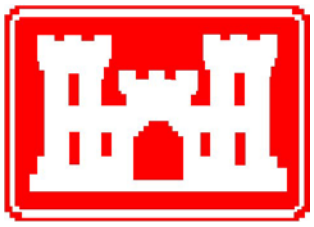
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM

Small Scale Drawdown Project Completion Report



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

September 2004

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SMALL SCALE DRAWDOWN
PROJECT COMPLETION REPORT

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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). Habitat Rehabilitation and Enhancement Project (HREP) construction is one element of the Environmental Management Program (EMP) (USACE 1997). The Small Scale Drawdown Project was initiated as an HREP and construction was completed in 1997 (USACE web page).

1.2 PURPOSE OF HABITAT PROJECT COMPLETION REPORTS

The purposes of this habitat project completion report for the Small Scale Drawdown Project are to:

- Document the post-construction monitoring activities for the 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. Geological Survey (USGS), the U.S. Fish and Wildlife Service (USFWS), and Wisconsin Department of Natural Resources (WDNR) for the period July 1996 through November 1999. It also contains other agency and public input.

2.0 PROJECT OBJECTIVES

2.1 GENERAL GOALS

The ultimate goals of the Small Scale Drawdown Project were to preserve, restore, and enhance backwater fish and migratory bird habitat on the Upper Mississippi River National Wildlife and Fish Refuge. These goals were to be accomplished by promoting the growth of aquatic vegetation using water level management techniques in selected backwater areas. The experimental Small Scale Drawdown Project was conducted at Lizzy Pauls Pond, a backwater area on navigation pool 5 of the UMRS (USACE 1997).

2.2 SPECIFIC HABITAT OBJECTIVES

On the basis of design criteria and future project assessment, the specific habitat objectives for the Small Scale Drawdown at Lizzy Pauls Pond were to:

- Increase the areal extent, interspersion, density, and species composition of macrophyte beds.
- Decrease suspended solids concentrations.
- Increase the area of emergent and submerged aquatic vegetation.

Specific monitoring tasks were to:

- Determine the size and species composition of the seed bank within and among vegetation types (Kenow et al. 2001).
- Determine the species composition, density, height, and seed production that developed on exposed substrates in the study area (Kenow et al. 2001).
- Relate seed production of vegetation that developed on exposed substrates to the timing of the drawdown and selected substrate characterizations (Kenow et al. 2001).
- Illustrate the distribution and area of exposed substrate and vegetation communities that develop following the drawdown using aerial photography (Kenow et al. 2001).

2.3 PROPOSED PROJECT SITES

Two proposed project sites were initially identified: Peck Lake in pool 9 and Lizzy Pauls Pond in pool 5. The drawdown of Peck Lake was deferred because no non-Federal sponsor was available to share the costs. However, the drawdown was completed in 1999 using other funds (USACE web page).

2.4 TARGET SPECIES AND HABITATS

The following target species and habitat types were identified for the Small Scale Drawdown Project for pool 5. This information provides a broad overview of pool 5, within which the Lizzy Pauls Pond project is located (USACE 1997).

2.4.1 Forests

Two types of forest occur in the region: upland xeric southern forests and lowland forests of the floodplain. A small amount of upland forest in pool 5 is found at the edge of the Richard J. Dorer Memorial State Forest. Lowland forests are predominant in the area and consist of floodplain forests found on river islands and riparian shorelines. Pool 5 contains 5,920 acres of floodplain forest habitat. These forests are seasonally flooded. The soil is saturated during most of the growing season and is inundated for short durations. Dominant tree species in the floodplain forests for pool 5 include river birch (*Betula nigra*), cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), and black willow (*Salix nigra)*. Species that dominate the higher quality areas include silver maple, green ash (*Fraxinus pennsylvanica*), basswood (*Tilia americana*), and black ash (*Fraxinus nigra*). American elm (*Ulmus americana*) was once a dominant species in the floodplain forest habitat; however, Dutch elm disease greatly reduced the occurrences of this species in the region. The mature floodplain forest areas have an overstory dominated by green ash, silver maple, red maple (*Acer rubrum*), cottonwood, and river birch. The understory is dominated by tree seedlings, alder (*Alnus* sp.), wood nettle (*Urtica dioica*), poison ivy (*Toxicodendron radicans*), wild grape (*Vitis* sp.), and woodbine (*Parthenocissus quinquefolia*). In the less successionally developed transitional zones between aquatic and terrestrial habitat (e.g., sandbars and mud-flat areas), dense stands of alder, small black willow, and cottonwood occur (USACE 1997).

2.4.2 Fresh (Wet) Meadow Wetlands

Fresh (wet) meadow wetlands are found in depressional areas or transitional areas with periodic inundation. Soils are saturated for extended periods during the growing season. Typical vegetation associated with fresh (wet) meadows includes sedges (*Carex* sp.), rush (*Scirpus* sp.), reed canary grass, cattail (*Typha latifolia*), manna grass (*Glyceria R.*), prairie cordgrass, and mints (*Mentha arvenis*) (USACE 1997).

2.4.3 Marsh Wetlands

Three types of marsh wetland communities (shallow marsh, deep marsh, and shallow open water) are typically associated with the floodplain of the pools. Marsh wetlands occur along major tributaries, on islands, or on peninsulas located throughout the river segment and within the main channel of the Mississippi River. In the mid-1970's, pool 5 contained 3,854 acres of marsh wetland. Marsh soils are typically saturated throughout the growing season. Water depths vary from zero to 6.6 feet. Since inundation, however, the amount of vegetation gradually declined, reducing many backwater marshes to open, windswept, riverine lakes. Emergent vegetation present in pool 5 includes sedges (*Carex* sp.), bulrushes (*Scirpus* sp.), spikerushes (*Eleocharis* sp.), cattails (*Typha latifolia*), arrowheads (*Sagittaria latifolia* and *rigida*), and smartweeds (*Polygonum* sp.). Giant reed grass (*Phragmites australis*) is also present and provides important cover for wildlife. Common submerged and floating-leaved vegetation includes coontail (*Ceratophyllum demersum*), water lilies (*Nuphar and Nymphaea* sp.), milfoil (*Myrophyllum* sp.), pondweeds (*Potamogeton* sp.), elodea (*Elodea* sp.), and wild celery (*Vallisneria americana*). Also, the lentic, open-water portions of the pool have a relatively productive planktonic community dominated by diatoms and green algae (USACE 1997).

2.4.4 Fish and Wildlife

Pool 5 has a variety of high-quality terrestrial and aquatic habitats. These habitats support a diverse and productive fishery and provide important waterfowl nesting, feeding, and resting areas. The most prevalent aquatic habitats include the main channel, main channel border, secondary channel, sloughs, river lakes, and tailwater. The important characteristics of these habitat types relative to fish and wildlife uses are described below (USACE 1997).

1. Main Channel - Pool 5 contains approximately 578 acres of main channel habitat. The main channel conveys the majority of the river discharge and in most reaches includes the navigation channel. It has a minimum depth of 9 feet (2.7 meters) and a minimum width of 400 feet (122 meters). A current always exists, varying in velocity with water stages and width. The bottom type is a function of current. The upper section has a sand bottom, changing to silt over sand in the lower section. Occasional patches of gravel are present in a few areas. No rooted vegetation is present (USACE 1997).

2. Main Channel Border - Pool 5 contains approximately 1,623 acres of main channel border habitat. Main channel borders exist in areas between the navigation channel and the riverbank. Channel borders contain the channel training structures: wing dams, closing dams, and revetted banks. Thus, a diversity of depths, substrates, and velocities is found in this habitat type. The bottom type is sand in the upper section of the pool and silt in the lower section. Definable plant beds are frequently absent, but single species of submerged plant clusters are sparsely scattered in areas of reduced current (USACE 1997).

3. Secondary Channel - Pool 5 contains approximately 1,110 acres of secondary channel habitat. Secondary channels are large channels that carry less flow than the main channel. Unless these channels are former main channels, the banks were usually unprotected. Undercut or eroded banks are common along the channels' departure from the main channel. The bottom type varies from sand in the upper reaches to silt in the lower reaches. In the swifter current there is no rooted vegetation, but vegetation is common in the shallower areas having silty bottoms and moderate to slight current (USACE 1997).

4. Sloughs - Pool 5 contains approximately 3,462 acres of sloughs. Sloughs are characterized as having no current at normal water stage, mud bottoms, and an abundance of submersed and emergent aquatic vegetation. These areas provided excellent spawning, nesting, and rearing areas. Declines in the fish and wildlife habitat values have occurred in the sloughs due to sedimentation, loss of vegetation, and periodic strong water currents (USACE 1997).

5. River Lakes and Ponds - Pool 5 contains approximately 2,856 acres of river lakes and pond habitat. River lakes and ponds are distinct lakes formed by fluvial processes or artificial lakes (excavated or impounded). They may have a slight current, depending on their location. Most of the bottoms are mud or silt, often consisting of a layer more than 2 feet thick. Vegetation abundance is highly variable. Emergents are often restricted to the perimeter of the waterbody. These waters have an abundance of rooted aquatic vegetation, both submerged and emergent (USACE 1997).

6. Tailwaters - Pool 5 contains approximately 77 acres of tailwater habitat. Tailwaters are the areas downstream of the navigation dams with deep scour holes, high velocity, and turbulent flow. The bottom is mostly sand. No rooted vegetation is present in the tailwaters (USACE 1997).

2.4.4.1 Fish

The continuum of aquatic habitats present in pool 5 ranges from the fast-flowing main channel to lotic backwaters. This range of habitat provides an abundance and variety of fish. There are 83 species of fish reported in pool 5. All species are native except brown trout, grass common carp, carp, and goldfish. Common game fish and panfish species include walleye, sauger, northern pike, channel catfish, largemouth bass, white bass, bluegill, and white and black crappie. Common non-game fish include freshwater drum, species of redhorse and buffaloes, and a variety of minnows. Catfishes, buffaloes, and carp are the primary fish of commercial interest (USACE 1997).

Game fish that use main channel habitat include walleye, sauger, smallmouth bass, and white bass. Freshwater drum and channel catfish are common commercial fish that use this habitat type. Commercial species found in the backwaters include carp, bigmouth buffalo, and catfish, while typical sport fish include northern pike, largemouth bass, crappie, and bluegill. Largemouth bass, smallmouth bass, bluegill, crappie, and walleye all use secondary channels and sloughs for life functions. Rearing, wintering, and spawning habitat is provided by sloughs and secondary channels for northern pike, white bass, carp, and buffalo. Tailwaters are particularly important areas for species like paddlefish and sturgeon, which were largely displaced by inundation of the natural river. Tailwaters provide spawning, rearing, and wintering areas for walleye, sauger, catfish, freshwater drum, and white bass (USACE 1997).

2.4.4.2 Wildlife

The numerous backwater areas interspersed with forested islands in pool 5 provide good habitat for a variety of wildlife species. The pool contains a rich mixture of vertebrate animals from throughout the United States (USACE 1997).

The great variety of bird species that use pool 5 is attributed to its location within the Mississippi flyway. Areas such as Lansing Big Lake, Weaver Bottoms, Belvidere Slough, Reno Bottoms, and Mozeman's Slough provide critical resting and foraging opportunities for these migratory waterfowl. Although pool 5 is not of great importance as a nesting area for waterfowl (other than wood ducks), it is an important resting area for waterfowl during spring and fall migration. In the fall and spring, ring-necked ducks, canvasbacks, and scaup use the deeper areas of the backwater, while mallards, widgeon, blue-winged teal, and wood ducks use the shallower areas. As a result of the reduced island landmass, less of the backwater is protected from wave action. In general, use of the pool by waterfowl had declined in the years previous to the Lizzy Pauls Pond drawdown. While waterfowl populations have decreased, the decline in use of pool 5 seemed to mirror the erosion of the islands and the reduction in protected backwater areas (USACE 1997).

Pool 5 provides nesting and foraging habitat for many passerine bird species. Some of these species spend the entire year in the area, while others migrate into the area at various times of the year. Great egrets and blue herons are the most common wading birds found in the pool. Spotted sandpiper, killdeer, and black terns also nest within the pool. Other shorebirds and gulls that use the pool include herring gulls, sandpipers, and ring-billed gulls. Numerous varieties of raptors use the river valley as a flyway, and a number of these species, such as eagles, hawks, and owls, have overwintered in these floodplain areas (USACE 1997).

Pool 5 provides habitat to a variety of mammals. White-tailed deer is the most popular and abundant big game animal. Many small carnivores such as fox, raccoon, mink, and weasel are found within the pool, while larger carnivores such as bobcat and coyote are infrequent. Otters are present but their numbers are not abundant. Many smaller mammals, including beaver, muskrat, shrews, moles, bats, rabbits, squirrels, and numerous varieties of mice, are relatively common (USACE 1997).

2.4.5 Amphibians and Reptiles

The floodplain of pool 5 provides habitat for a wide variety of amphibians and reptiles. Common species typically found in marshes and aquatic areas of the pool include snapping turtles, map turtles, false map turtles, painted turtles, smooth soft-shell, spiny soft-shell, northern water snake, eastern garter snake, blue racer, bullsnake, eastern tiger salamander, American toad, gray tree frog, western chorus frog, green frog, and leopard frog. Pool 5 contains the largest known population of Blanding's turtles, an endangered species in Minnesota (USACE 1997).

2.4.6 Invertebrates

There is a large assemblage of invertebrate species within the pool. The varied invertebrate fauna is due to the wide variety of habitats. Lake forms of invertebrates find suitable habitat in the lentic portions of the pool. Organisms that require running water find a wide range of water velocities in the tailwaters, in the main channel, along the wing dams, and in secondary channels. The rocks associated with the wing dams and shoreline protection provide suitable habitat for specialized invertebrates (USACE 1997).

1. Mussels - More than 50 mussel species native to the UMRS are known to occur in pools 1 through 10. Pool 5 supports various species of mussels. Species found in the pool include threeridge, threehorn, pimpleback, deertoe, pigtoe, fawnfoot, fragile papershell, pocketbook, giant floater, and fat mucket. A recent exotic introduction, the zebra mussel (*Dreissena polymorpha*), was observed in the pool and its numbers have been steadily increasing. The impact of the zebra mussel is unclear, but it is generally thought to be deleterious (USACE 1997).

   Fingernail clams (*Musculium transversum*) have thrived in areas of pool 5 that had adequate dissolved oxygen and silt bottoms. They are important food items for waterfowl and several species of fish (USACE 1997).

2. Insects - In pool 5, the insect fauna was dominated by immature stages of mayflies, midges, and caddisflies, indicative of high dissolved oxygen levels. Being efficient converters of detritus, aquatic insects are an important link in the food web, providing food for both fish and waterfowl (USACE 1997).

2.4.7 Threatened and Endangered Species

Twenty-two wildlife species in pool 5 have protective status from Federal or State agencies. At the time of the project, the bald eagle and the peregrine falcon were both federally protected under the Endangered Species Act. Currently, the bald eagle is federally listed as threatened. The bald eagle is also listed as endangered in Iowa and threatened in Minnesota and Wisconsin. The following protected species are listed as threatened or endangered in Wisconsin: Acadian flycatcher, peregrine falcon, bald eagle, Blanding's turtle, cerulean warbler, great egret, massasauga rattlesnake, Kentucky warbler, northern cricket frog, osprey, red-shouldered hawk, worm-eating warbler, and wood turtle (USACE 1997).

Twenty-three aquatic species with protected status are present in this reach. The Higgins eye mussel (*Lampsilis higginsii*) is the only species with Federal protection under the Endangered Species Act. The following species are listed by Wisconsin as threatened or endangered: black buffalo, blue sucker, crystal darter, goldeye, greater redhorse, paddlefish, pallid shiner, river redhorse, skipjack herring, speckled chub, butterfly mussel, monkeyface mussel, purple wartyback mussel, and rock pocketbook mussel. However, the paddlefish and crystal darter have been identified by the USFWS as potential candidates. The Higgins eye mussel has not been recorded in recent times in pool 5 or in adjoining pools (USACE 1997).

Twenty-eight protected plant species are found in counties bordering the pool. The northern monkshood is federally listed as threatened. In Wisconsin, two species are listed as endangered: hairy parsnip and wild petunia. Six are listed as threatened: clustered broomrape, northern monkshood, prairie thistle, tubercled orchid, white lady slipper, and yellow giant hyssop. Iowa lists one species as threatened and three species as endangered. Many of the species listed, including the one federally listed species, are not floodplain species and are not present at the drawdown site (USACE 1997).

3.0 PROJECT DESCRIPTION

3.1 LOCATION

The drawdown site in the study area is Lizzy Pauls Pond, a backwater area in pool 5 of the UMRS (Figure 1). The site is a relatively small (21 hectares), isolated backwater located on the Wisconsin side of the Mississippi River channel in the Upper Mississippi River National Wildlife and Fish Refuge. The refuge includes about 200,000 acres in the Mississippi River pools 5 through 14. The portion of the refuge included in this study is limited to pool 5 (USACE 1997).

3.2 PROJECT AREA

Lizzy Pauls Pond is a 21-hectare backwater area located between the northern end of the higher Buffalo terrace on the river side and the higher river bluffs on the east at river mile (R.M.) 747 in pool 5 (Kenow et al. 2001).

3.3 PRE-PROJECT HABITAT CONDITIONS

3.3.1 Pool 5 Pre-Project Habitat Conditions

The most dramatic change in the UMRS in recent history was the construction of the locks and dams, permanently raising the water levels. This was most pronounced immediately upstream of each dam where large pools were created. Areas that were originally high and dry during normal flows were now permanently inundated or had become islands. Within the lower area of the pools, the water was open and deep. While aquatic vegetation may have grown, there was practically no marsh development. Island habitat was once abundant along the UMRS. However, since the construction of the locks and dams, island habitat along the UMRS has been lost, particularly in the lower sections of several pools (USACE 1997).

Although the UMRS is important for many species of fish and wildlife, declines in habitat values have been noted in recent years. Aquatic vegetation has generally declined in abundance and extent. Initially abundant with new reservoir productivity in the decades following dam construction and impoundment of the navigation reservoirs, aquatic vegetation declined mostly due to the effects of continuous impoundment. The lower water levels associated with summer low-river discharge and periodic droughts have not occurred since construction of the dams because minimum project pool depths were maintained for navigation. Aquatic vegetation declined significantly during the 1988-89 drought period, probably due to a combination of factors involving the underwater light climate and availability of plant nutrients in the sediments. Submerged vegetation had rebounded in previous years, but the extent of emergent aquatic vegetation remained limited prior to the onset of the drawdowns (USACE 1997).

3.3.2 Lizzy Pauls Pond Pre-Project Habitat Conditions

In 1996, Lizzy Pauls Pond contained approximately 89 percent floating/submersed aquatic vegetation and 11 percent emergent vegetation. Substrate of the basin is a fine silty muck (Kenow et al. 2001).

3.4 PROJECT FEATURES AND HISTORY

The drawdown for Lizzy Pauls Pond was performed in 1997. All project implementation activities were conducted by the USACE. Post-project monitoring was completed by the USGS in 1998 (Kenow et al. 2001).

To perform the drawdown at Lizzy Pauls Pond, the outlet culvert was closed and electric pumps were used to draw down the water level at least 2 feet to dry out bottom sediments around the perimeter of the lake (Figure 2). Water was discharged into the lobe of Lizzy Pauls Pond on the downstream side of County Road 00. The proposed drawdown start date was June 24, 1997. Pump selection was based on the volume of water to pump and the size that could be handled with available equipment. Two 4-inch pumps were used for continuous pumping at 500 gallons per minute to reach the desired drawdown. Small trenches were excavated by hand to drain any pooled areas. Heavy rains during the drawdown period and debris prompted the use of two additional pumps on an intermittent basis. As can be seen on Figure 1, water levels actually rose over a 2-week period, inundating previously exposed areas. The use of additional pumps resulted in reduced water levels and maintenance of the desired drawdown level for the remainder for the drawdown (Figure 1). Pumping ceased on September 17, 1997, and the lake was permitted to gradually refill from natural inflows. After the water level reached normal elevation, the culvert closure was removed and the drawdown operation ended (USACE 1997).

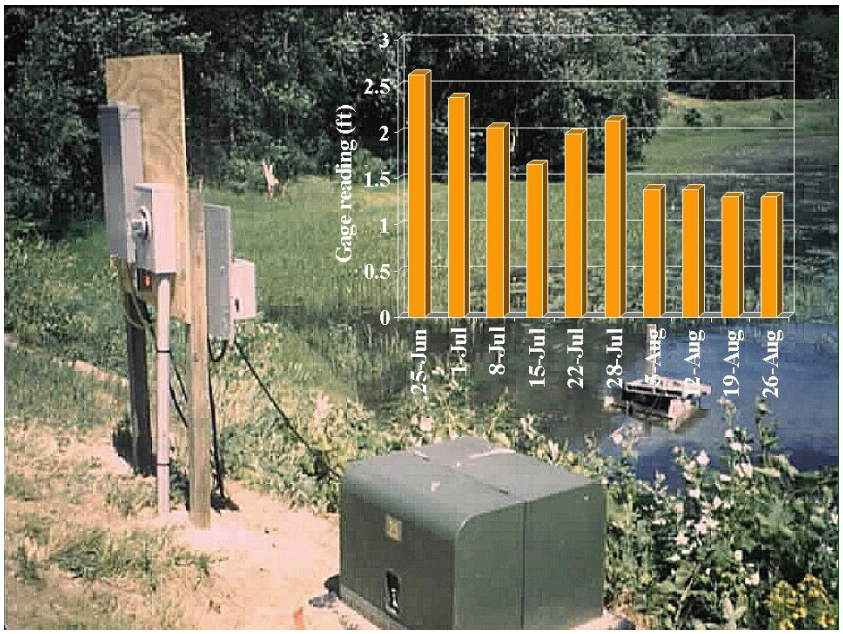


Figure 1. Water Levels at Lizzy Pauls Pond During Summer Drawdown of 1997

4.0 PROJECT MONITORING

4.1 MONITORING OBJECTIVES

Monitoring objectives for project evaluation purposes were included within the original Definite Project Report to directly measure the degree of attainment of the project objectives. For each project objective, an appropriate monitoring parameter was identified. The parameter originally targeted for measurement of each objective is shown in Table 1. Monitoring was planned before, during, and after the drawdown. The monitoring plan was modified as needed on the basis of field operations. Because of funding limitations, not all monitoring activities were ultimately performed. Post-project monitoring focused mainly on vegetation response. Monitoring activities were closely coordinated with any similar efforts by the Environmental Management Technical Center, the USFWS, and the WDNR.

TABLE 1

Parameters Initially Targeted for Pool 5 Small Scale Drawdown Objectives

Goal	Project Objective	Enhancement Feature	Unit of Measure	Measurement Plan	Monitoring Interval	Projected Cost per Effort
Improve Fish and Wildlife Habitat Conditions	Consolidate sediments	Drawdown	Water depths (feet); Soils-texture, % moisture, organic, etc.	Water surface elevations and stratified soil survey at random locations	Pre-constr, 1 year, 5 years, and post-constr.	$13,000
	Reduce turbidity	Drawdown	Suspended solids (mg/L); Turbidity (NTU)	Spot-checks spring/summer, Continuous turbidity monitoring, light penetration, light extinction, temperature	Pre-constr, 1 year, 5 years, and post-constr.	$5,000
	Increase aquatic vegetation	Drawdown	Aquatic vegetation (percent cover)	Aquatic plant surveys	1989, 1994, 0, 1, 2, 3, 5, 10 years, and post-constr.	$4,000

Source: Definite Project Report for Small Scale Drawdown HREP. St. Paul District, USACE 1997.

4.2 MONITORING HISTORY

4.2.1 Pre-Construction Monitoring

Pre-construction habitat monitoring at the Small Scale Drawdown was performed by the USACE. Table 2 summarizes the monitoring data collection efforts.

TABLE 2

Pre-Construction Monitoring Data, Pool 5 Small Scale Drawdown

Date	Agency	Components Monitored
August 1996	USGS	Aerial photography for vegetation mapping.
October 1996	USACE	Physical and chemical characteristics of sediment.

August 1996 Aerial Photography

Aerial photographs were taken at a scale of 1:15,000 to develop accurate pre-project vegetation maps.

October 1996 Physical and Chemical Characteristics of Sediment

James and Barko (1996) collected background information on physical and chemical sediment composition in Lizzy Pauls Pond in pool 5 prior to drawdown. During October 1996, sediment cores were collected from 10 stations that were randomly selected in both waterbodies. A Wildco KB Sediment Core Sampler was used to collect the sediment samples. Analysis of total sediment nitrogen and phosphorus concentrations was performed colorimetrically using a Lachet QuikChem procedure following digestion with sulfuric acid, potassium sulfate, and red mercuric oxide. Additional sediment cores collected at the same stations were analyzed for moisture content and sediment density, loss-on-ignition, and particle size distribution.

Results showed that Lizzy Pauls Pond sediment had a high mean moisture density (73.1 percent) but a low mean sediment density (0.381 g/mL), indicating a dominance of silts and clays in the sediment. Mean exchangeable nitrogen, which is important for macrophyte root uptake, represented 2 percent of the mean total sediment nitrogen (James and Barko 1996). Inorganic phosphorus accounted for 76 percent of the mean total sediment phosphorus concentration. James and Barko (1996) concluded the Lizzy Pauls Pond results by stating that when stratified with respect to depth, mean moisture content, loss-on-ignition, exchangeable nitrogen, total sediment phosphorus, sodium hydroxide (NaOH) extractable phosphorus, and inorganic phosphorus were significantly higher at depths $\geq$0.7 m, compared to depths <0.7 m.

4.2.2 Post-Construction Monitoring

Post-construction habitat monitoring at the Small Scale Drawdown has been performed by the USGS. Kenow et al. (2001) monitored the substrate seed bank and vegetation response to dewatering activities in Lizzy Pauls Pond during the summer of 1997. Kenow et al. (2001) includes a thorough discussions of methods used in these analyses.

Forty taxa of moist soil species were identified in the Lizzy Pauls Pond seed bank flats. The seed bank was dominated by rice cutgrass, redroot flatsedge, chufa flatsedge, bearded flatsedge, stiff arrowhead, nodding smartweed, and pink knotweed. Plant propagule densities were significantly higher in samples from emergent/moist soil plant communities than in those from the submersed aquatic plant community (Kenow et al. 2001).

The most notable change in the gross distribution of vegetation classes following the drawdown was the expansion of *Sagittaria* and *Phalaris* along the southwest shoreline of the basin. There was a net increase

of about 1.8 ha (4.4 acres; 8.3%) of moist soil vegetation, an increase of about 1.4 ha (3.5 acres; 6.5%) of emergent vegetation, and a decrease of about 2.9 ha (7.2 acres; 13.6%) of submersed aquatic vegetation (Table 7).

Vegetation development on the mud flats exposed during the 1997 experimental drawdown at Lizzy Pauls Pond was apparently limited by the delay in dewatering the area, the inability to maintain the water level reduction, and the relatively high soil moisture levels (Kenow et al. 2001).

Kenow et al. (2001) also measured soil moisture in relation to the drawdown (Table 4). Soil moisture levels remained high (about 70 to 81%) throughout the summer. Frequent precipitation and subsurface seepage likely contributed to these elevated levels. As a result, Kenow et al. (2001) believed it was unlikely that any appreciable substrate consolidation took place.

TABLE 3

Summary of Substrate Moisture Readings in Vegetation Quadrats (n=12 per exposure date) at Lizzy Pauls Pond, Navigation Pool 5, UMR, in Relation to Exposure Date. Soil moisture was measured on September 15, 1997.

Quadrat exposure date	Percent substrate moisture (SD)
June 25	70.6 (4.5)
July 1	74.5 (6.7)
July 8	76.8 (6.7)
July 15	79.6 (3.8)
August 5	80.9 (3.9)

Table 4

Net Change in Coverage of Vegetation Classes at Lizzy Pauls Pond Following an Experimental Drawdown During Summer 1997

Vegetation Type	Vegetation Class	Change in Area	
		Hectares	**Acres**
Terrestrial	Forest-mesic (moist soil spp)	- 0.69	- 1.7
	Roadside levee/grass/forb/shrub	0.69	1.7
	Shrub/grass/forbs	- 0.59	- 1.5
	net change	***- 0.59***	***- 1.5***
Moist Soil	Carex/grasses/forbs	0.54	1.3
	Mixed forbs and/or grasses	- 0.11	- 0.3
	Phalaris	1.24	3.1
	Scirpus/Carex/Leersia/Polygonum	0.76	1.9
	Typha/grasses/forbs	- 0.68	- 1.7
	net change	***1.75***	***4.3***
Emergent	Nymphaea/Sagittaria	0.41	1.0
	Sagittaria	0.89	2.2
	Scirpus	trace	trace
	Typha	0.06	0.1
	net change	***1.36***	***3.3***
Submersed Aquatic	Lemnaceae	0.07	0.2
	Nymphaea/submergents	- 2.49	- 6.2
	Submergents	- 0.43	- 1.1
	net change	***- 2.85***	***- 7.1***
Open Water	Open water	0.68	1.7
Other	Agriculture	- 0.33	- 0.8

NOTE: Comparison based on aerial photography obtained on August 21, 1996, and August 13, 1997, using interpretation procedures and classification schemes of the Upper Midwest Environmental Sciences Center.

4.3 PRESENT HABITAT CONDITIONS

Unfortunately surveys have not been performed to evaluate the effects of the project beyond those observed in 1997. Although some changes in vegetation and substrate moisture were observed during the drawdown, these changes were not substantial and may well have been limited by the challenges of maintaining the drawdown. It is possible that changes in vegetation may have persisted the following year; however, it appears unlikely that they would have persisted substantially beyond. Changes observed within the project area since 1997 are likely the result of a number of factors. It is not known to what level this drawdown has affected the conditions of Lizzy Pauls Pond 7 years after the project.

5.0 OPERATION AND MAINTENANCE

5.1 PROJECT FEATURES REQUIRING OPERATION AND MAINTENANCE

All operation and maintenance of the drawdown was conducted by the USACE as part of the project implementation responsibilities. Upon termination of the drawdown, no operation or maintenance was required, only post-drawdown performance monitoring.

6.0 PROJECT EVALUATION

6.1 PROJECT TEAM

A project team workshop was held with the resource managers 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. 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. 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. One excellent rating and three fair ratings were also received. The resource managers agreed that the project increased the emergent vegetation cover and slightly increased the diversity and density of macrophytes. Problems associated with this project were related to timing. Excessive rainfall during implementation limited the success of the drawdown. Sedimentation of the receiving water also occurred during dewatering, which may have adversely affected the fishery near the discharge location.

Suggested considerations for future drawdowns include the following:

1. Install more pumps and dredge channels to achieve the desired drawdown effect.

2. Improve design to reduce maintenance required to remove vegetation from pump enclosures.

3. Complete detailed pre-construction bathymetric surveys to evaluate drainage pathways during dewatering.

6.2 INTERESTED PUBLIC

A public participation workshop was held on December 6, 2000, at the Municipal Building in Buffalo City, 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. Appendix B presents the questions and the recorded responses from this meeting.

Eight people attended the workshop, including five public participants. Three agency participants, including one from the USFWS and two from the WDNR, were also in attendance to address questions about the technical aspects of the project. In general, those in attendance thought favorably of the project. A majority of the attendees rated the overall project as fair. However, the public perception was that the project had no significant impact on the appearance of Lizzy Pauls Pond following the project. This was expected because pre-project conditions were generally considered good. The project demonstrated that a drawdown would not harm the area and, in fact, caused more dense vegetation growth. The public was aware that excessive rainfall occurred during project implementation, which created challenges during dewatering. The public also expressed concern that sedimentation occurred on the north side of the road culverts, which may have adversely affected the fishery.

Project improvements suggested by those in attendance include the following:

1. Dredge sediment from the pond to restore water depths and improve the fishery to conditions observed 30 years prior.

2. Install informational signs adjacent to the project area (in Wayside) to educate the public regarding the project goals and objectives.

3. Install more pumps to better dewater the area and possibly influence the effects of groundwater infiltration.

4. Isolate the north and south portions of the pond to possibly make the dewatering more effective.

6.3 SUMMARY EVALUATION OF ECOLOGICAL EFFECTIVENESS

The monitoring data gathered for this project indicates the project goals and objectives were partially achieved. The vegetative response to the drawdown was limited by the inability to lower and control water levels in Lizzy Pauls Pond as much as desired. Excessive rainfall during the drawdown, groundwater seepage, and bathymetrics of the pond contributed to the project limitations. These conditions resulted in a partial drawdown of the pond. The drawdown increased the emergent vegetation cover and slightly increased the diversity and density of macrophytes. Important plant species such as arrowhead have seen an increase in abundance since the drawdown. The increase in vegetative cover also facilitates removal of suspended solids within the water column. The loss of suspended solids and increased water clarity will enable the establishment of important species of aquatic macrophytes.

The amount of soil consolidation that occurred on the pond could not be measured accurately due to the partial drawdown condition associated with this project. Additional study may be required to measure the effects of soil consolidation in similar riverine settings.

During construction, water was pumped from the pond and discharged to a channel on the north side of the road. This resulted in sedimentation and possible impacts to the fishery in the channel.

6.4 SUMMARY EVALUATION OF ENGINEERING EFFECTIVENESS

The engineering for this project was completed by the USACE. Comments received by the resource managers indicate the project goals and objectives were achieved. The effectiveness of the drawdown was affected by the bathymetrics of the pond, which limited water flow to the pumps. A channel was dug within the pond to facilitate water flow to the pumps. Soil consolidation was not achieved because of the partial drawdown condition. Bathymetric surveys would benefit the project design and may affect dewatering techniques or pump location.

The pumps were also routinely clogged by vegetation, which required maintenance of the system and reduced efficiency of the pumps. Future drawdown projects should consider measures to reduce operation and maintenance costs associated with pumps.

6.5 SUMMARY EVALUATION OF COST

6.5.1 Estimated Cost

The total estimated cost for the project, including the drawdown of Peck Lake in May 1997, was $87,200. A detailed cost estimate for Lizzy Pauls Pond is shown in Table 5.

6.5.2 Actual Costs

General design costs were $35,000, and construction costs were $62,000. There are no annual operation, maintenance, and repair costs for the project (USACE 1997).

TABLE 5

Project Cost For Small Scale Drawdown, Pool 5

EMP SMALL SCALE DRAWDOWN – LIZZY PAULS POND	
	COST ($)
PORTABLE SUBMERSIBLE PUMPS	$18,488.23
INSTALLATION OF ELECTRICAL SERVICE	$1,120.12
USAGE OF ELECTRICAL POWER	$2,200.00
LABOR COSTS (CON-OPS)	$9,358.50
LABOR COSTS (ENG)	$4,423.93
TOTAL COSTS	**$35,590.78**

7.0 LESSONS LEARNED

The following lessons have been learned from evaluating the effectiveness of the pool 5 Small Scale Drawdown Project.

- Bathymetric survey data should be included as part of project design.
- Drawdowns can be effective for changing vegetation structure and diversity.
- Flexibility should be incorporated into a drawdown plan to account for weather conditions.
- Channel construction can be considered to allow water flow to the pumps.
- Hydraulic connection with groundwater should be accounted for when developing a dewatering plan.
- Sedimentation of adjoining habitats from the discharge water should be considered.
- Removal of vegetation from pumps is a daily requirement.

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:

- Improve public relations and education regarding the importance of the project and resulting benefits.
- Obtain detailed bathymetric surveys for project design.
- Consider design elements to minimize maintenance associated with debris buildup at the pumps.
- Consider construction of a forebay to allow the collection of sediment prior to pumping to a receiving area.
- Consider dredging channels to allow total drawdown.
- Complete additional study on the short- and long-term vegetational response to drawdowns and the effects on soil consolidation.
- Install informational signs adjacent to the project area to educate the public regarding the project goals and objectives.
- Take measures to minimize sedimentation impacts from future dewatering projects.

9.0 REFERENCES

James, William F., and J.W. Barko. 1996. Sediment Physical and Chemical Chara cteristics for Lizzy Pauls Pond (Pool 5) and Peck Lake (Pool 9) of the Upper Mississippi River. Report 1: Pre-restoration Results. Report prepared by the USACE. 1996.

Kenow, Kevin P., R.K. Hines, and J.E. Lyon. 2001. Assessment of Vegetation to an Experimental Drawdown on Pool 5 of the Upper Mississippi River: A Progress Report. Report prepared by the USFWS. 2001.

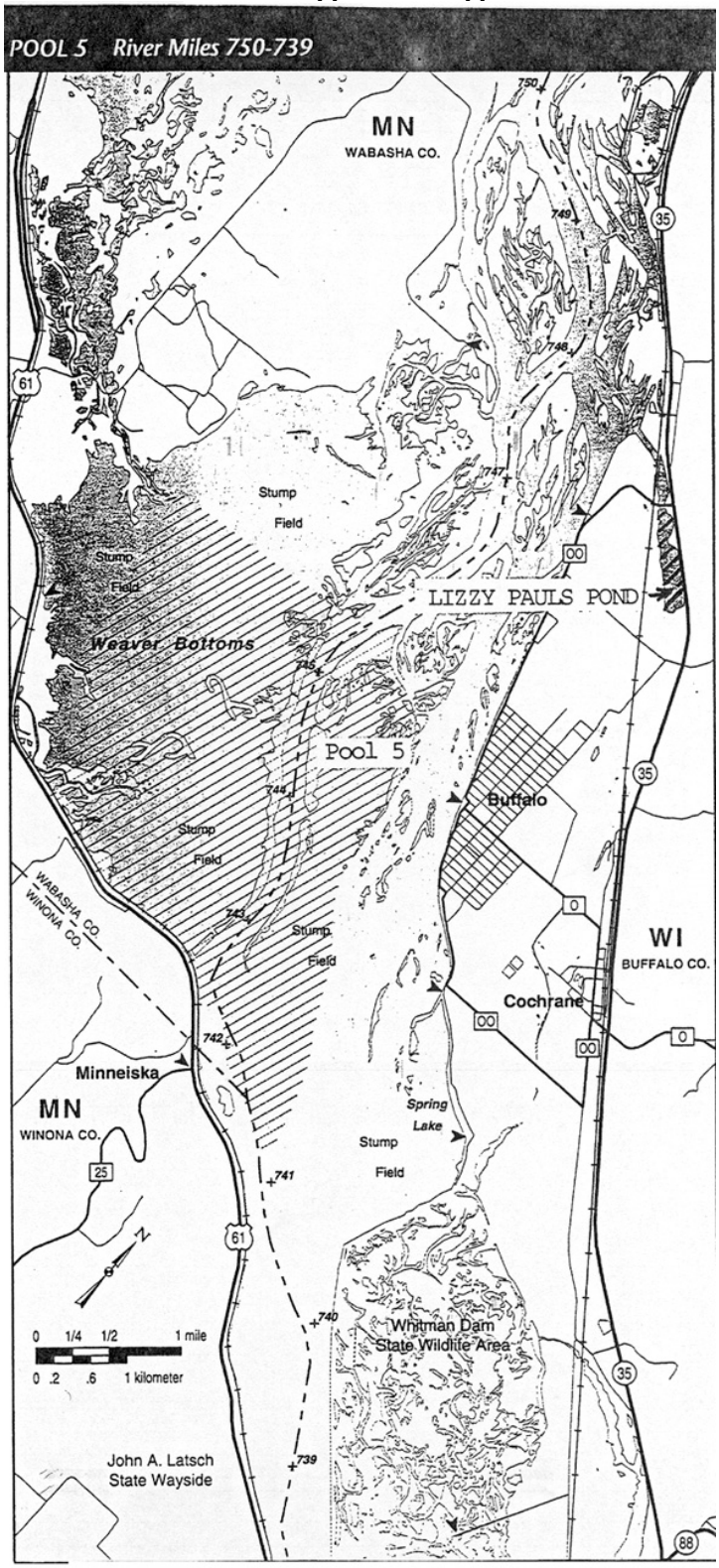
United States Army Corps of Engineers. 1996. Scope of Work for Pre-project Monitoring, Small Scale Drawdown, Habitat Rehabilitation and Enhancement Project. Report prepared by the St. Paul District, USACE. 1996.

United States Army Corps of Engineers. 1997. Definite Project Report/Environmental Assessment (SP-21), Small Scale Drawdown, Habitat Rehabilitation and Enhancement Project. Department of the Army, North Central Division, Corps of Engineers, 536 South Clark Street, Chicago, Illinois 60605-1592.

http://www.mvp.usace.army.mil

http://www.umesc.usgs.gov/http_data/hrep_projects/small_scale_drawdown

Figure 2. Project Location for the Small Scale Drawdown in Lizzy Pauls Pond, Pool 5 of the Upper Mississippi River



APPENDIX A

COMPILED RESULTS OF INTERVIEWS WITH PROJECT TEAM

PROJECT OBJECTIVES

1. Increase the areal extent, interspersion, density, and species composition of macrophyte beds.
2. Decrease suspended solids concentrations.
3. Increase the area of emergent and submerged aquatic vegetation.

PROJECT TEAM RESPONSES
SMALL SCALE DRAWDOWN
FEBRUARY 13, 2001

Question	Response
Q1 *Which of the project objectives were effectively addressed by the project?*	- Air photo showed mixed response to Objective #1. - Increased emergent vegetation cover. - Did not achieve Objective #2. - Subsurface seepage kept soil moist throughout the project. * NOTE: Include the Peck Lake Report (Kenow) as an Appendix to this completion report.
Q2 *What project features could have been changed to make a more effective project?*	- Use pumps at other locations or mechanically dredge to adequately drain the area in shorter duration. - Vegetation clogged the boxes that the pumps were in – pumps were less effective. - Clear debris from pumps more often. - Move the location of discharge farther from the pond.
Q3 *How could the appearance of the project be improved?*	No changes.
Q4 *How did this project affect use of the area?*	- Locals no longer fish on Lizzy Pauls Pond. - during and post-project. - Sediment buildup near discharge has affected fishing.

Question	Response

Q5 *Is the amount of O&M appropriate, and how could it be reduced?*	- Cleaning pumps is labor intensive.
	- Get pumps to lowest pond elevation.
	  - i.e., floating pumps.
	  - better pre-project bathymetric surveys to locate low areas.

Q6 *What monitoring is appropriate to assess project effectiveness?*	- Measure TSS if not measured. - Measure L.C. soil compaction (i.e., moisture content, physical monitoring with penetrometer).
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 - 1 response) (B - 4 responses) (C - 3 responses)
Q8 *What needs to be done to further improve habitat conditions in the project area?*	- Another drawdown in 5 to 6 years. - Acquire cropland on the south border of Lizzy Pauls Pond to minimize sedimentation. - Dredge the pond to increase depths. - Use improvements to drawdown (more pumps) and draw down pond again with more monitoring. - Control beavers.

Question	Response
Q8 (continued)	- Culvert elevation is set too high.
Q9 *What was the public reaction to the project?*	- Positive. - Fishing was adversely affected at the culvert. - Better public education/outreach. - Public pleased with vegetation response – stayed the same visually. - Fish kills (public wanted fish netted/rescued). - similar concerns at Peck Lake.

Q10 *What were the "lessons learned" from this project?*	- Excessive rainfall/weather affected the project outcome.
	  - make water flow to pumps, complete pre-project bathymetric survey and dredging channel to pumps.
	  - increased labor costs from plan.
	- Do not expect too much, especially when related to a pool drawdown.
	  - do not rely solely on this one management technique.
	- Build flexibility into a drawdown plan.
	- Monitoring - post-project, long-term monitoring of vegetation and sediment consolidation.

APPENDIX B

COMPILED RESULTS OF INTERVIEWS WITH INTERESTED PUBLIC

INTERESTED PUBLIC RESPONSES
SMALL SCALE DRAWDOWN
DECEMBER 6, 2000

Question		Response
Q1	*Were all the habitat project objectives met?*	(Yes - 0) (No - 0) (Unknown - 4) - Excessive rains did not result in total drawdown.
Q2	*If not, which of the project objectives were not attained and why?*	No responses.
Q3	*How could the project features be changed to better meet the objectives?*	- More pumps could have been installed to lower the groundwater table, resulting in a total drawdown. - Groundwater infiltration did not allow the area to dewater. - Could have isolated the northern half from the southern half of the pond.
Q4	*Are the present habitat conditions in the project area satisfactory?*	(Yes - 3) (No - 0) (Unknown - 0) - Project did not adversely affect the site. - Project resulted in increased plant life including wild rice.
Q5	*If not, what needs to be done to restore habitat conditions?*	- Increase water depths in the pond through dredging. - Dredge sediment from the pond.
Q6	*How did this project affect use of the area?*	- Project did not adversely affect the site. - Fewer waterfowl use the area since project completion. - Fishing is worse since project completion. - Sedimentation has occurred on the north side of the project area as a result of the dewatering which has adversely affected the fishery.
Q7	*How does the project look?*	- Pond does not look different after drawdown. - No significant change in vegetation growth observed in the pond after drawdown.
Q8	*How could the appearance of the project be improved?*	- Suggested changes to the project during drawdown. - Install an informational sign at the wayside to inform the public.

Question	Response
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 - 0) - (B - 0) - (C - 3) - (D - 0) - (F - 0) - Project was marginally effective.
Q10 *How could public participation in project planning be improved?*	- Public notices and letters are helpful to notify the public. - Meeting held nearer the end of the project, with presentation of preliminary results to the public prior to asking for public input. - Local groups meeting regularly with the USACE throughout the project duration, similar to the Weaver Bottoms project. - Put project information on Internet web pages to provide access to public. - Generate mailing lists for specific projects and distribute to local areas.
Q11 *What are your recommendations for habitat protection and restoration on the Upper Mississippi River?*	- Remove sand from the river in areas where access is limited. - Dredge areas specifically for recreational boaters, not only for wildlife (similar to Polander Lake). - Include a recreational boating component in projects to increase access to the river since improvements use public monies.
	Overall theme of public comments: - Would like to understand the monitoring data and results of the project prior to the public input meeting. - Lizzy Pauls Pond was deeper 20 to 30 years ago and was a better fishery. - The road culvert on the north end of the site is likely not the cause of fluctuating water levels within the pond during the past 30 years.