlife including waterfowl, small furbearers, wading birds, and a variety of fish including walleye (*Sander vitreus*), sauger (*Sander canadensis*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), smallmouth bass (*Micropterus dolomieu*), and channel catfish (*Ictalurus punctatus*). Though many of the objectives may have also provided increased habitat to other wildlife in the area, the majority of the goals were targeted at improving and sustaining the areas fishery.

### **2.4.1 Threatened and Endangered Species**

The DPR/EA did not indicate any threatened or endangered species of concern for the project. There were, however, some threatened and endangered species whose range extended to within the project area. Both the peregrine falcon (*Falco peregrines anatum*) and the bald eagle (*Haliaeetus leucocephalus*) were federally listed species at the time of project construction but have since been delisted.

In 1976 the Higgins eye pearlymussel (*Lampsilis higginsii*) became listed as a federally endangered species. Higgins eye have been historically know to occur in pool 8 but limited sampling has been performed in the immediate vicinity in recent years.

In a letter dated July 12, 1995 the FWS indicated that the three above mentioned species could occur in the project area, but there were no designated critical habitat areas identified for any of the species within the project area. There were no negative affects reported on fish or wildlife associated with this project.

## **3.0 Project Goals and Objectives**

Each individual study area had its own unique set of goals and objectives. "Goals" were the general habitat or management goals for the study area, based on U.S. Fish and Wildlife Service/State DNR management goals. "Objectives" were the specific habitat parameters which the project was designed to achieve and could be monitored to determine the success of the project later on in the study process. A summary of project objectives can be found in Table 1.

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

## **3.1 Interstate 90 Bay**

### **3.1.1 General Habitat Goals**

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

### **3.1.2 Specific Project Objectives**

**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.

**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.

The objectives were established to meet the general habitat goal of maintaining or increasing the amount of protected bay habitat and to provide ideal walleye and sauger habitat. Physical constraints prevented enlarging the bay to a size greater than 4.4 hectares. The depth criteria were based on State and Federal fisheries biologists' professional judgment for walleye and sauger preference in areas of the bay greater than 2.5 meters in depth.

## **3.2 Lower Island 98 and Minnesota Island**

### **3.2.1 General Habitat Goals**

The general habitat goal for Lower Island 98 and Minnesota Island was to maintain the islands. The islands provided a variety of habitats ranging from shallow waters to mature oak forests, adding diversity to the floodplain corridor.

### **3.2.2 Specific Project Objectives**

**Isl-1:** Maintain the upper shoreline of Lower Island 98 in its present location.

**Isl-2:** Maintain the upper shoreline of Minnesota Island in its present location.

The objectives were formed to stabilize the islands in their current locations as restoration of the shorelines to previous locations would not be feasible.

**Table 1.** East Channel HREP objectives and potential enhancement opportunities.

Objective	Project Accomplishment	Potential Enhancement Feature	Units	Enhancement Potential		
				Preproject	Future Without	Est. Future w/Project
Maintain protected deep off-channel habitat	Prevent the loss of 1.6 hectares of protected deep off-channel habitat	Rock bank protection	Ha 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	Ha 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	Ha of island maintained	4.5 hectares	1.75 hectares	4.5 hectares
Maintain head of Minnesota Island	Maintain wooded island habitat	Rock bank protection	Ha of island maintained	30.8 hectares	29.1 hectares	30.8 hectares

## 4.0 Project Description

Detailed project alternatives were reviewed for the I-90 Bay, Lower Island 98, and Minnesota Island. The alternatives with the greatest justification were chosen based on project goals, objectives, and incremental analysis. Only the chosen alternatives will be discussed in this report. For all alternatives considered see the East Channel DPR/EA (USACE 1995).

### 4.1 Chosen Alternatives

#### 4.1.1 Interstate 90 Bay

It was determined that the stabilization of I-90 Bay was a reasonable and prudent resource investment as it provided important seasonal and life stage habitat for a variety of species.

The cost per unit of providing an additional 1.25 hectares of protection for the bay by restoring areas of the peninsula that had been previously eroded was incrementally lower than simply stabilizing the bay as it existed. Because of this, the additional protection was chosen to be incorporated in the project. Features were to be constructed primarily by marine equipment. Water depths were sufficient enough so no access dredging was required.

The breach in the I-90 Bay peninsula would require approximately 300 cubic meters of material. It was expected that this material would be sand capped with fines dredged from the adjacent river and/or from within I-90 Bay.

Approximately 120 meters of shoreline on the peninsula was stabilized using rock fill. To avoid having to shape the bank, the rock terminated into a small rock berm adjacent to the bank. The area between the berm and the bank was filled with sand to prevent high flows that overtop the berm from eroding the bank.

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

Approximately 450 cubic meters of sand fill were required to fill in between the rock berm and the shoreline. Just as with the filling of the breach in the peninsula, the material was capped with sand fines dredged from the adjacent river.

Roughly 105 meters of the peninsula were restored using a rock breakwater design. It was decided to use a rock breakwater design for peninsula restoration because this approach was less costly than restoring the peninsula using earthen fill armored with rock.

The top elevation of 634.0 was selected as the optimum elevation for the bays protection. An elevation of 634.0 also ensured that the structure stood high enough above the water for visibility to small craft.

#### **4.1.2 Lower Island 98**

The alternative chosen for Lower Island 98 was to stabilize the head of the island by using 1,340 cubic meters of rock. The island was stabilized using a combination of rock berms and rock layers with a terminal groin on the northeast end of the bank. This design was selected for the northeast portion of the island because of the deep water in the area. Along areas with shallower water a rock mound design was used. A rock groin was constructed extending out about 45 meters from the northwest side of the shore.

#### **4.1.3 Minnesota Island**

The alternative chosen for Minnesota Island was to stabilize the head of the island using 1,270 cubic meters of rock in a 0.8-meter layer.

At the northeast corner of the shoreline a rock groin was constructed on top of the old closing dam tying into the island. The groin extends 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. This was much less costly than riprapping the bank in this lower 120-meter reach where the deep water would require a significant amount of rock.

## **5.0 Project Implementation History**

The East Channel HREP was co-sponsored by the FWS. Together with the Corps of Engineers, the Environmental Management Technical Center (EMTC) of the National Biological Service, as well as the Minnesota and Wisconsin DNR, identification of habitat problems and project planning took place.

The primary resource problem identified by these agencies was the loss of off-channel, deepwater habitat and islands to erosion and sedimentation. The East Channel project was initially assessed as two separate projects in June 1987; the Head of East Channel project and the French and Smith Slough project. In 1990, the Fish and Wildlife Work Group (FWWG) of the River Resources Forum (RRF), a group of biologists responsible for managing the river for their respective agencies, ranked the project as #5 and #7 in a list of HREP candidate projects. The FWWG recommended the projects be combined because of their close proximity and for efficiency purposes.

The projects were programmed by the St. Paul District, Corps of Engineers for study initiation in fiscal year (FY) 1993 and combined as a single project. The Fact Sheet for the East Channel projects was approved in October 1992. Studies were delayed from summer floods in 1993 but commenced in the fall of 1993. The East Channel DPR/EA was completed and finalized in September 1995.

A contract was awarded to J.F. Brennan Co., Inc. of La Crosse, Wisconsin, in September 1996. Construction began in October 1996, and all rock work was completed in November 1996. Willow plantings to provide stabilization at I-90 Bay took place in June 1997.

### **5.1 Project Costs**

In the East Channel DPR/EA (USACE 1995) estimated construction costs for the project totaled \$452,000. Actual construction costs were over \$125,000 under budget at \$324,743.51; \$265,048.94 for the base contract as well as \$59,694.57 in modifications for additional rockfill. Table 2, on the following page, summarizes the projects construction costs.

**Table 2.** Project construction and modification costs

<b>Description</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Earnings</b>
Mobilization	1 JB	\$8,000	\$8,000
Rock fill I-90 Bay	7,450 MT	\$17.75	\$132,238
Rock fill Lower Island 98	3,300 MT	\$18.75	\$61,875
Rock fill Minnesota Island	2,267 MT	\$19.35	\$43,861
Sand fill	1 JB	\$9,000	\$9,000
Plantings	1 JB	\$8,000	\$8,000
Performance Bond	1 JB	\$2,075	\$2,075
Base Contract			\$265,049
Modifications			
Rock fill Overrun I-90 Bay	2,372 MT	\$17.75	\$42,111
Rock fill Overrun Lower Is. 98	938 MT	\$18.75	\$17,584
Total Modifications			\$59,695
Total Contract Earnings			\$324,744

MT = Metric Ton

JB = Per job

## 6.0 Monitoring

Monitoring plans were established to reflect the project goals and objectives discussed in section 3 of this report.

### 6.1 Inspections

FWS inspections by the District Manager were to be made at a minimum frequency of once a year. The frequency of inspections was subject to review by the FWS and Corps and could change upon mutual agreement of both parties. The timing of the annual inspection could be made at the discretion of the District Manager.

The Corps District Engineer was to be kept informed on the operation and maintenance activities for the East Channel habitat project through a periodic inspection by a Corps representative and through the analysis of an annual inspection checklist submitted by the FWS. The first Corps inspection was to occur within 3 years after project completion. Subsequent inspections were then to occur at 3 to 5 year intervals thereafter. After the first 10 years of project operation, the Corps and the FWS had planned to jointly review the inspection plans and make any appropriate revisions. No documentation of inspection plan review or Corps inspections could be found for the East Channel HREP.

### 6.2 Annual Report

An annual report covering inspection of the project was to be submitted by the FWS to the District Engineer by April 30 of each year. The East Channel report could be sent

in conjunction with reports on other habitat projects or with the annual Cooperative Agreement Report sent every April. The report was to include a provided inspection checklist and a brief summary of the condition of the project, including any maintenance work done during the past 1-year period. Reports were received from the FWS for 2007 and 2008.

### **2007 Report:**

Though there has been mention of FWS inspections prior to the 2007 report, it was the oldest written report that could be found on the East Channel HREP. All structures were reported to be functioning properly, however, it was noted that barges may have struck the upstream end of where rockfill had been keyed into the bank.

### **2008 Report:**

Lower Island 98 was inspected but Minnesota Island and I-90 Bay were not. The tip of the groin protruding from the northwest corner of Lower Island 98 appeared to have been shaved off by passing barges. The damages to the rock groin were not anticipated to have any adverse effects to the structures function.

## **7.0 Operations and Maintenance**

Operation and Maintenance responsibilities of the East Channel HREP have been outlined and documented in the East Channel HREP Operations and Maintenance Manual (USACE 1997) as well as the East Channel HREP DPR/EA (USACE 1995). An agreement was signed formally recognizing responsibilities of the project by the FWS and the St. Paul District, Corps of Engineers on January 23, 1996. The capability of the FWS to carry out the maintenance responsibilities would be contingent upon the passage of sufficient appropriations by Congress.

### **7.1 Maintenance**

Maintenance of the project features were to be completed on an as needed basis such that their structural integrity was maintained and continued to function in the manner for which they were designed. Trees and other woody vegetation are to be removed from rock features as dislodgement of woody vegetation by ice action or other natural forces may result in rock displacement.

Displaced or missing rock is to be replaced as soon as possible to prevent further damage to the structures. Construction specifications for the project can be found in the East Channel HREP Operations and Maintenance Manual (USACE 1997).

There have not been any repairs made to the project at this time. The FWS will not take maintenance responsibilities for project features damaged by barges. The damage

caused by the barges is minimal and believed to have negligible effect to the function of the structures.

Annual operations and maintenance costs estimated during the preparation of the Definite Project Report were \$5,100. Table 3 displays project costs since completion. Costs prior from 1999-2002 were not very well documented and therefore are not provided in the table.

**Table 3.** Cost of project operations and maintenance.

Year	Years In O&M	Estimated Annual Cost w/Inflation	Actual FWS Costs	Activities
1997	1	\$5,369	\$0	None
1998	2	\$5,454	\$500	Inspections, investigate tows tie-in on rock mound
1999-2002	3-6	-	NA	NA
FY 2003	7	\$6,159	\$150	Inspections
FY 2004	8	\$6,325	\$108	Inspections
FY 2005	9	\$6,540	\$90	Completion report meeting
FY 2006	10	\$6,749	\$0	None
FY 2007	11	\$6,945	\$722	Inspections, annual report
FY 2008	12	\$7,223	\$25	Inspections
FY 2009	13	\$7,195	\$190	Inspections
FY 2010	14	\$7,315	\$30	Inspections

## 8.0 Project Evaluation

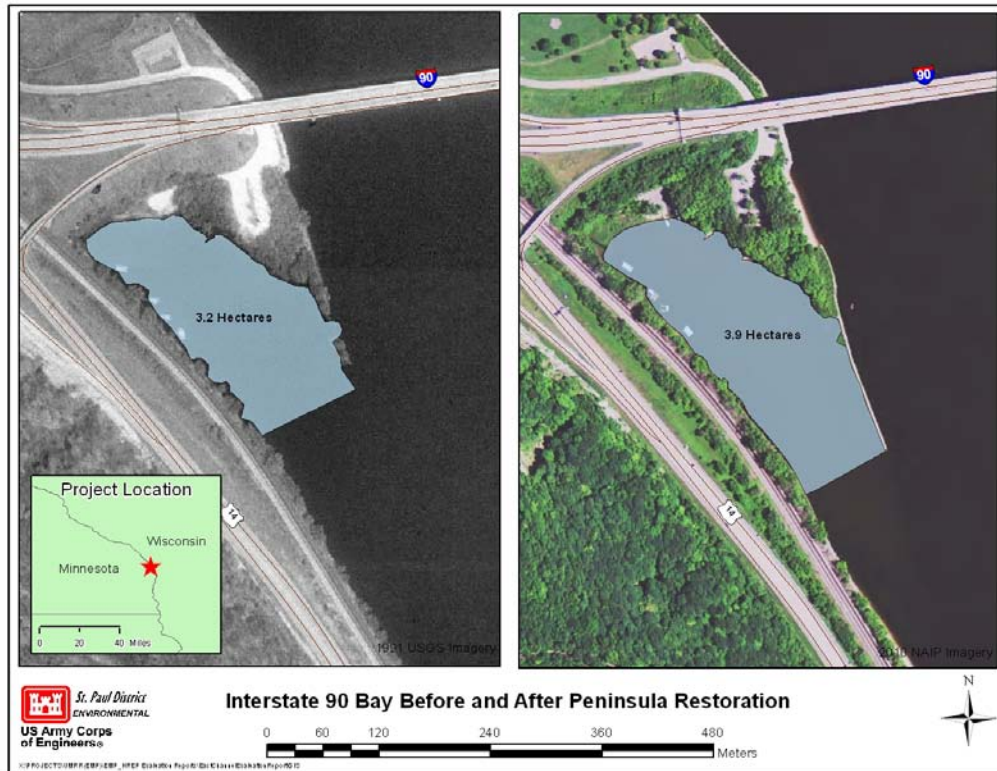
### 8.1 Maintain Deep, Off-Channel Habitat

The deep, off-channel habitat found in the East Channel HREP is unique and rare in this region of the Upper Mississippi River. It provides a number of valuable benefits to the areas fisheries and therefore was identified as a primary objective for the project. Prior to the project it was determined that the deep, off-channel habitat would be decreased from 3.2 hectares to 1.6 hectares if no action was taken to prevent the degradation of the I-90 peninsula.

From a visual analysis of the I-90 Bay it looks as though the area has been restored from earlier degradation and is further protected from the main channel by the extension and repair of the peninsula. Though the peninsula is often flooded during high water events, no breaches in the barrier have been reported.



Figures of the 3.2 hectare bay measurement described in the pre-project documents were not available. Computer analysis was conducted in an attempt to recreate the 3.2 hectare bay area (Figure 2). A post project measurement of the bay area was performed in a fashion similar to that of the pre-project measurement. The post project bay area measured 3.9 hectares (Figure 2).

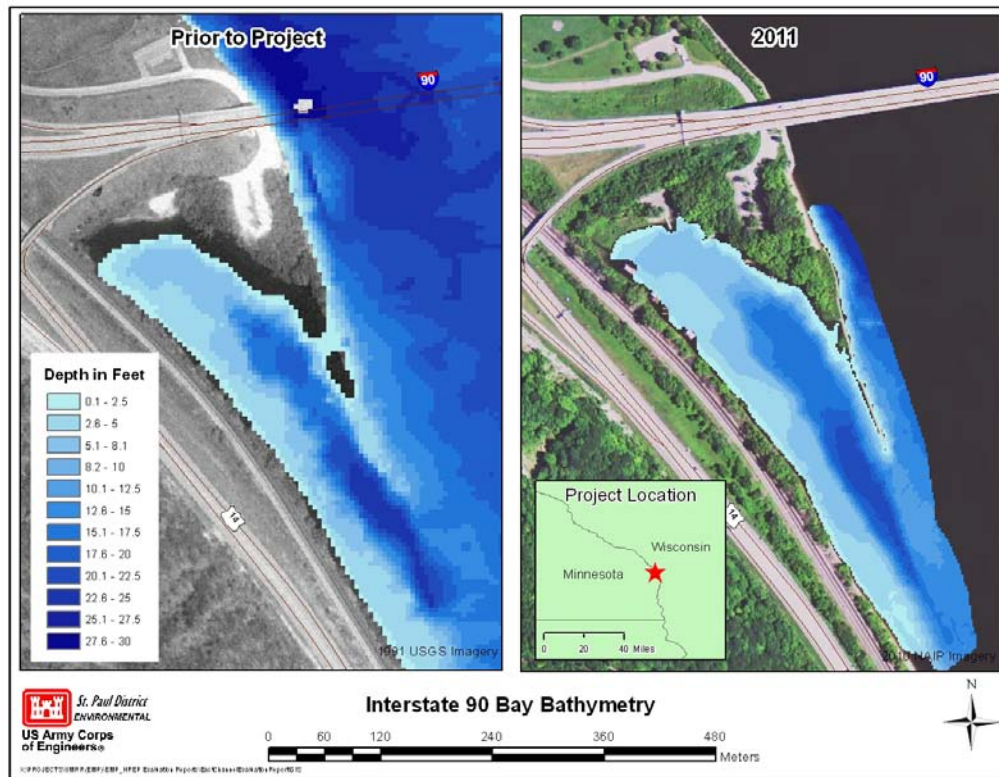


**Figure 2.** Interstate 90 Bay area before and after East Channel HREP implementation.

The 3.9 hectares of bay habitat created by the project was enough to meet the 3.2 hectares required for objective I90-1, but it was not enough to meet the 4.5 hectares required by objective I90-2. Both objectives for I-90 Bay also had depth requirements. In order to reach the depth requirement, at least 50 percent of the bay needed to be more than 2.5 meters (8.2 feet) in depth.

In August 2011 bathymetry of I-90 Bay was conducted in order to evaluate the current depths of the bay. River stage was adjusted to the lowest controlled pool (LCP) of 631 feet and compared to 1998 Upper Midwest Environmental Sciences Center (UMESC) bathymetry (though the project was completed in 1996, the 1998 UMESC bathymetry for I-90 Bay was taken prior to the project). I-90 Bay failed to meet the objective of having at least 50 percent of the bay at depths of greater than 2.5 meters. Approximately 1.43 hectares, 36.7 percent, of the area delineated as I-90 Bay was greater than 2.5 meters deep; an increase from the 0.77 hectares, 24 percent, observed prior to the project.

The 1998 and 2011 bathymetry looks to be very similar in depth and structure (Figure 3). From visual analysis it appears I-90 Bay has continued to function as a deepwater, off channel habitat area as it did prior to the project. Neither of the objectives set for I-90 Bay were reached despite the bay area increasing from 3.2 hectares to 3.9 hectares and the habitat area greater than 2.5 meters in depth increasing from approximately 24 percent to 37 percent.



**Figure 3.** A comparison of 1998 UMESC bathymetry taken prior to the project and 2011 USACE bathymetry.

The peninsula restoration affected an area much larger than I-90 Bay. The deep water habitat protected by the peninsula extends downriver, outside of the bay area. The deep water occurring in I-90 bay and the area extending downstream encompasses over 2 hectares of habitat greater than 2.5 meters in depth.

The purpose of the I90-1 objective was to *preserve* the remaining deep, protected, bay habitat that existed. The specifications of the objective, however, did not match the habitat that was present at that time. Objective I90-1 required the preservation of more habitat greater than 2.5 meters than even existed. During problem identification in the DPR/EA it was recognized that only 49 percent of the bay consisted of depths of 1.8 meters or greater (USACE 1995).

## 8.2 Island Protection and Maintenance

Rock berms were constructed on the upstream ends of Lower Island 98 and Minnesota Island to prevent further erosion of the islands. Computer analysis of aerial photography revealed island changes from 1991 and 2010 (Figure 2). Although there were small areas of erosion on both islands, the majority of the land has withstood the rivers forces over this period. One notable area of erosion has occurred on the northeast end of Lower Island 98 where 0.2 hectares were lost. Both islands are currently larger than estimated prior to the project (Table 4). An accumulation of sediments on the downstream ends of the islands has resulted in a net increase of 0.6 hectares for Lower Island 98 and 1.3 hectares for the northern portion Minnesota Island (Table 5).

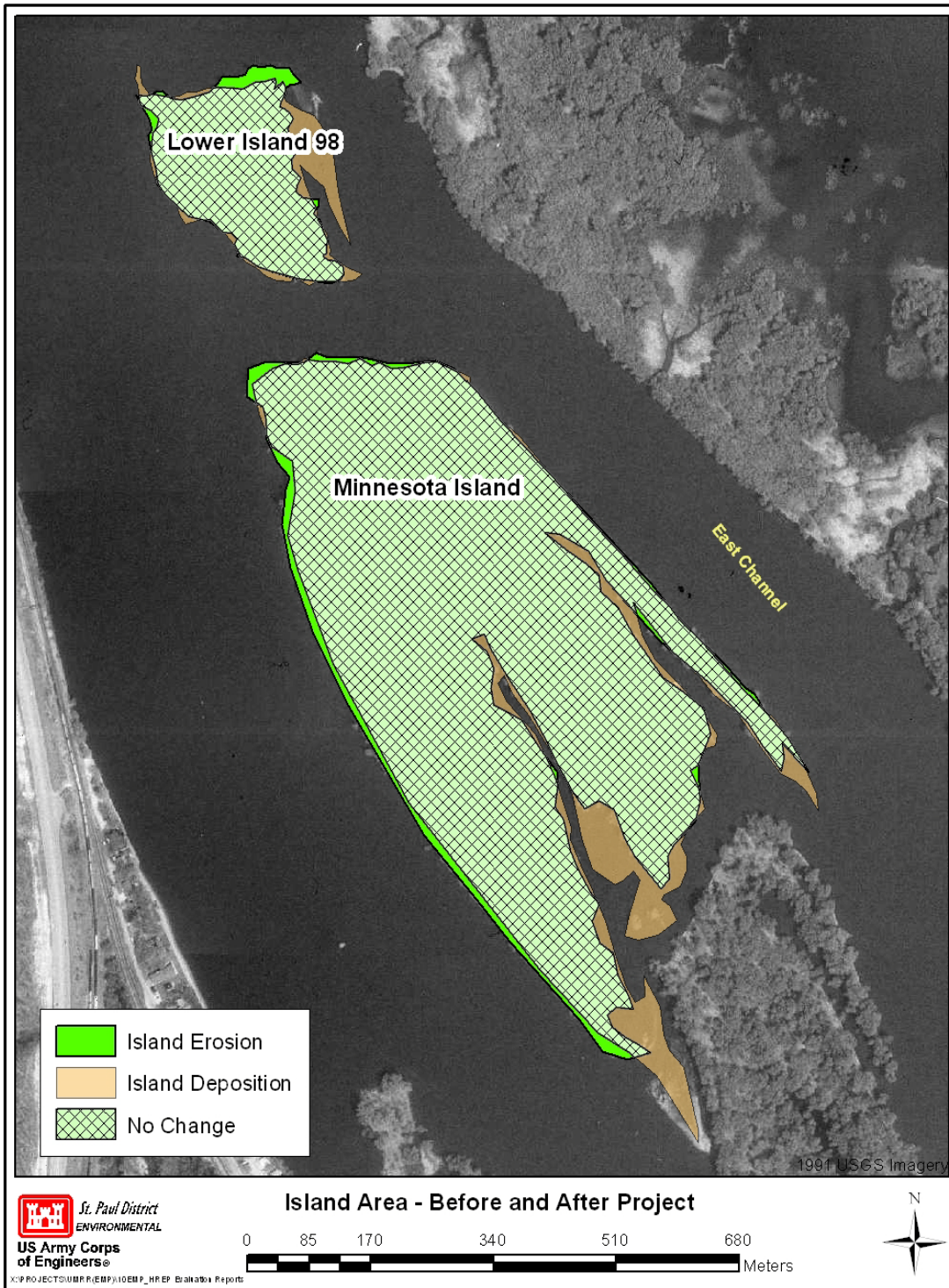
**Table 4.** East Channel HREP project objectives and results.

Objective	Project Accomplishment	Potential Enhancement Feature	Preproject	Est. Without Project	Est. With Project	Actual Results
Maintain protected deep off-channel habitat	Prevent the loss of 1.6 hectares of protected deep off-channel habitat	Rock bank protection	3.2 Ha	1.6 Ha	3.2 Ha	3.9 Ha
Restore protected deep off-channel habitat	Restore 1.25 hectares of protected deep off-channel habitat	Rock berm	3.2 Ha	1.6 Ha	4.45 Ha	3.9 Ha
Maintain head of Lower Island 98	Maintain wooded island habitat	Rock bank protection	4.5 Ha	1.75 Ha	4.5 Ha	5.12 Ha
Maintain head of Minnesota Island	Maintain wooded island habitat	Rock bank protection	30.8 Ha	29.1 Ha	30.8 Ha	32.11 Ha

**Table 5.** Changes in Island acreage from 1991 to 2010 for Lower Island 98 and Minnesota Island.

	<u>Lower Island 98</u>	<u>Minnesota Island</u>
Prior to project (1991)	4.5 Ha	30.8 Ha
Currently (2010)	5.1 Ha	32.1 Ha
Change in Acreage	+ 0.6 Ha	+ 1.3 Ha





**Figure 2.** Erosion and depositional changes on Lower Island 98 and Minnesota Island between 1991 and 2010.

### **8.3 Lessons Learned and Recommendations**

Most of the work completed on the East Channel HREP project involved protection with hard armoring. Since completion, the rock armoring has prevented shoreline erosion that was previously occurring on the I-90 Peninsula, Lower Island 98, and Minnesota Island. Rather than only installing riprap along the shore, groins were installed at the sites to help alter water flows. It is likely that by deflecting these forces it has allowed for minimal erosion of the sites.

There were no figures showing a border from I-90 Bay to the main channel in the DPR/EA or the O&M Manual. This led to some uncertainty when measuring features in that area. The project could be more accurately assessed with a figure to clarify any ambiguity.

One recommendation for the project is to provide follow-up monitoring for the Head of East Channel, Smith Slough, and Upper French Slough. The individual project areas not carried through to construction were once components of the East Channel HREP. These projects were deferred as they appeared to be able to sustain themselves for the foreseeable future.

## 9.0 References

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