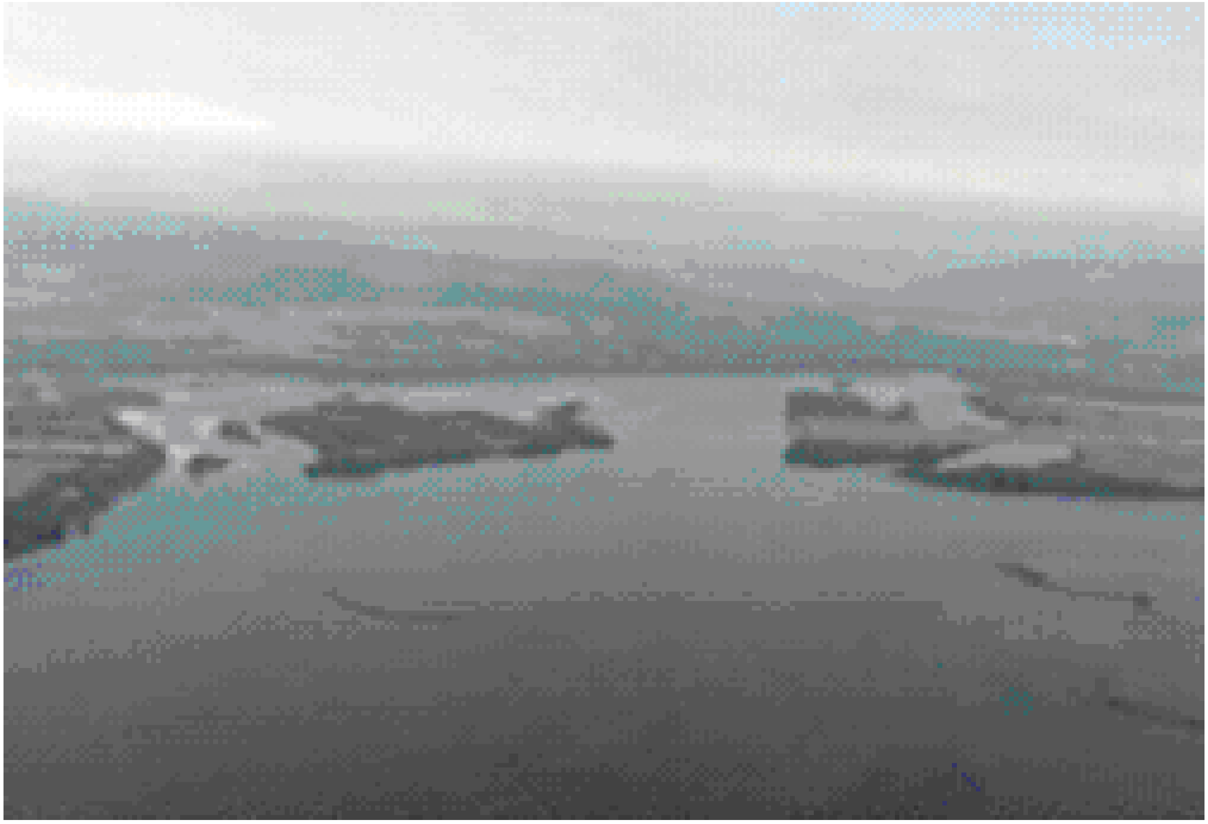
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM



U.S. Army Corps of Engineers
St. Paul District
190 Fifth Street East
St. Paul, MN 55101-1638

September 2004

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**LAKE ONALASKA DREDGE CUT
AND ISLAND CREATION
PROJECT COMPLETION REPORT**

September 2004

Lake Onalaska islands and Rosebud Island, Pool 7, La Crosse, Wis.

U.S. Army Corps of Engineers
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1.0 INTRODUCTION

1.1 HABITAT REHABILITATION AND ENHANCEMENT PROJECTS

Section 1103 of the 1986 Water Resources Development Act authorized a multi-element program designed to protect, restore, and balance the resources of the Upper Mississippi River System (UMRS). The Habitat Rehabilitation and Enhancement Project (HREP) construction is one element of the Environmental Management Program (EMP) (USACE 1988). Construction of the Lake Onalaska Dredge Cut and Island Creation project was initiated as an HREP in February 1989 and completed in July 1990. The planning, design, and construction of the project were the result of extensive cooperation and coordination efforts by the involved Federal and State agencies and the public (USACE 1998).

1.2 PURPOSE OF HABITAT PROJECT COMPLETION REPORTS

The purposes of this habitat project completion report for the Lake Onalaska project are to:

- Document the pre- and post-construction monitoring activities for the Lake Onalaska 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 habitat rehabilitation and enhancement projects.

This report summarizes all available monitoring data, operation and maintenance information, and project observations made by the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), the University of Wisconsin-La Crosse, and the Wisconsin Department of Natural Resources (WDNR) for the period August 1986 through February 2001. It also includes other agency and public input.

2.0 PROJECT OBJECTIVES

2.1 GENERAL GOALS

The general goals of the project were to improve water quality and clarity, provide overwinter habitat, create deepwater habitat, reduce wind-induced erosion, and restore habitat diversity (USACE 1988).

2.2 SPECIFIC HABITAT OBJECTIVES

On the basis of design criteria and future project assessment, the following specific habitat objectives for Lake Onalaska have been identified:

- Improve water quality in the area east of Rosebud Island.
- Prevent the area east of Rosebud Island from freezing to the bottom.
- Create deepwater fish habitat.
- Improve water clarity in Lake Onalaska.
- Reduce wind-induced erosion on existing land areas.
- Restore habitat diversity that has been lost over time.
- Provide predator-free waterfowl nesting/loafing habitat.

2.3 TARGET SPECIES AND HABITATS

The following target species and habitat types were identified in the Lake Onalaska Definite Project Report/Environmental Assessment (USACE 1988).

2.3.1 Habitat Types and Distribution

Lake Onalaska historically contained an abundance of aquatic plants. Principal emergent species were arrowhead (*Sagittaria* sp.) and yellow lotus (*Nelumbo lutea*), which covered a large area of the upper portion of the lake. Bulrush (*Scirpus* sp.), bur reed (*Sparganium* sp.), pickerelweed (*Pontederia cordata*), and cattail (*Typha latifolia*) were also present in substantial densities. The dominant submerged species were wild celery (*Vallisneria americana*) and several species of pondweed (*Potamogeton* sp. and *Nojas* sp.). Wild celery covered an area of approximately 3,500 acres, almost half of the total water area of Lake Onalaska. Other submerged species included mud plantain (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), marestail (*Hippuris vulgaris*), and Canada waterweed (*Elodea canadensis*). In certain areas of the lake, including the area north of Rosebud Island, the vegetation growth had become so luxuriant that problems with water circulation and low dissolved oxygen (DO) concentrations were beginning to occur (USACE 1988).

2.3.2 Fish and Wildlife

The Halfway Creek area, a portion of Lake Onalaska north of Rosebud Island, was historically an important bluegill/largemouth bass overwintering area. The Halfway Creek area diminished in habitat value because of the low DO levels and the shallow water depths that allowed much of the area to freeze throughout its entire depth to the bottom of the lake. The DO problems were a result of sedimentation and excessive aquatic plant growth, and the areas of freezing of the entire water depth, preventing the circulation of water in the area. Under these conditions, flow from Halfway Creek frequently moved upstream around Rosebud Island. Since the initiation of operation of Lock and Dam 7, the 7,700-acre Lake Onalaska area has lost an extensive amount of deepwater habitat and the associated structural diversity. The area within Lake Onalaska with depths greater than 7.5 feet decreased from 585 acres (shortly after impoundment) to between 151 and 282 acres. Prior to this HREP project, the portion of the deepwater habitat that existed in Lake Onalaska was artificially created by dredging borrow material for the runway expansion at the La Crosse Airport and for the construction of the dike for Lock and Dam 7 (USACE 1988).

2.3.3 Threatened and Endangered Species

At the time of project construction, it was noted that three federally listed threatened or endangered species occurred in the area: Higgins eye mussel (*Lampsilis higginsii*), bald eagle (*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrinus*). A mussel survey conducted in the main channel border areas at Winters Landing detected the presence of the Higgins eye mussel. This occurrence was the first recorded presence of the Higgins eye mussel in pool 7 (USACE 1988). Bald eagles were sighted in the area during migration and used the adjacent areas for roosting. Peregrine falcons also were sighted in the area occasionally during migration. The peregrine falcon was a federally listed species at the time of construction but it has since been delisted. It remains listed as an endangered species by the State of Wisconsin.

3.0 PROJECT DESCRIPTION

3.1 LOCATION

The project is located in La Crosse County, Wisconsin, just upstream from the cities of Onalaska and La Crosse (Figure 1). Lake Onalaska is a 7,700-acre backwater lake on the Wisconsin side of the Mississippi River navigation channel in pool 7. The project is located in the Lake Onalaska/Black River area of the Mississippi River, 3 miles northeast of the navigation channel at approximately river mile (R.M.) 704. The project location is approximately 2 miles upstream of the Black River spillway. The project area is within the boundaries of the Upper Mississippi River National Wildlife and Fish Refuge (USACE 1988).

3.2 PROJECT AREA

Prior to inundation in 1937, the Lake Onalaska area consisted of floodplain meadow with scattered farms, marshlands, and stands of cottonwood and willow. The Black River is a major tributary entering pool 7 north of Lake Onalaska. Flows from the Black River entering Lake Onalaska generally follow the Wisconsin shoreline of the lake and proceed around the south side of Rosebud Island to the Black River spillway at the city of Onalaska. Approximately 4 miles downstream of the spillway, the Old Black River channel joins the navigation channel of the Mississippi River (USACE 1988).

The area of the dredge cut is bounded on the west by Lake Onalaska, on the south by Rosebud Island, on the north by the town of Brice Prairie, and on the east by a Burlington Northern Railroad embankment along the Wisconsin shoreline. The Wisconsin shoreline adjacent to the project area transitions to a flat prairie area (Brice Prairie). Marsh habitat is present where Halfway Creek enters Lake Onalaska. The next plateau rises to about 60 to 80 feet above the lake, where most of the urban development has taken place. Approximately 2 miles inland, the bluffs rise 600 feet or more above Lake Onalaska (USACE 1988).

3.3 PRE-PROJECT HABITAT CONDITIONS AND CHANGES

Water depths in the project area adjacent to Rosebud Island ranged from 1 to 4 feet with abundant aquatic vegetation growth. The shallow water and the excessive plant growth contributed to the problem of low DO content in the water and areas of freezing of the entire water depth in the project area. During most years, a majority of the 300-acre project area north of Rosebud Island experienced low DO levels during the winter. The severity and duration of reduced oxygen levels in any given year depended on ice thickness and snow cover, which in turn affected water circulation and the amount of photosynthetic activity. Several general water studies of the area north of Rosebud Island showed that winter DO levels frequently fell below what was considered necessary to sustain a good winter fishery (USACE 1988).

The sedimentation rates within Lake Onalaska were estimated using various methods: bottom contour changes since inundation, Cesium-137 sediment cores, and sediment input. The estimates ranged from 0.2 centimeter (cm) per year to 2.10 cm per year. The approximate 300-acre area north of Rosebud Island had lost 37 percent of its total water volume from pre-inundation to 1976. The period 1937 to 1976 had an average sedimentation rate of 0.7 cm per year. Approximately 560,000 cubic yards of sediment had accumulated in this area. Similar sedimentation occurred for the areas south of Rosebud Island (approximately 0.96 cm per year) (USACE 1988).

The commercial fishing harvest in pool 7 has been relatively stable. Approximately 181,440 kilograms per year of fish were harvested from Lake Onalaska prior to construction. Lake Onalaska is well known for its sport fishery, especially bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*). It was estimated that, during the winter of 1976-77, 31,696 kilograms of bluegills were harvested from Lake Onalaska within the area north of Rosebud Island. Studies conducted by the WDNR during 1984-85 indicated that bluegill winter use in selected areas adjacent to the project area was high. The projected ice-fishing harvest for bluegills during the 1984-85 winter season on all of Lake Onalaska was 167,853 kilograms (USACE 1988).

Shortly after the inundation of pool 7, the area north of Rosebud Island had a diversity of water depths ranging from zero to 6 feet deep. A 1976 survey showed that very little of the area had water depths greater than 4 feet, with most of the area less than 2.5 feet deep. Deepwater habitat is important to the fisheries of Lake Onalaska because it provides escape during the summer when the vegetated shallows experience high water temperatures and low DO levels and also in the winter when bluegills form schools and move to the deep water (USACE 1988).

3.4 PROJECT FEATURES

3.4.1 Highway Project Features

During the planning stages of the Lake Onalaska Project, an opportunity arose to combine this project with the Wisconsin Department of Transportation (WISDOT) Highway 53 realignment and upgrade, beginning at Interstate 90 in the city of Onalaska and extending 7 miles to State Highway 35. This project required approximately 900,000 cubic yards of borrow material, which WISDOT obtained from the dredge cut in Lake Onalaska. The material was hydraulically pumped to the highway alignment and put directly in place (USACE 1988, 1998). The return water from this placement contained extremely high total suspended solids (> 15,000 mg/L), which undesirably were discharged to the La Crosse River.

3.4.2 Habitat Project Features

3.4.2.1 Aquatic Habitat Project Features

The dredge cut portion of the project was designed to maintain DO levels between Rosebud Island and the Wisconsin shoreline by supplying adequate water flows throughout the year into this backwater area of Lake Onalaska (Figure 2). Velocity and channel depths were evaluated in an effort to meet this particular goal, while maintaining habitat requirements for the target species of bluegills and largemouth bass. This portion of the project consists of a dual-channel system that extends from the upstream end (head) of Rosebud Island to its downstream end. Each channel leg is approximately 7,000 feet long and 100 to 150 feet wide, although some parts of the channels were dredged up to 300 feet wide to gain additional material for highway fill. The majority of the channel bottom was excavated to a depth between 10 and 15 feet, except the lower 1,500 feet of each channel, which was dredged to a depth of 8 to 10 feet (at the low control pool elevation of 639 feet above mean sea level [msl]). Greater depths were excavated in a spur that extends toward Halfway Creek, creating a sediment basin at the mouth of the creek. Additional channels were dredged adjacent to and between the habitat channels in order to supply the additional amount of material required for the WISDOT highway project. These channels are not considered to be part of the habitat project; however, they do provide increased deepwater habitat benefits to this backwater area. A total of approximately 1,340,000 cubic yards of material was dredged from the channel areas (160,000 cubic yards for islands, 900,000 cubic yards for highway embankment, and 280,000 cubic yards of fine material placed on Rosebud Island). The project was designed with sufficient dredged depths to preclude maintenance dredging during its 50-year life (USACE 1998).

3.4.2.2 Island Creation Habitat Features

Three semi-elliptical-shaped islands were constructed in Lake Onalaska in 1989. The islands are about 1,500 feet long, have a 50-foot top width with a 20-foot berm on the inner side, and are 5 feet above low control pool. One of the islands, Broken Gun, was built in slightly deeper water (about 4 to 6 feet deep). The other two islands, Cormorant and Arrowhead, were constructed in shallower areas where islands had previously existed. The fill to construct the islands was taken from the upper single leg of the excavated habitat channel. Rock riprap on geotextile fabric was used on the northerly side of each island to provide erosion protection from wind-induced waves. A total of about 14,000 cubic yards of rock riprap was placed on the convex side and around the ends of the islands. The berm on the inner (southern) shore of each island was constructed to a height of 2 feet above low control pool. About 38,000 cubic yards of fine material was excavated from the lake immediately adjacent to the convex side of each island to provide topsoil for the top and berm of each island. The material was placed on the islands and permitted to dry over the winter. Seeding was accomplished in May 1990 and was very successful. The initial seeding included perennial ryegrass. However, the most abundant species currently growing on the islands are side oats grama, switchgrass, reed canary grass, and bluegrass.

After completion of the construction, erosion of the berm was more severe than expected and became a threat to the main island structure. Therefore, in June and July 1993 (during flood conditions), the inner side of the three islands was stabilized using a combination of rock “wedge” and groins to better trap eroding material and maintain a stable shoreline. A total of about 1,500 cubic yards of rock was used for this remedial work (USACE 1998).

3.5 PROJECT HISTORY

The St. Paul District of the USACE awarded the construction contract in February 1989. Channel dredging, island construction, and placement of fill were completed in October 1989. The spreading and seeding of topsoil on the three islands and the rehabilitation of Rosebud Island were completed in the summer of 1990. Remedial work to correct an erosion problem on the islands was completed in 1993 (USACE web page).

4.0 PROJECT MONITORING

4.1 MONITORING PLAN

A monitoring plan was developed for this project to evaluate whether project objectives were met (USACE 1998). The general monitoring parameters for each project objective are as follows:

1. Project Objective: Provide 60 acres of 8- to 15-foot depths in an area near Rosebud Island for centrarchid habitat.

   Evaluation: Perform bathymetric soundings of the dredged area in 1990 and 1999.

2. Project Objective: Maintain summer DO levels in the area near Rosebud Island at greater than 5.0 mg/L.

   Evaluation: Monitor DO in the late summer of 1990.

3. Project Objective: Maintain winter DO levels in the area near Rosebud Island at greater than 5.0 mg/L and water temperature at greater than 2 ºC.

   Evaluation: Monitor DO and temperature during the winters of 1989-90, 1991-92, and 1992-93.

4. Project Objective: Maintain flow velocities of from 0.05 to 1 ft/sec in the project channels for low-flow conditions of winter and high-flow conditions of late summer, respectively.

   Evaluation: Monitor flow velocity in the project channels in the winters of 1989-90, 1991-92, 1992-93, 1994-95, and at appropriate intervals thereafter.

5. Project Objective: Create 11 acres of islands in Lake Onalaska.

   Evaluation: Perform aerial photography and visual inspection for the first 3 years after construction. Perform cross-section surveys of the islands each year for the first 3 years after construction and on an as-needed basis thereafter.

6. Project Objective: Provide vegetation on islands suitable for waterfowl nesting.

   Evaluation: Perform island vegetation surveys in 1991, 1992, 1993, 1994, and 1995.

Monitoring activities were coordinated with similar efforts by the Long-Term Resource Monitoring (LTRM) program, a component of the EMP.

4.2 MONITORING HISTORY

4.2.1 Pre-Construction Monitoring

Pre-construction habitat monitoring at Lake Onalaska was performed by the WDNR and the USACE from January 1986 to February 1987. Table 1 summarizes pre-construction monitoring data collection efforts.

TABLE 1

Pre-Construction Monitoring Data, Lake Onalaska

Date	Agency	Components Monitored
January 21 to February 18, 1986	WDNR	Winter water quality.
August 8 to 15, 1986	WDNR	DO and water temperature.
December 19, 1986, to February 9, 1987	USACE	DO, current velocity, and sediment depth.
January 9 to February 4, 1987	WDNR	DO.

4.2.2 Post-Construction Monitoring

Post-construction habitat monitoring at Lake Onalaska was performed by the University of Wisconsin-La Crosse, WDNR, USFWS, and USACE. Table 2 summarizes the monitoring data collection efforts.

TABLE 2

Post-Construction Monitoring Data, Lake Onalaska

Date	Agency	Components Monitored
Summer 1989	UW-La Crosse	Vegetation.
December 1, 1989, to July 30, 1991	WDNR	Water, ice and snow depth, DO, temperature, conductivity, and velocity.
August 19-22, 1991	USACE	Vegetation.
August 19-22, 1991	USACE	Terrestrial vegetation.
July 22, 1992	USACE	Discharge measurements.
1992, 1993, 1998, 1999, 2000, 2002, 2003	WDNR	Water velocity and discharge estimates.
August 5, 1992	USFWS	Duck nesting.
August 12, 1992	USACE	Terrestrial and aquatic vegetation.
January 15 to February 10, 1993	WDNR	Current velocity, DO, and temperature.
August 17, 1994	USACE	Terrestrial vegetation.
August 14, 1995	USACE	Terrestrial vegetation.
August 17, 1999	USACE	Terrestrial vegetation.
October 16, 2003	WDNR	Fisheries resources.

Summer 1989 Vegetation Monitoring

Skewes (1989) monitored vegetation on the newly created crescent islands (Arrowhead Island, Broken Gun Island, and Cormorant Island) in Lake Onalaska to obtain a first-year assessment of the vegetation established on the islands and in the surrounding water. The fieldwork was performed during the end of the summer in 1989. Before sampling, the islands were divided into three zones: an outer zone, which is the riprapped slope on the north facing the outer curve of the island; the inner zone, which is the beach on the south facing the inside curve of the island; and the top zone, which is the flat area bounded on the outside curve by the riprapped area and on the inside curve by the erosion zone. A plant list was compiled for each zone. Percent coverage and vegetation height were also measured at each location. Eight 100-meter transects were laid out around each island to examine aquatic vegetation. Skewes (1989) reported that 61 different species of plants were documented on the three islands. Within the inner zone of each island, 19 species were found. Umbrella sedge (*Cyperus strigosus*), smartweed (*Polygonum* spp.), pigweed (*Amaranthus* spp.), and rice cutgrass (*Leersia orysoides*) were the dominant vegetation on the three islands. Skewes (1989) stated that 43 species of plants occurred in the outer zone of the islands, but the plants were sparsely distributed among the riprap. The top zones of the three islands were seeded with four species of grasses during construction. During the monitoring period, one of the four seeded species, perennial rye (*Lolium perenne*), was dominant. Nearly all of the aquatic vegetation was found at depths of less than 1.0 meter. Cormorant Island had the most aquatic macrophyte growth, while Broken Gun Island had no growth. The aquatic vegetation growing around Cormorant Island consisted almost entirely of small amounts of wild celery (*Vallisneria americana*) and watermilfoil (*Myriophyllum spicatum*). Skewes (1989) stated that the lack of aquatic vegetation might be due to wave disturbance along the shoreline, to the steepness of the lake bottom in the littoral zone, or to the general aquatic vegetation decline in Lake Onalaska. Skewes (1989) concluded that the topsoil composition and seeding of the islands provided a good grass cover in the top zone and thus achieved the goal of soil stabilization. The outer zone was made up of weedy annuals and some seedling trees, which will eventually provide excellent habitat. Since the inner zone was designed to erode to an eventually stable bank, the vegetation was sparse, but should become denser over time.

August 1991 Terrestrial Vegetation Monitoring

Anfang (1991) monitored the revegetation sites on the three Lake Onalaska islands. To evaluate the suitability of the seeded species, 20 quarter-square-meter plots were randomly selected along a transect on each island. Percent cover, total species, and Robel readings were taken for each plot. Robel readings in 1991 showed average values of 3.7, 4.1, and 2.1 for Broken Gun, Cormorant, and Arrowhead Islands, respectively. These Robel readings were above the project goal of 1.0 to 2.0. The total percent cover data showed a decrease in 1991 from the 1990 data. Anfang (1991) concluded that this was likely due to the decline in perennial rye, which was being replaced by more desirable long-lived species such as switchgrass (*Panicum virgatum*) and side oats grama (*Bouteloua curtipendula*). An “Analysis of Variance” was performed on the percent cover estimates to determine if there was a difference among the islands. During the 1991 sampling period, there was no significant difference in percent cover among the three islands. The Jaccard Index of Species Similarity was calculated for the three islands and showed that the vegetation was more similar in 1991 than in 1990. An aquatic plant survey was conducted around each of the islands. No aquatic vegetation was found at Broken Gun Island, which was attributed to the relatively unsuitable habitat for aquatic macrophyte growth. Aquatic vegetation on Cormorant Island was found primarily on the north and south sides of the island. Species collected at these locations include Eurasian watermilfoil, wild celery, and sago pondweed. Aquatic vegetation around Arrowhead Island was found primarily on the west end of the island in the vicinity of the natural island. The dominant species were wild celery and sago pondweed. Anfang (1991) concluded that the terrestrial vegetation was well established and that seeding was very successful. He also noted that, in general, aquatic vegetation around the islands was sparse and that it might require additional time to become established.

July 1992 Discharge Monitoring

A memo from Jon Hendrickson, USACE, on July 22, 1992, describes monitoring results on the discharge from the Lake Onalaska dam south of Rosebud Island. Hendrickson (1992) stated that the winter discharges were extremely high and could possibly have an impact on the system from a fisheries standpoint. He recommended that at least three more data sets be obtained at discharges of 10,000 and 20,000 cubic feet per second (cfs) to properly determine the effects of different discharge rates. Hendrickson also discussed the possible use of stoplogs to reduce discharge in the project channels. He concluded the memo by stating that one more year of data must be collected to justify project modifications.

1992 through 2003 Discharge Monitoring

The WDNR has performed regular measurements of discharge in the vicinity to the project since the early 1990s. Much of this effort was done to evaluate the effect of discharge on habitat quality, and how habitat conditions in the project area might be further improved. As mentioned above, high discharge in the project area was a concern following construction. Sampling by the WDNR frequently noted elevated discharges either within the dredge cuts or within the Onalaska spillway immediately downstream. Since all flow through the spillway must pass through the project area, flow measurements from this location provide great insight into discharges at the project. Discharge was frequently measured at over 1,000 cfs, which was frequently over 5 percent of the discharge through Lock and Dam 7. It was believed that these elevated discharges were responsible for low water temperatures observed within the dredge cuts, thus reducing overwintering habitat quality.

In response to the elevated flows, the USACE modified the spillway downstream of the project area in 1994, incorporating a stop log structure to modify winter flows. This modification was intended to reduce flows through the spillway, thus reducing the amount of flow drawn through the project area. Monitoring by the WDNR since 1994 shows that winter flows are regularly between 500 and 800 cfs, which is only about 2 to 3 percent of the flow measured through Lock and Dam 7. The results of discharge monitoring would suggest that flows have been reduced within the project area.

August 1992 Waterfowl Nesting Monitoring

The District Manager of the Upper Mississippi River National Wildlife and Fish Refuge in La Crosse, Wisconsin, describes results from a waterfowl nesting monitoring study completed for the three Lake Onalaska islands during the summer of 1992 (Nissen 1992). The islands were visited four times during 1992 to locate waterfowl nests. During the survey, eggs were counted, candled, and then numbered. Nesting sites were marked with flagging for future reference. A total of 46 nests were observed on Broken Gun, Arrowhead, and Cormorant Islands. The results showed that Cormorant Island had the most hatched nests (29), while Broken Gun had the fewest (3). Only two nests had been preyed upon by other animals, and only one nest was abandoned. During the visit, two nests on Arrowhead Island and one on Cormorant Island still had adults incubating them. On the basis of this data, the islands seem to provide good nesting habitat for ducks, and the habitat is expected to improve as the islands become more vegetated.

August 1992 Terrestrial and Aquatic Vegetation Monitoring

Anfang (1992) monitored revegetation of the dredged material on the three Lake Onalaska islands. To evaluate the suitability of the seeded species, 20 quarter-square-meter plots were randomly selected along a transect on each island. Percent cover, total species, and Robel readings were obtained for each plot.

During the 1992 monitoring period, 24 different species were described on the three islands. The most dominant species was switchgrass, while the least dominant was an uncharacterized bluegrass species. The Robel reading for Broken Gun Island was lower in 1992 (3.3) than in 1991 (3.7). The reason may be that people who use the island for recreation frequently mow to keep the vegetation from getting too high. The Robel reading for Cormorant Island was also lower in 1992 (3.1) than in 1991 (4.1), while Arrowhead Island had the same reading as the year before. The average percent cover for the three islands was lower during the 1992 monitoring period than in previous years. Anfang (1992) concluded that this was likely due to the decline in perennial rye. An "Analysis of Variance" was performed on the percent cover data, which showed a significant decrease from 1991 to 1992. Anfang (1992) noted that the willow cuttings placed along the shore of Broken Gun Island had not survived due to heavy erosion. The Jaccard Index of Species Similarity showed that the vegetation on the three islands had become less similar than in the previous years.

Anfang (1992) also monitored the growth of aquatic macrophyte vegetation on the three islands on August 12, 1992. No aquatic vegetation was observed growing on Broken Gun Island, due primarily to the lack of suitable habitat around the island. Cormorant Island had macrophytes growing primarily on the north and south sides of the island. As in 1991, the vegetation was dominated by Eurasian watermilfoil and sago pondweed. The vegetation was observed in distinct beds that had visible clam beds within them. Aquatic vegetation growing around Arrowhead Island was concentrated on the west side of the island near the natural island. Eurasian watermilfoil, sago pondweed, and wild celery were the dominant species. The milfoil bed had grown in size from the previous year and also supported a clam bed. Anfang (1992) stated that the aquatic vegetation around the islands and throughout Lake Onalaska remained sparse. He concluded that terrestrial vegetation seemed to be well established on the islands. Switchgrass was the dominant species, and there was a decrease in percent cover from the previous monitoring period.

<u>January through February 1993 Current Velocity, DO, and Temperature Monitoring</u>

Sullivan et al. (1993) measured discharge and water quality parameters in or near the vicinity of the Lake Onalaska dredge cut during January and February 1993. Current velocity was determined using a Marsh-McBirney 201D current meter. During measurement, current velocities less than 0.01 ft/sec (0.3 cm/sec) were reported as not detected. Discharge measurements were made at three locations, outside and inside the dredge cut channels and in the Black River above the La Crosse airport runway lights. If the depth of water was less than 2 feet, current velocities for discharge calculations were determined at 60 percent depth. If the water depth was greater than 2 feet, velocity measurements were made at 20 and 80 percent depth. Dissolved oxygen and temperature measurements were obtained using a Yellow Springs Instrument (YSI) model 54 or 57 DO meter. Detailed cross-sectional profiles of DO levels, water temperature, and current velocity were collected at five transects in the center and lower end of the dredge cut. Measurements were made at 100- to 200-foot intervals, starting from the left descending bank and terminating at or near the shoreline of Rosebud Island. Vertical profiles of DO levels, water temperature, and velocity were normally collected at 0.5 foot below the ice, mid-depth, and 0.5 foot above the bottom.

Total flows through the Rosebud Island dredge cut were 379 and 372 cfs during the winter measurements in January and February 1993, respectively. Total flow through the entire dredge cut and Black River was 1,230 cfs during both surveys and represented 6.5 percent of the total Mississippi River flow reported for Lock and Dam 7. These readings were substantially lower than the 1992 data. DO profiles were similar to previous winter conditions reported for the dredge cut; however, DO levels during the 1993 sampling period were slightly lower than in previous years. Surface DO level averages ranged from 7.6 to 10.3 mg/L. The lowest concentrations were encountered in shallow water (less than 2 feet deep)

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with no current (and moderate snow cover), or deepwater areas in the dredge cuts where the sediment oxygen demand likely had a greater influence. The median DO concentration for all samples collected during the two surveys was 9.3 mg/L, with 88 percent exceeding 5.0 mg/L. Water temperatures were normally less than 1.0 °C when current velocity was detected and exceeded 2.0 °C in deep water where no current velocity was detected. Sullivan et al. (1993) concluded that water temperature was inversely related to current velocity and exhibited a negative relationship with DO levels when cold-water samples with low DO levels were excluded.

Radiotelemetry studies on bluegills and black crappies conducted by the WDNR suggest that the minimum acceptable winter centrarchid criteria are DO levels greater than or equal to 3.0 mg/L, water temperatures greater than or equal to 1.0°C, and current velocities less than or equal to 0.03 ft/sec. The data from the 1993 monitoring period suggests that the Lake Onalaska dredge cut habitat is limited primarily by cold water. On the basis of the data from January and February 1993 and the above centrarchid winter water criteria, only 12 percent of the more than 300 samples were within the accepted habitat limits.

Sullivan et al. (1993) conclude their report by stating that the Lake Onalaska dredge cut must be modified to reduce the flow through the area by at least 50 to 75 percent during normal winter flow conditions. This will enable the area to stratify and increase the bottom water temperatures to provide for better winter fish survival. The final design flow should be based on a surface target DO level of 5.0 mg/L, considering the expected oxygen demand within the project area under reduced velocity conditions.

August 1994 Terrestrial Vegetation Monitoring

Anfang (1994) monitored the revegetation of the dredged material on the three Lake Onalaska islands. To evaluate the suitability of the seeded species, 15 quarter-square-meter plots were randomly selected along a transect on each island. Percent cover, total species, and Robel readings were obtained for each plot. Arrowhead Island had a Robel reading of 3.4 in 1994, and the vegetation appeared normal. The vegetation on Broken Gun Island and Cormorant Island was mostly dead during the 1994 monitoring. Therefore, Robel readings for this monitoring period were misleading because they reflected a large proportion of dead vegetation. Anfang (1994) stated that the dense growth of the previous years might have smothered the new growth. To alleviate this problem, Anfang (1994) recommended burning the sites on an annual basis. The “Analysis of Variance” test showed a significant difference in percent cover on all the islands from 1993 to 1994.

During the 1994 monitoring period, switchgrass was the dominant species in percent cover, but decreased in importance on Broken Gun and Cormorant Islands. Importance values showed that switchgrass, side oats grama, reed canary grass, and bluegrass were the most important species on all the islands. Aquatic vegetation monitoring was not conducted in 1994 because of the lack of vegetation. Anfang (1994) concluded by stating that the vegetation on both Broken Gun and Cormorant Islands was surprising, considering what was found in 1993. Between 70 and 90 percent of the vegetation was dead, and reed canary grass had begun to take over. He recommended annual burning of the islands to help alleviate this problem.

August 1995 Terrestrial Vegetation Monitoring

Anfang (1995) monitored revegetation of the dredged material on the three Lake Onalaska islands on August 14, 1995. To determine the suitability of the seeded species, 15 quarter-square-meter plots were randomly selected along a transect on each island. Percent cover, total species, and Robel readings were obtained for each plot. Because of the lack of new vegetation the previous year, the eastern half of Broken Gun Island and the western half of Cormorant Island were burned in the fall of 1994. Tests conducted the previous year determined that the soil was deficient in nitrogen.

The burning stimulated growth, but Robel readings yielded unrealistic numbers due to the large amount of standing dead vegetation. The burn resulted in an increase in vegetation density as compared to the unburned areas. However, this increase was significant only on Cormorant Island. Total percent cover for Broken Gun, Cormorant, and Arrowhead Islands was 65, 71, and 65 percent, respectively. An "Analysis of Variance" test on 1994 and 1995 data showed a significant difference in percent cover between the two years, but not among islands. The most important species on burned areas in 1995 were reed canary grass and bluegrass. On unburned areas, the most important species were bluegrass and switchgrass. Anfang (1995) concluded that weedy species were much more prevalent on burned areas than on unburned areas. He also concluded that there seemed to be an increase in the importance of reed canary grass, which may have been triggered by the burning of dead vegetation.

August 1999 Terrestrial Vegetation Monitoring

Anfang (1999) monitored the dredged material revegetation sites on the three Lake Onalaska islands. To evaluate the suitability of the seeded species, 15 quarter-square-meter plots were randomly selected along a transect on each island. Percent cover, total species, and Robel readings were obtained for each plot.

During the 1999 monitoring period, switchgrass was the dominant species in percent cover and increased in importance on both Broken Gun and Cormorant Islands. Importance values showed switchgrass, side oats grama, reed canary grass, and bluegrass to be the most important species overall on all the islands. The Jaccard Index of Species Similarity was calculated for the species found on the sample plots. The index had been fairly stable at about 40 or 50 since the seeding of the islands in 1990, but decreased in 1995 and 1999, possibly due to the burn. Anfang (1999) stated that Robel readings for the 1999 sampling period declined further and that there was a slight decrease in percent cover.

October 2003 Fisheries Resource Monitoring

The WDNR (J. Janvrin, personal communication) performed fisheries sampling on October 16, 2003, to assess use of the project area by fisheries resources. Sampling during this time, prior to ice-up, provides an opportunity to document use of the area by fisheries resources. Sampling was performed by day electroshocking at several locations within the project area. Sampling rates (as measured by Catch per Unit Effort) averaged over 600 fish per hour, with a range of about 250 to more than 1,200 fish per hour. The WDNR noted that additional fish were frequently missed during sampling runs because of the high volume of fish shocked. The most common species observed included bluegill and largemouth bass, while spotted sucker, yellow perch, and northern pike were also collected. Other taxa, such as cyprinids, were also observed. While black crappie were observed, they were collected in relatively low numbers. Many of the fish collected were young-of-the-year or juvenile fishes. However, the large numbers of fish collected point to the project area's high use and likely value as an overwintering site.

Given the lack of pre-project fisheries data and the limited temporal scale of this dataset, it is difficult to determine the specific influence of this project. However, on the basis of the observations here, the project area appears to be heavily used by a variety of species, and could be especially valuable for bluegill and largemouth bass. Fishery managers for the area consider the project a success in terms of receiving heavy use by overwintering fish.

4.3 PRESENT ISLAND HABITAT CONDITIONS

On the basis of the above reports, the current habitat conditions on the Lake Onalaska islands suggest that a lack of nitrogen in the soil is the main cause for the low growth rate and reseeding of vegetation. Percent cover seems to have become stabilized over the past 5 years. However, according to the Jaccard Index of Species Similarity, the plant communities on each of the islands have become less and less similar. Possible reasons are the invasion of exotic plant species or the burning activities that took place to eliminate the large amount of dead vegetation. The dominance of reed canary grass on all four islands is cause for concern. Once it has become established, this plant species takes over an area and is very difficult to remove. Even though a serious problem with reed canary grass has developed on the islands, the vegetation present along the shorelines is alleviating the erosion problem. Aquatic vegetation remained sparse throughout the monitoring period. These areas should be enhanced because of their documented importance as habitat and feeding grounds for mussels and other aquatic life.

5.0 OPERATION AND MAINTENANCE

5.1 PROJECT FEATURES REQUIRING OPERATION AND MAINTENANCE

The project was originally designed to require minimal maintenance. After project construction, the operation and maintenance of the immediate project was the responsibility of the USFWS. Periodic maintenance on the islands may be required to repair erosion or displaced riprap. To maintain the islands as desirable waterfowl nesting areas requires periodic burning and replanting with other seed varieties. Sedimentation of the channel cut was likely to occur to some extent. No maintenance dredging is required because a sediment trap was installed. Over the 50-year project life, the average annual maintenance cost of the habitat project was estimated to be $3,000 (USACE 1988).

One addition to the Operation and Maintenance schedule is the use of a structure to better discharge through the project area. As discussed above, it was determined that the project increased flow through the project area. However, winter discharges were extremely high and may have had an impact on fisheries resources. During reconstruction of the Lake Onalaska spillway in 1994, the spillway was modified to include a stoplog structure that could be used to control downstream flow conditions as well as to influence flow through the upstream project area. Stoplogs can be added or removed, typically through the use of a crane, to reduce or increase flow, respectively. Stoplogs are added in fall to reduce flows for winter habitat needs (target spillway discharge of 500 cfs), while stoplogs are removed in spring to increase flow and benefit both upstream and downstream habitat conditions (target spillway discharge of 1,200 to 1,500 cfs). Operation of this structure will continue to be adaptive in an effort to best optimize summer and winter habitat conditions.

5.2 OPERATION AND MAINTENANCE RESPONSIBILITIES

The District Manager of the USFWS in Onalaska, Wisconsin, conducts the operation and maintenance of the project (USACE 1998). The USFWS assured that the non-Federal operation and maintenance responsibilities were in conformance with Section 906(e) of the Water Resources Development Act of 1986 (USACE 1988).

Operation of the stoplog structure has subsequently been performed by the USACE.

5.3 OPERATION AND MAINTENANCE TASKS AND SCHEDULE

There are no operational requirements associated with the Lake Onalaska Project. Inspection of the islands occurs a minimum of once a year, the time of year decided by the District Manager. The islands are inspected following flood events that produce a water surface elevation greater than 645 feet (National Geodetic Vertical Datum, 1912 adjustment) at Lock and Dam 7. They are also inspected at the discretion of the District Manager after any major storm that includes sustained high winds (especially from the south) or when high winds occur in conjunction with a water surface elevation greater than 641 feet. The inspection includes a visual check of the dredge cut to evaluate general aquatic vegetation and siltation conditions and visual inspection of the islands to ensure they are functionally intact (USACE 1998).

5.4 OPERATION AND MAINTENANCE HISTORY

A checklist report covering inspection and maintenance of the habitat project is to be submitted annually to the USACE St. Paul District Engineer (USACE 1998). Project construction was largely completed by

1990. Since that time, the USFWS has spent $61,570 for operation and maintenance. Over 13 years, this is an average annual cost of about $4,700.

Although the Lake Onalaska stoplog structure benefits the HREP, its construction was for multiple purposes. Operation of the structure does not use any EMP funds.

6.0 PROJECT EVALUATION

6.1 PROJECT TEAM

A project team workshop was held with the resource managers from 8:00 a.m. to 9:00 a.m. on February 13, 2001, at the USFWS District Headquarters office in Onalaska, Wisconsin. The purpose of the workshop was to receive input from the resource managers relative to the project. Mr. Don Powell, USACE Project Manager, and Mr. Jon Gumtow, Earth Tech, Inc., facilitated the workshop. The format included a brief summary of the project history followed by solicitation and recording of responses to 10 questions related to the effectiveness, appearance, and implementation of the project. Responses were recorded on a flip chart. Appendix A presents the questions and the recorded responses from this meeting.

Eight people attended the workshop. Two people were unable to attend and provided written responses. In general, the resource managers considered the project successful. A majority of the attendees rated the overall project as good. Two excellent ratings were also received. The resource managers agreed that the project improved water quality and clarity, created deepwater fish habitat and wintering areas, reduced wind-induced erosion on existing land areas, provided predator-free waterfowl nesting/loafing habitat, improved the fishery, and increased public use in the area.

Suggested considerations for future projects include the following:

1. Change island design to create more diverse elevations on top of the islands and increase the shelf width for more waterfowl loafing habitat.

2. Improve topsoil specifications to increase revegetation success and reduce operation and maintenance costs. Suggestions include increasing topsoil thickness, obtaining better quality topsoil, and limiting equipment traffic during construction to reduce soil compaction.

3. Locate islands closer to shore to decrease wave action and wind-induced erosion.

4. Incorporate groins near the end of the islands.

5. Inspect construction materials imported to the islands to control the introduction of invasive species.

6. Implement invasive species control measures.

6.2 INTERESTED PUBLIC

A public participation workshop was held from 8:00 p.m. to 9:00 p.m. on December 7, 2000, at the USFWS District Headquarters office in Onalaska, Wisconsin. The purpose of the workshop was to receive input from the public relative to the project. Public responses were requested to 11 questions related to the effectiveness, appearance, and implementation of the project. Responses were recorded on a flip chart. Appendix B presents the questions and the recorded responses from this meeting.

Eight people attended the workshop including six public participants. Two agency participants, including one from the USFWS and one from the WDNR, were also in attendance to address questions about the technical aspects of the project. In general, the project was well received by the public. A majority of the attendees rated the overall project as excellent. The public perception was that the project improved the physical appearance of Lake Onalaska, significantly improved the fishery and overwinter fish habitat, and provided additional nesting habitat for migratory waterfowl. One comment expressed concern that bank erosion and increased water levels have been observed since the project.

Suggested project improvements include the incorporation of more natural irregular shorelines in future island designs.

6.3 SUMMARY EVALUATION OF ECOLOGICAL EFFECTIVENESS

The post-construction monitoring data gathered for this project indicates the project goals and objectives were achieved. The channels have created deepwater, overwinter habitat areas for fish and restored habitat diversity in Lake Onalaska. Construction of the dredged channels has facilitated the flow of fresh, well-oxygenated water into the area behind Rosebud Island. However, the implementation of the stoplog structure in the Onalaska spillway appears to have been critical in best managing discharge through the project dredge cuts. This provided the ability to reduce discharge through the project area, which was elevated above desirable levels following construction. Since completion of the project, the public and the resource managers have observed increased public use, increased use by migratory birds, and improved fishery in the backwater areas.

The islands were designed to provide waterfowl habitat, increase water clarity, and reduce wind-induced erosion on the existing land areas. Waterfowl used the islands for nesting and loafing. Revegetation of the islands with desired species was accomplished; however, more effective revegetation could be realized by the addition of soil amendments to facilitate plant growth. The shadow effects of the islands to meet these water clarity and wind-induced erosion goals were localized to the near-island area. Additional island creation projects and moving the islands closer to shore would be required to achieve these goals. Topographic changes on the top of the islands and creating more littoral shelf area on the periphery of the islands would increase the biological value.

During construction, dredged material was placed on Rosebud Island, selected collectively by participating State and Federal agencies. This placement action included the creation of a perched wetland. While this created the desired habitat, it came with the trade-off of sand prairie habitat. Future projects may want to consider the protection of this sand prairie habitat since subsequent study has revealed the value of this habitat.

6.4 SUMMARY EVALUATION OF ENGINEERING EFFECTIVENESS

The engineering of this project was completed by the USACE. Comments received by the resource managers indicate the project goals and objectives were achieved. The island designs were successful and the construction areas were effectively stabilized following construction. Revegetating the islands following construction was difficult in some areas because of limited topsoil cover, poor topsoil quality and nitrogen levels, and soil compaction.

The dredge cut was successful and improved the fishery. The WDNR has performed transect work since project construction and estimates a sedimentation rate within the dredge cuts of 1 to 3 cm/yr. This sedimentation rate of the dredge cut and the sediment trap should be further evaluated to assess possible future operation and maintenance costs.

6.5 SUMMARY EVALUATION OF COST

6.5.1 Estimated Cost

The total estimated cost for the project in August 1988 was $2,430,000.

Annualized first costs, using first construction costs and general design expenditures, amounted to $213,000 (the project is based upon a 50-year economic life and an 8½ percent discount rate, and sharing the project with the WISDOT). With the addition of annual operation and maintenance costs, the total average annual costs were estimated to be $216,000 (USACE 1988).

6.5.2 Actual Cost

General design costs were $80,000, and construction costs were $1,932,000. Annual costs for operation, maintenance, and repair were estimated at $3,000 and will be the responsibility of the USFWS.

TABLE 3

Contract Construction Costs, Lake Onalaska HREP

EMP LAKE ONALASKA				
WISCONSIN DEPARTMENT OF TRANSPORTATION - PARTNER HOFFMAN CONSTRUCTION CO. BLACK RIVER FALLS, WI - PRIME CONTRACTOR LW MATTESON BURLINGTON, IA - SUB-CONTRACTOR (DREDGING)				
FINAL COSTS (FEB 1992)				
DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EARNINGS
MOB & DEMOB	1	LS	$275,200.00	$275,200.00
SILT SCREEN	172	LF	$2.00	$344.00
ISLAND FILL	160278	CY	$2.47	$395,886.66
GEOTEXTILE FABRIC FOR ISLANDS	24951	SY	$2.70	$67,367.70
RIPRAP FOR ISLANDS	13754	CY	$27.00	$371,358.00
TOPSOIL FOR ISLANDS	38256	SY	$3.00	$114,768.00
SEEDING FOR ISLANDS	7.9	ACRE	$1,970.00	$15,563.00
FINE MATERIAL TO ROSEBUD ISLAND	221330	CY	$2.81	$621,937.30
TEMPORARY FENCING FOR ROSEBUD ISLAND	8913	LF	$1.00	$8,913.00
FENCING FOR ROSEBUD ISLAND	2500	LF	$3.15	$7,875.00
TOPSOIL FOR ROSEBUD ISLAND	20803	SY	$1.74	$36,197.22
FERTILIZE & SEED	8.6	ACRE	$1,910.00	$16,426.00
TOTAL EARNINGS				$1,931,835.88

7.0 LESSONS LEARNED

The following lessons have been learned from evaluating the effectiveness of the Lake Onalaska project.

- Island construction in pools can have many ecological benefits.
- Island construction in pools has localized effects on water clarity and wave action. Additional islands are needed to create pool-wide benefits.
- Increasing the flow of fresh water to backwater areas can benefit fishery resources and increase public use. However, the use of flow must be carefully considered and planned to achieve the desired response.
- Locating islands closer to shore can decrease wave action and wind-induced erosion on existing islands.
- Locating islands closer together can achieve better cumulative effects.
- Rockfill groins should be a consideration for near the end of the islands.
- Island revegetation plans should contain a long-term management plan including burning or addition of soil amendments.
- Construction materials imported to the islands should be inspected to control the introduction of invasive species.
- Invasive species control measures likely should be a consideration for future HREPs.
- Off-site discharge of carriage water needs to be carefully managed to ensure sufficient retention time to minimize water quality effects (e.g., total suspended solids).

8.0 RECOMMENDATIONS FOR FUTURE SIMILAR PROJECTS

On the basis of the information summarized in this project completion report, the following recommendations have been developed for consideration in future similar projects.

- Consider islands creation in additional UMR pools, where appropriate.
- Include public relations and education regarding project benefits because the public is very interested.
- Incorporate more natural irregular shorelines into future island designs.
- Change island design to create more diverse elevations on top of the islands and increase the shelf width for more waterfowl loafing habitat.
- Improve topsoil specifications to increase revegetation success and reduce operation and maintenance costs. Suggestions include increasing topsoil thickness, obtaining better quality topsoil, adding soil amendments, and limiting equipment traffic during construction to reduce soil compaction.
- Inspect construction equipment and materials for the presence of invasive species prior to importing material to the islands.
- Consider the existing habitat of the dredged material disposal area and the impacts associated with using the area for disposal.
- Strive to improve coordination between coordinating agencies, especially when targeting projects with dual objectives (e.g., habitat vs. highway improvement projects).
- Consider a refined hydraulic analysis to better evaluate the benefits of increased or reduced flow on habitat conditions.

9.0 REFERENCES

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FIGURES

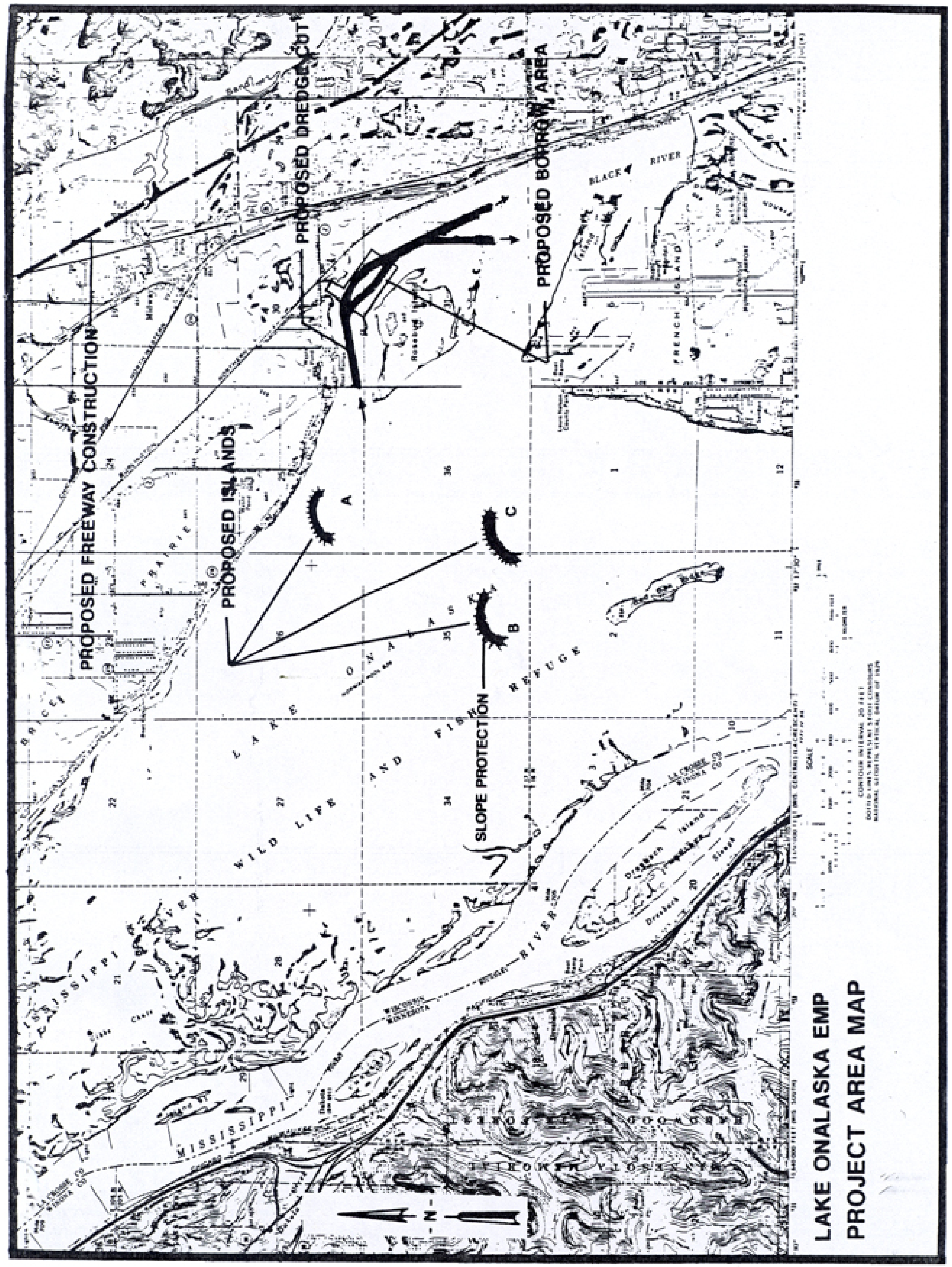

Figure 1. Lake Onalaska HREP, Project Location

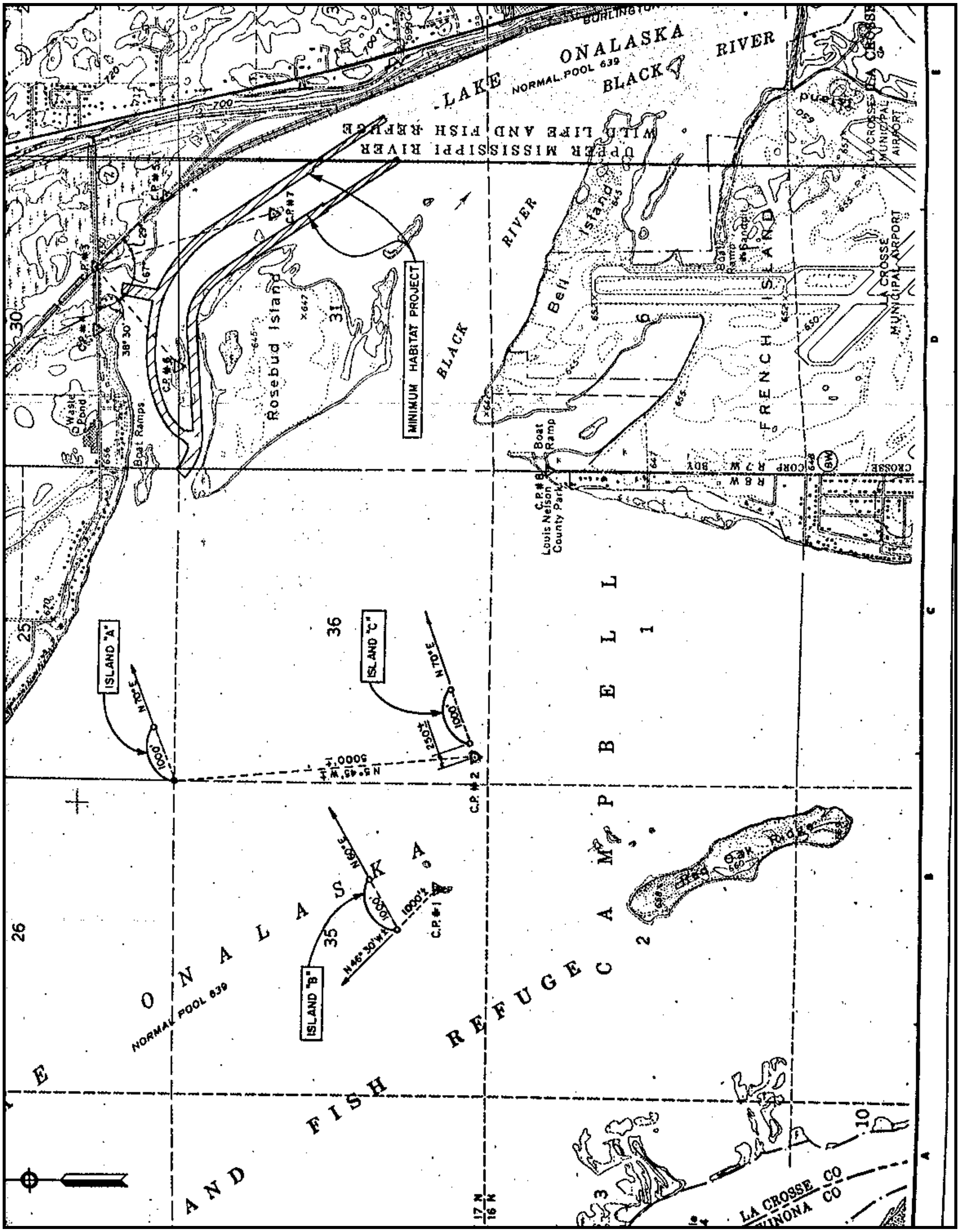

Figure 2. Lake Onalaska HREP, Project Features

APPENDIX A

COMPILED RESULTS OF INTERVIEWS WITH PROJECT TEAM

PROJECT OBJECTIVES

1. Improve water quality in the area behind Rosebud Island.
2. Prevent the area from freezing to the bottom.
3. Create deepwater fish habitat.
4. Improve water clarity in Lake Onalaska.
5. Reduce wind-induced erosion on existing land areas.
6. Restore habitat diversity that has been lost over time.
7. Provide predator-free waterfowl nesting/loafing habitat.

PROJECT TEAM RESPONSES
LAKE ONALASKA
FEBRUARY 13, 2001

Question	Response
Q1 *Which of the project objectives were effectively addressed by the project?*	- Yes to all objectives, with localized effects to Objectives # 4 and # 5. Objective # 1 - Achieved through dredging to increase flow. Objective # 2 - Achieved through dredging to increase flow. Objective # 3 - Achieved through dredging to increase flow. Objectives # 4 and # 5 - The effect of islands in the middle of the lake is questionable, not in Lake Onalaska. - Cormorant and Arrowhead Islands near shore location. - Local water clarity improvements near islands. - Broken Gun Island (deeper lake island). Objective # 5 - Reduced localized wave action, but total lake effect was small. - Too far offshore to affect shore currents/wave action. Objective # 7 - Islands serve as loafing areas during high flows as observed in 1997 - even though the islands are vegetated. - Broken Gun Island has more loafing due to less vegetation cover.
Q1 (Continued)	

Question	Response
	- Predator-free nesting has been met. - Loafing habitat was present in the first couple of years; now the islands are vegetated, as designed. Loafing declined as vegetation increased.

Q2 *What project features could have been changed to make a more effective project?*	- More elevation diversity on top of islands.
	- Increased topsoil thickness on top of islands.
	- Better quality topsoil and more homogeneous.
	- Soil compaction may have affected vegetation cover.
	- Increase shelf width on periphery of islands from 20 to 40 feet (more loafing area, greater littoral zone/lower maintenance costs).
	- Seeding –
	    - better inspection to make sure proper seeds are being sown.
	    - include legumes, other species in mix (soil nutrification).
	- Dredging near Rosebud Island was added to account for WISDOT project.
	- Rosebud Island – changed sand prairie habitat (rarer habitat) on island with fill material and grass.
	    - include timber sales in project clearing island.
	- Dredge cuts – velocity and flow criteria could be modified in future projects.

Q3 *How could the appearance of the project be improved?*
 	
Q3 (Continued)
	- Elevation diversity on top of islands.
	- Width – vary overall width of islands.
	- Crescent shape is adequate.
	    - effective.
	    - appearance ok (could be made to look more natural).
	    - remnant portion of Arrowhead Island helped give natural appearance.

Question	Response
	- Change dredge cut designs to increase aesthetics.
Q4 *How did this project affect use of the area?*	- Dredge cuts are very productive fishery. - Fished more heavily than prior to the project. - Post-project fishing increased near islands and increased fish species diversity.

Q5 *Is the amount of O&M appropriate, and how could it be reduced?*	- Reduce overall operation and maintenance.
	  - Create wider berms.
	  - Move islands closer to shore (decrease wave action/increase shoreline stability).
	  - Put rock on end areas (flat slope) affected by ice.
	  - Groins placed near ends of islands.
	  - Invasive species concerns imported to islands from imported material (rock and mulch).

Q6 *What monitoring is appropriate to assess project effectiveness?*	- All the monitoring in the plan is appropriate.
	- Monitor the rate of sediment filling the dredge cut (bathymetric surveys).
	  - in channel.
	  - in sediment trap.
	- Better pre-project physical data of island areas.
	- Aquatic invertebrate monitoring associated with islands and dredge cuts.

Question	Response
Q7 *What is your assessment of the project overall?* A = Excellent - ecologically effective, appropriate design/cost, appearance acceptable. B = Good - mostly ecologically effective, good design, reasonable cost, etc. C = Fair - marginally effective, fair design, somewhat costly, etc. D = Poor - not ecologically effective, inappropriate design, too costly, etc. F = Failure - no positive attributes.	(A - 2 responses) (B - 6 responses)
Q8 *What needs to be done to further improve habitat conditions in the project area?*	- Invasive plants control (purple loosestrife and leafy spurge). - Look at summer shoot area (flows). - Reduce velocities in dredge cuts as the cuts fill in. - Restore barrier island complex to the west. - Stabilize other islands including parts of Rosebud Island. - Brice Prairie channel – deepen channel for fish habitat. - More islands to the north of the project area. - Over winter fish habitat improvement in sailboat club area.
Q9 *What was the public reaction to the project?*	- Public comment (perception) is that aquatic vegetation die-off was caused by the project – vegetation die-off occurred through the river. - “Thumbs up.” - Increased dredging should occur in the lake.

Question	Response
Q10 *What were the "lessons learned" from this project?*	- Increased diversity and improved dimensions of islands (horizontal and vertical). - more rock in areas, less rock in areas. - "Islands work." - Waterfowl nesting – provides excellent habitat. - Good location – islands are isolated from predators. - Public is very interested and should continue to be involved in the process. - Put islands closer together to get better cumulative effects (shadow zone, scouring). - To get good vegetation response, projects should break wave action on the south side of the lake.

APPENDIX B

COMPILED RESULTS OF INTERVIEWS WITH INTERESTED PUBLIC

INTERESTED PUBLIC RESPONSES
LAKE ONALASKA
DECEMBER 7, 2000

Question		Response
Q1	*Were all the habitat project objectives met?*	(Y - 4) relative to objectives 1, 2, 3, 6, and 7. (N - 5) relative to objective 5. (UNKNOWN - 0)
Q2	*If not, which of the project objectives were not attained and why?*	- Fishery is improved; over winter habitat is improved. - Erosion patterns within the lake have changed. - Loss of mud flat areas has decreased habitat diversity. - Erosion has occurred along French Island. - Erosion has occurred near Dakota Street. - Water levels have increased in the pools that have increased erosion. - More could be done to reduce wind erosion on the lake.

Q3	*How could the project features be changed to better meet the objectives?*	- Additional post-project monitoring.
		    - Sedimentation.
		    - Water quality.
		    - Flora/fauna.
		    - Aquatic.
		- Reduce water levels in the lake slightly.

Q4	*Are the present habitat conditions in the project area satisfactory?*	- Habitat on Rosebud Island has been improved since the project (i.e., switchgrass nesting grasses). - When these projects are completed, changes occur and some habitat is lost and some is gained.
Q5	*If not, what needs to be done to restore habitat conditions?*	- Spillway construction has improved flows and fishery. - Monitor and maintain the islands, and natural succession will occur and the areas will mature.
Q6	*What needs to be done to further improve habitat conditions in the project area?*	- Fish use has increased. - Waterfowl use has changed from puddlers to divers. - The project has provided additional predator-free nesting habitat. - Waterfowl nesting has increased.
Q7	*How could public participation in project planning be improved?*	- Islands look artificial, but the benefits outweigh the artificial look.
Q8	*How could the appearance of the project be improved?*	- Create more natural, irregular shaped shorelines. - Need residual cover for nesting cover in spring (switchgrass stands need to

Question	Response
	mature to provide better residual cover).
Q9 *What is your assessment of the project overall?* A = Excellent - ecologically effective, appropriate design/cost, appearance acceptable. B = Good - mostly ecologically effective, good design, reasonable cost, etc. C = Fair - marginally effective, fair design, somewhat costly, etc. D = Poor - not ecologically effective, inappropriate design, too costly, etc. F = Failure - no positive attributes.	(A - 4) (B - 0) (C - 0) (D - 0) (F - 0) Overall process was well received. - Public knowledge of the project was aided by the Lake Association.
Q10 *How could public participation in project planning be improved?*	- Provide periodic project updates. - Put monitoring data available to the public on the Internet. - Projects should be updated on Lake District maps upon completion. - Provide project summaries on a web site and add information as it becomes available.
Q11 *What are your recommendations for habitat protection and restoration on the Upper Mississippi River?*	- No response.