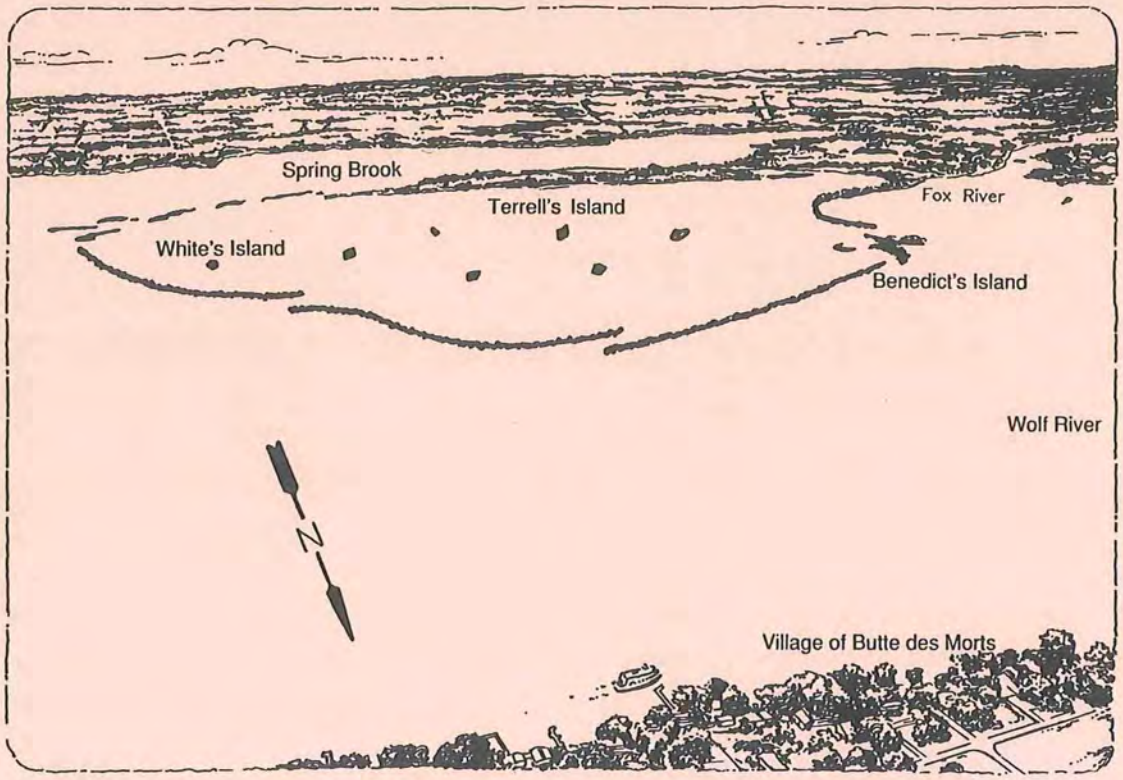
# UPRIVER LAKES HABITAT RESTORATION PROJECT




# ENVIRONMENTAL IMPACT STATEMENT

WINNEBAGO COMPREHENSIVE MANAGEMENT PLAN

**Department of Natural Resources**
**April 1991**

# TO THE READER

You are invited to ask questions and to voice your concerns or comments on this Environmental Impact Statement (EIS). Your participation is vital to ensure the EIS on the breakwall proposal adequately addresses critical public issues. The proposed review schedule for the EIS is as follows:

| | |
|---|---|
| *Release for Review:* | *Mid-April, 1991* |
| *Public Meeting:* | *Mid-May, 1991* |
| *EIS Comment Deadline:* | *Early June, 1991* |

*The Public Hearing will be held at*
*Winneconne High School*
*400 N. 9th Avenue*
*Winneconne, WI*

Readers with comments or questions on the EIS contents or EIS review procedures should contact:

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*Oshkosh, WI 54904*
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## ENVIRONMENTAL IMPACT STATEMENT PROCESS

The environmental impact statement process under the Wisconsin Environmental Policy Act (s. 1.11, Wis. Stats.) is a process of disclosure. It is intended to relay factual judgments regarding the proposed project, including whether the breakwalls may or may not comply with the general policies and goals of the Department. Specifically, it is intended to assist decision makers identify potential adverse impacts and seek means of reducing or eliminating them. Impact statements address issues in a broad sense and a review of detailed consultant submittals or background files is often necessary to understand how the proposal is anticipated to comply with a particular, and often complicated, set of environmental standards or policies.

The approvability of this project depends upon the legally adopted standards and criteria applied to all such proposals, whether sponsored by private or public entities. Since human activity typically causes measurable changes in the environment, the breakwalls will be judged on whether the anticipated impacts are within acceptable bounds as set out in the published standards. If the Department's review of this proposal indicates the breakwalls can be expected to comply with published standards, the agency will seek funds and authority to implement the project.

In deciding whether to approve the project, to require further changes, or to disapprove the project altogether, the Natural Resources Board considers agency and public comments and information presented in the EIS. If the Board approves the proposal, authorization and construction funds will be sought from the Legislature and required permits (federal, state and local) will be applied for.

# EXECUTIVE SUMMARY

The dramatic loss of thousands of acres of wetlands, deteriorating water quality, degraded fish and wildlife habitat, and diminished fish and wildlife populations are evident in the Lake Winnebago pool. Past actions to halt wetland loss included riprapping shore areas and dumping rubble and car bodies along wetland margins. Many of these efforts failed because they were either poorly conceived or inadequately constructed. Where riprapping has been successful it only prevents further loss rather than enhancing wetland habitat.

In response to local concerns, the Department of Natural Resources (DNR) developed the Winnebago Comprehensive Management Plan (WCMP) with significant input from the public and other state, local and federal agencies. A key element of the plan recommended that breakwalls be studied as a means of protecting or enhancing critical fish and wildlife habitat areas in Lakes Butte des Morts, Poygan, and Winneconne (the Upriver Lakes). An examination of the breakwall concept by the Department and its engineering consultant (W. F. Baird and Associates) determined rock rubble breakwalls to be the most cost effective and proven technique for breaking waves and reducing the inflow of turbid waters.

Based upon this initial favorable analysis, the department is proposing to build breakwalls and/or wildlife islands in six different locations around the Upriver Lakes over the next 10-15 years. The first phase would consist of three or four segments of rock rubble breakwalls (about 8,300 feet) and six wildlife islands north of Terrell's Island in Lake Butte des Morts. This phase is conservatively estimated to cost $2.9 million to construct with preliminary maintenance costs conservatively estimated at $250,000 every decade. Final engineering for the breakwalls and selection of the final alignment will be undertaken if the project is authorized by the legislature. The Department proposes to study the effectiveness of the Terrell's Island loop for 3-5 years before constructing breakwall segments in the other Upriver Lakes.

About 15-18 acres of lakebed in Lake Butte des Morts would be covered by the project structures. Three to six acres of terrestrial disturbance (e.g., quarrying and road building) would be anticipated for the Terrell's Island project.

Construction of breakwalls and revegetation of the restoration area should significantly reduce wave action and improve water clarity within the 630 acre Terrell's Island restoration area. The breakwalls should not result in increased sedimentation or flood flows in other parts of the lakes or upstream of the structures. Accelerated shore erosion is not anticipated to be a concern, except perhaps near Benedicts Island where remedial action by the Department may be needed. Plant growth in other parts of the lake should not be affected by habitat restoration behind the breakwalls.

The fishery, wildlife and endangered resources goals established in the WCMP are believed to be achievable if the breakwalls and wildlife islands are constructed and wetland restoration is successful. To facilitate wetland restoration near Terrell's Island, the existing very sparse submerged plant beds (10-15 acres total) would be augmented by the Department replanting 10-12 acres as starter beds within the enclosure with desirable emergent and submerged species. Cyclic fluctuations in plant density and species diversity are anticipated, but the long-term goal of 50-70% coverage by aquatic plants is believed to be obtainable. The monitoring and replanting efforts would cost approximately $100,000/year over a three year period, but would use existing staff and equipment to the maximum extent feasible. In addition, active control of nuisance species (e.g., Eurasian water milfoil, purple loosestrife, carp, etc.) is contemplated if the need arises.

Other structural options, both permanent and temporary, and most resource management techniques studied were either too expensive, lacked a track record for evaluating their performance or did not appear to adequately meet the project objectives of successful habitat restoration. Lower spring and summer water levels on the Upriver Lakes is the least expensive means of restoring wetland habitat, but is not considered a viable option because widespread public and industry support is lacking.

The Department is also considering the feasibility of designating the restoration area an acquisition area. This would provide resource managers with greater latitude in the timing and techniques used in the restoration area. Such a designation would authorize the Department to purchase or obtain easements on properties of willing owners within the project boundaries.

Though there is broad support for the project, several concerns have also been raised about the breakwall proposal. These concerns include the construction and maintenance costs relative to the perceived benefits, aesthetic issues regarding how the breakwalls will look given the changing character of the surrounding land uses (particularly for Lake Butte des Morts), and navigation safety issues. The final breakwall alignment and design will influence the impact the structures have on these concerns.

This restoration project is not anticipated to have any significant effect on property values or land uses around the lakes. If successful, the Terrell's Island project should enhance fish and wildlife populations thus increasing the types of recreational opportunities available as well as the quality of these experiences.

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# CHAPTER ONE

# PROJECT DESCRIPTION

## PROJECT AREA

The proposed breakwalls, nesting islands, and wetland restoration areas would be located in Lakes Butte des Morts, Winneconne and Poygan (the Upriver Lakes) in Winnebago County (Figure 1-1). Water levels in the lakes are controlled by two dams located at the outlets of Lake Winnebago in the cities of Neenah and Menasha. The Upriver Lakes are within 75 miles of over 2 million people and receive heavy recreational use by boaters, anglers, swimmers, hunters and trappers.

## HISTORY OF THE LAKES

The Upriver Lakes were large, naturally fertile, riverine marshes supporting dense emergent and submerged plant communities dominated by wild rice prior to impoundment (source 1). Large sedge meadows and lowland prairies surrounded these riverine marshes. Fish and wildlife populations thrived in these habitats.

Dams constructed in the 1850s to manage water levels for commercial navigation raised the water levels of the lakes 2.5-3.0 feet to form what is known as the Winnebago Pool. Impoundment of the system began the transition of the Upriver Lakes from a riverine marsh ecosystem to a large, nutrient-rich, open-water lake system (Figure 1-2). This transition occurred in three phases, involving major changes in species composition, abundance, and distribution of aquatic vegetation from the 1850s up to the present time (Appendix A).

The decline in aquatic vegetation accelerated from 1930 through the 1960s and resulted in the large, turbid open water lakes evident today (sources 3, 4, 5, 10 and 11). The decline was influenced primarily by higher water levels, but compounded by extreme flooding, increased water turbidity, accelerated nutrient, pesticide and sediment loading from agricultural lands, lake shore and urban development, plant removal (e.g. dredging, harvesting, and chemicals), erosion of unstable shorelines and bottom sediments by wave and ice action, and the introduction of carp. Wave action, particularly during high water years, continue to erode shorelines and adjacent wetlands though wetland loss has slowed and is less noticeable than in the past.

The alteration and loss of wetland habitat since impoundment has directly affected the abundance and diversity of fish and wildlife. Though waterfowl populations are down nationally, the loss of habitat on the Upriver Lakes has resulted in lower nesting success and reduced use by migrating ducks. Game fish populations have declined due to decreased habitat, lower reproductive success, reduced foraging efficiency, and diminished food resources. Lower gamefish populations are less able to control carp and sheepshead populations exacerbating high turbidity and vegetation loss. The present habitat favors less desireable open water fish such as carp, sheepshead and gizzard shad rather than game species such as northern pike, largemouth bass, yellow perch and other panfish.

### Past Wetland Protection Efforts

Previous efforts to protect marshes on the Upriver Lakes met with varied success. Early efforts centered on holding marshes in place. Methods included placing car bodies or driving wooden stakes around the edge of the marshes during winter. Such efforts often failed, largely because the car bodies and stakes were poor wave barriers and were ineffective against ice damage. Most importantly, many of the

marshes were already floating and/or breaking apart. Efforts to protect marshes and shorelines with rock riprap have been highly successful, with exceptions in areas where the lake bottom was too soft and rocks sank over time or too little rock was used. Most of the developed shorelines and many of the remaining marshes on the Upriver Lakes are now protected by rock riprap. Some 4-6 miles of poorly or unprotected shoreline and wetland areas, however, continue to erode, including some sections to be protected by breakwaters in Lakes Butte des Morts and Poygan.

## WINNEBAGO COMPREHENSIVE MANAGEMENT PLAN (WCMP)

Past efforts to manage the Lake Winnebago pool have been hampered by the sheer size of the watershed, the complexity of the lake ecosystem, and conflicting interests among various users. The system is primarily managed by the Wisconsin Department of Natural Resources (e.g., resource management) and the U.S. Army Corps of Engineers (e.g., water level control), though many other local, state, and federal agencies have specific regulatory or management responsibilities for land use, recreation and navigation on the lakes. For the most part, each group has focused on a single issue or resource. Though valuable, these efforts were too small and narrow in perspective to result in effective holistic management of the system's resources. Given the amount of use of the Winnebago system and the long standing nature of its management problems, integrated management is needed to maintain, and more importantly, improve the quality of the resource.

For these reasons, a comprehensive management planning process was initiated by the Department in 1986 and the Winnebago Comprehensive Management Plan (WCMP) was completed in December, 1989. Additional details about the WCMP are contained in Appendix B. The resulting WCMP integrates Department management efforts with those of the other agencies and groups interested in the system's well being. The goal of the plan is "to restore, improve, and maintain the ecological diversity and quality, and beneficial uses of the fish, wildlife and water resources of the Winnebago system". A key proposal in the WCMP for habitat restoration is the construction of breakwalls in select areas of each of the Upriver Lakes. Public and agency comments and concerns received during the review of the WCMP are considered in this EIS.

## REQUIRED AUTHORIZATION AND PERMITS

This project will need authorization at the state level from the Wisconsin Legislature to place fill on the bed of a navigable waterbody before construction can begin. A U.S. Army Corps of Engineers s. 404 permit and s. 10 (River and Harbors act) approval will also be required. A s. 401 water quality certification will also be needed. No local permits are required for the breakwall proposal.

This Environmental Impact Statement (EIS) concentrates on the Lake Butte des Morts initiative, but provides a broader project perspective when reasonably accurate information is available for the other Upriver Lakes. Environmental assessments or supplements to this EIS will be developed, as appropriate, for the remaining breakwall segments and wildlife islands mentioned in the WCMP before they are constructed.

## PROPOSED WETLAND RESTORATION OBJECTIVES

Restoring or protecting the remnant wetlands in the Upriver Lakes to enhance fish and wildlife habitat is a high priority for the Department. Constructing breakwalls to enclose and/or protect designated habitat restoration areas was specifically identified in the WCMP as a technique to facilitate plant growth. The restoration activities, in general, and the breakwalls, particularly, will need to achieve two major goals to be successful. First, protect and enhance remnant wetlands and aquatic habitat enclosed

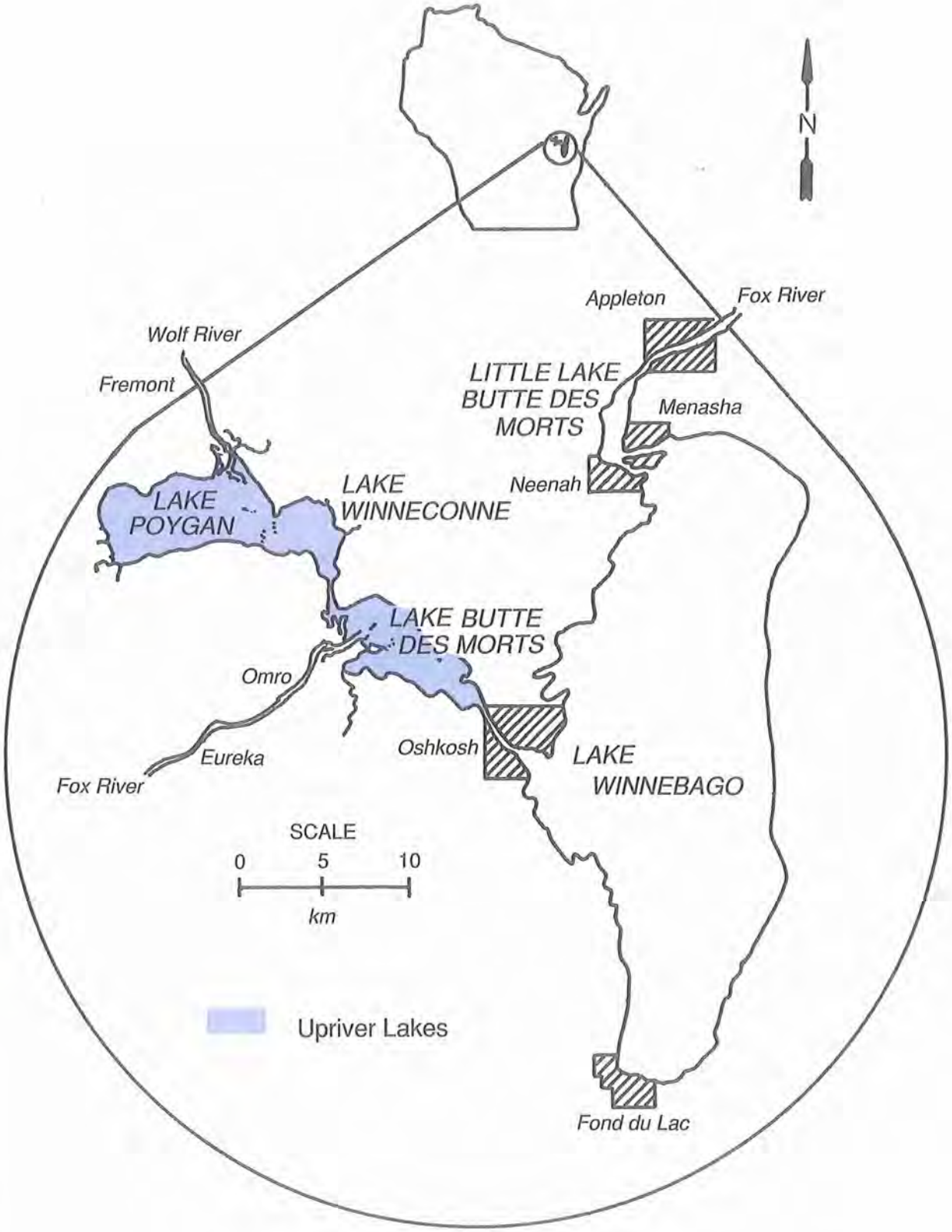


**Figure 1-1** Project Location

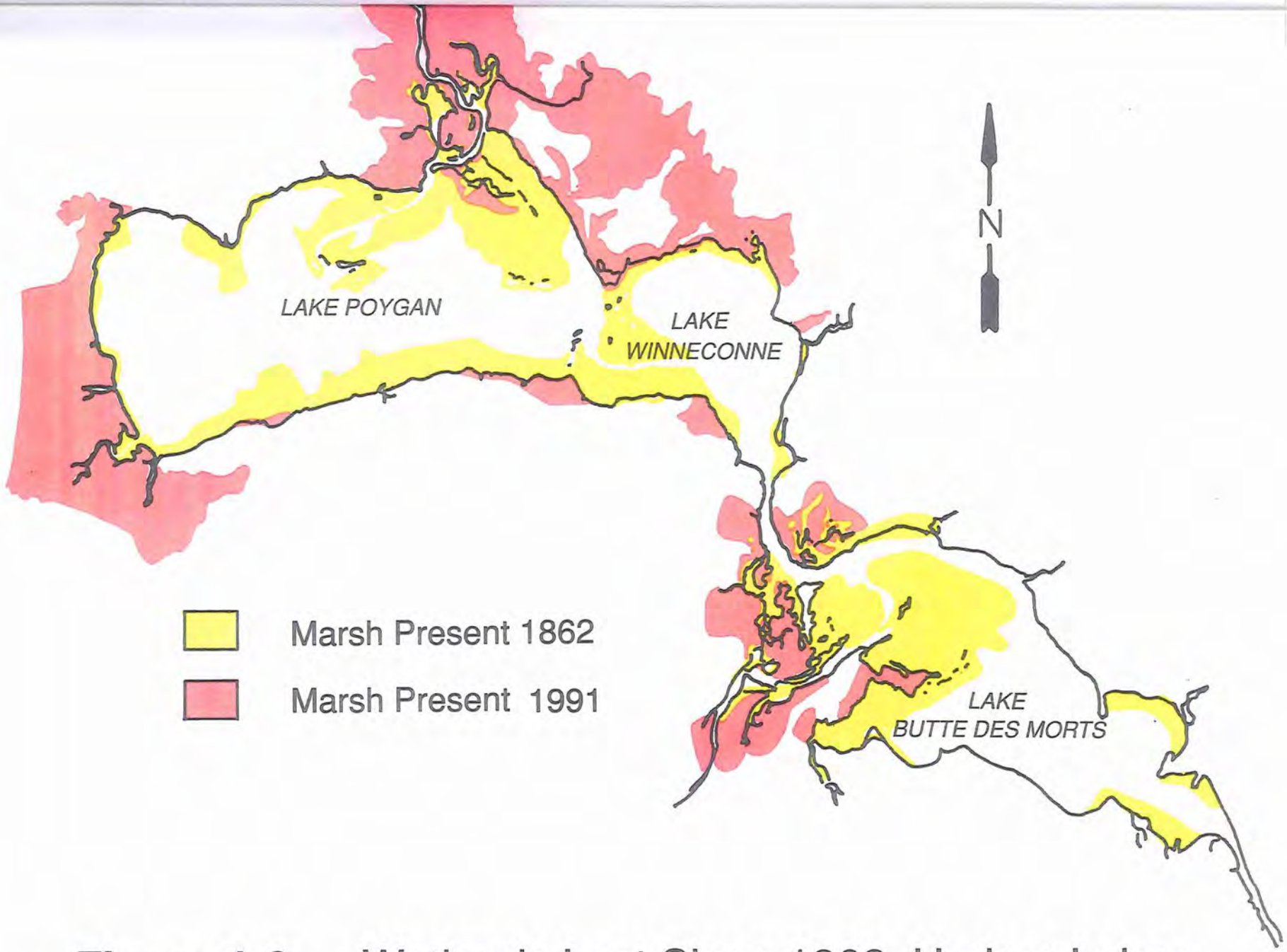


**Figure 1-2** Wetlands Lost Since 1862, Upriver Lakes

by the breakwalls, and second, increase recreational opportunities and satisfaction associated with fishing, hunting, trapping, and boating.

The breakwalls will reduce wave action and diminish sediment resuspension to improve water clarity within the enclosures. Deflecting turbid, nutrient enriched river and lake waters should further improve water clarity. Aquatic plants currently present in low numbers should multiply within the enclosed areas once wave action is reduced and water clarity improves.

Re-establishment of desireable emerged and submerged vegetation will provide food, cover, breeding and spawning habitat for a variety of waterfowl, marsh birds, furbearers, fish and non-game species. Waterfowl and marsh birds will use seeds and tubers of aquatic plants for food. Cattail, canes, and bulrush will provide nesting sites. Muskrats can eat the shoots and tubers of many species, and build their houses with vegetation. The vegetation will also increase insect and snail populations which are critical components of a healthy ecosystem and important in the diets of fish and wildlife.

**Specific objectives for the habitat restoration areas and breakwalls include:**

* Revegetate 50 to 70% of the 630 acre restoration area with moderately dense beds of emergent and submerged plants.
* Re-establish historic navigation channel boundaries in three locations: the Fox River where it enters Lake Butte des Morts; the Wolf River through both the Boom Cut and the original mouth; and the Wolf River channel between Lake Poygan and Lake Winneconne;
* Break waves generated by the wind and boat, thus reducing shore and wetland erosion and sediment resuspension in the restoration areas;
* Reduce the movement of turbid river and lake waters into the restoration areas to improve water clarity;
* Increase populations and reproductive success of yellow perch, northern pike, largemouth bass, breeding dabbling ducks, endangered Forster's and common terns, muskrat, and associated non-game fish and wildlife;
* Increase aquatic insect populations critical in fish and wildlife diets; and
* Increase the number of migrating diving and dabbling ducks utilizing the Upriver lakes and increase their time spent on the lakes.

## PROPOSED BREAKWALL LOCATIONS

### Breakwalls

Breakwalls are proposed to be constructed in six locations (Figures 1-3, 1-4, 1-5). The first area proposed for habitat restoration is the Terrell's Island area of Lake Butte des Morts. The second phase would protect the extensive wild celery beds between Boom Bay and the mouth of the Wolf River from the prevailing southwesterly winds and river currents. The Wolf River West and the Poygan/Winneconne North and South breakwall segments were proposed because they would protect remnant wetlands.

### Wildlife Islands

Wildlife islands are being considered at several locations. Initially, six 0.5 acre islands are proposed for the Terrell's Island restoration. Two other potential sites in the Upriver Lakes are Scott's Bay in Lake Butte des Morts and north central Lake Poygan between the mouth of the Wolf River and Boom Cut.

## BREAKWALL DESIGN

The proposed construction techniques and materials may vary depending on breakwall location. The proposed rock rubble breakwalls (constructed of locally quarried limestone) for Lake Butte des Morts are anticipated to have a 12 foot wide top, 3 to 1 sideslopes, and a height of 3 feet above the ordinary summer water level (i.e., 3.0 on the Oshkosh gauge) (Figure 1-6).

The breakwall would be constructed in 1,400-2,500 feet segments separated by a minimum of 300 foot wide gaps. The gaps would have the following characteristics:

1) sufficient width and depth to minimize mammalian predator (e.g., raccoons, foxes, and skunks though not mink) use of the breakwalls as travel and foraging lanes;

2) adequate depth and width to allow boaters to safely and conveniently enter and leave the restoration area; and

3) sufficient overlap between breakwall segments to reduce wave propagation into the restoration area.

The actual water depth in the gaps will depend upon two key factors (a) final engineering specifications for the breakwalls and (b) the bottom elevations at the gap locations along the final breakwall alignment. Under the present Terrell's Island proposal, the gaps would not be dredged and the water depth would vary from 1-2 feet deep near Benedict's Island to 4-5 feet for those gaps closer to White's Island. At a minimum, the gaps will be designed to accommodate the shallow draft boats which have traditionally used the restoration area.

## CONSTRUCTION SCHEDULE

Construction of the breakwalls is proposed to be phased in over a 10 to 15 year period. The breakwall project schedule calls for completion of the Terrell's Island loop by 1993-94. A delay of 3-5 years following the construction of this loop would be used to assess the breakwalls effectiveness. If restoration of the Terrell's Island loop is successful, the next priority would be the Boom Cut and Wolf River East segments. Breakwalls for Scott's Bay may be considered (See Alternatives Section) if more detailed studies indicate they would not create backwater effects during flood flows or the Terrell's Island breakwall alignment is modified to allow flow on both sides of Benedict's Island. Poygan/Winneconne North and South and Wolf River West breakwalls would be installed last.

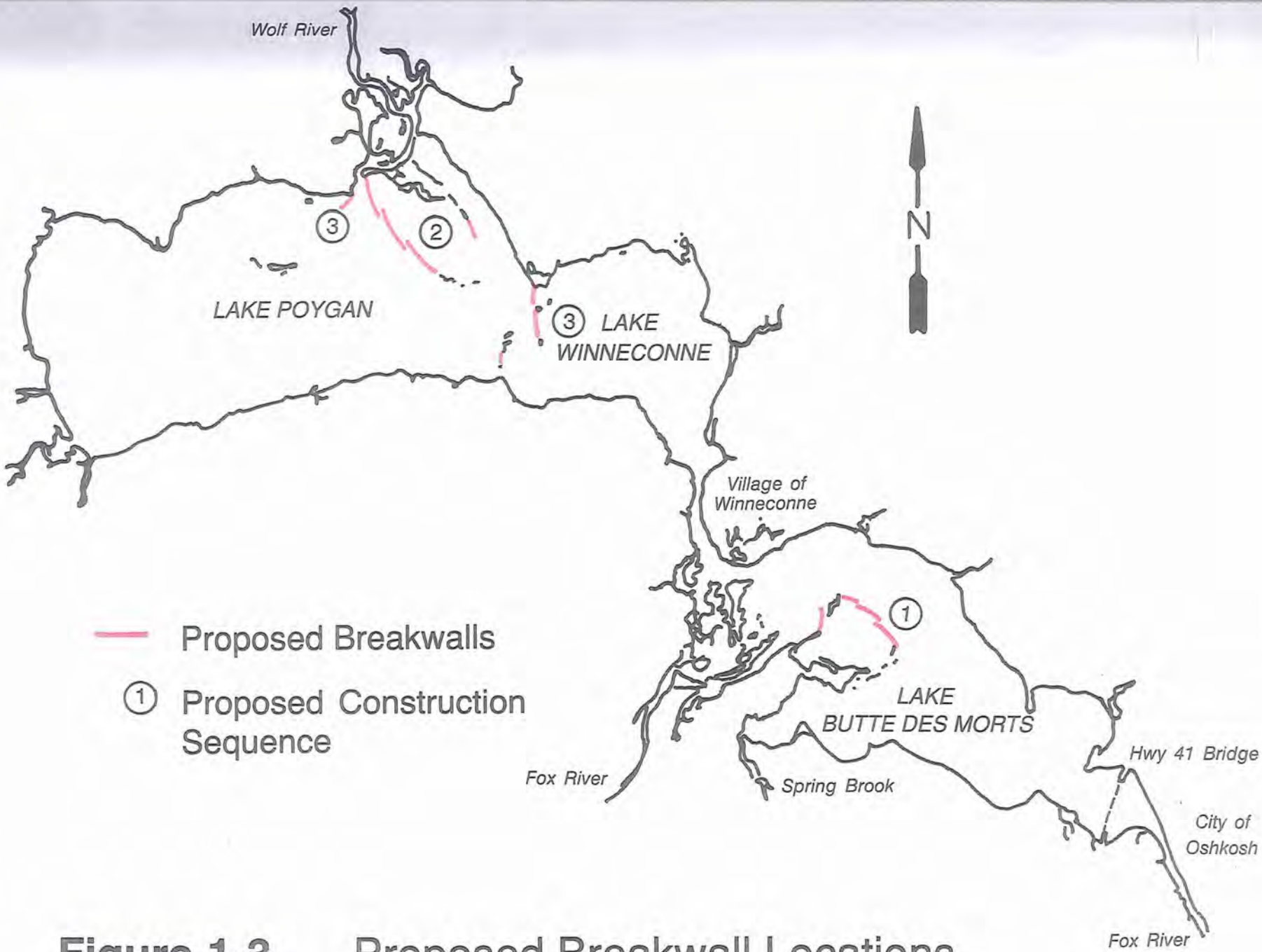


**Figure 1-3** Proposed Breakwall Locations

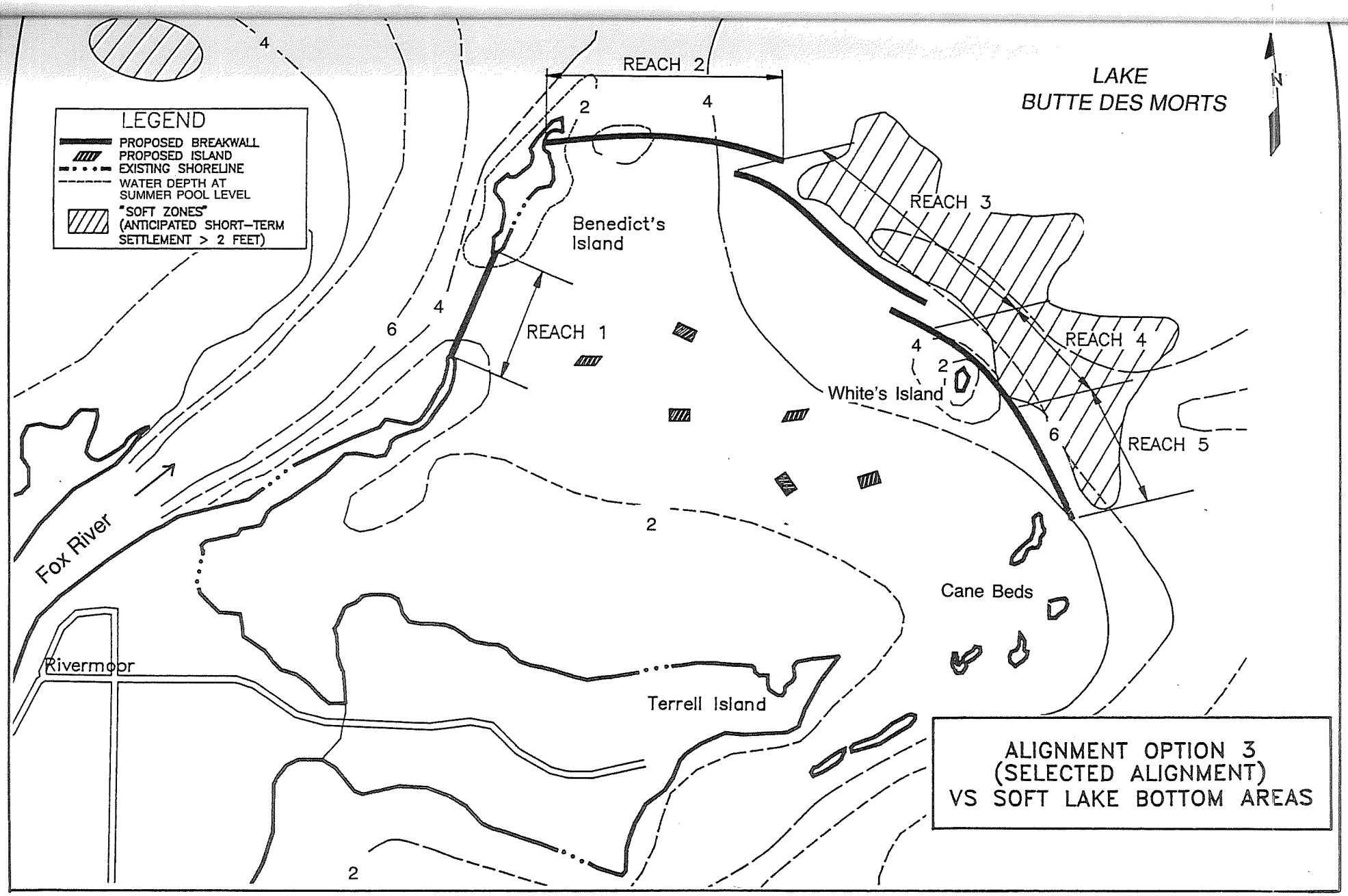


**Figure 1-4** Proposed Breakwall Configuration – Lake Butte des Morts

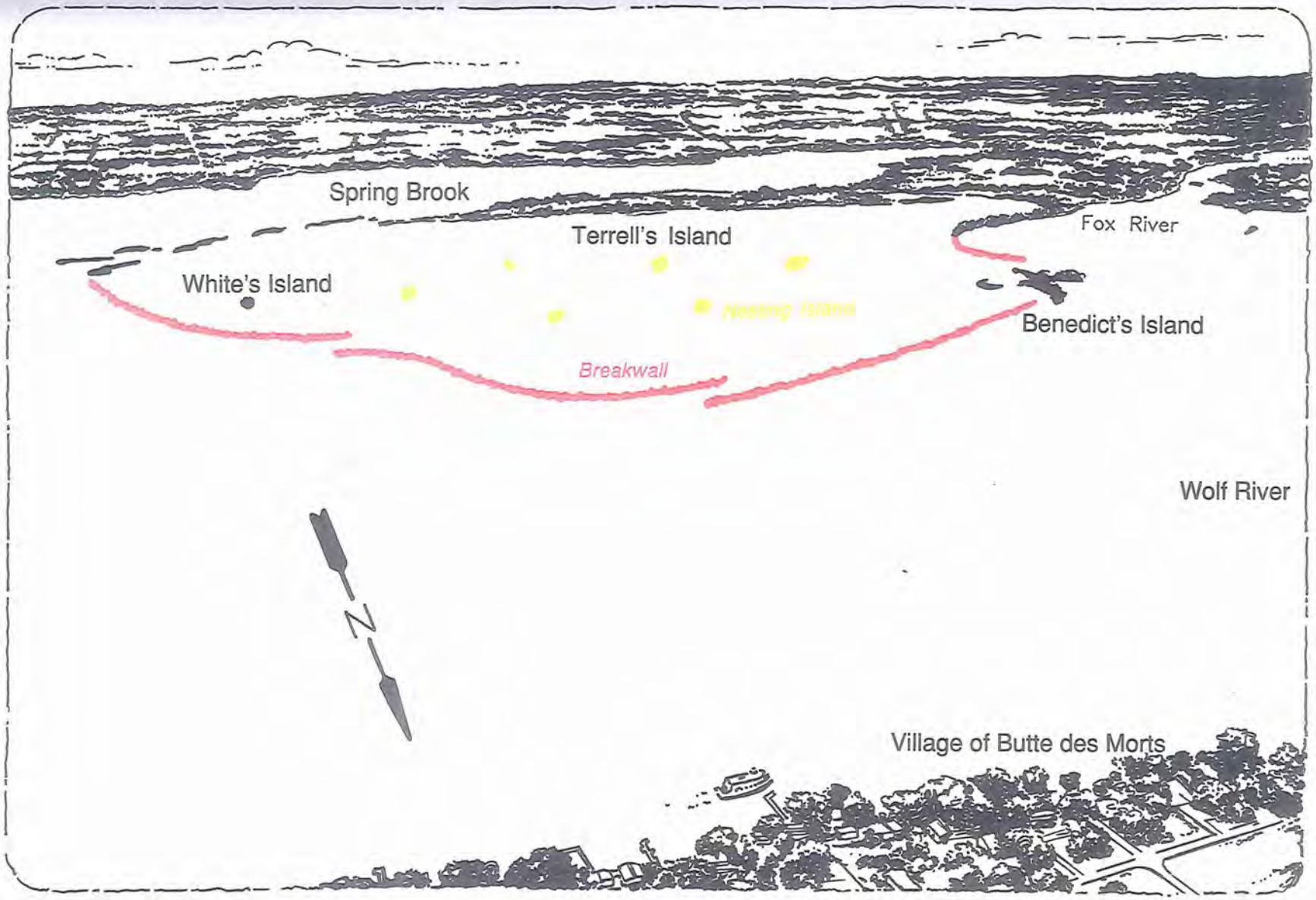


**Figure 1-5** Oblique View of Proposed Habitat Restoration Area in Lake Butte des Morts

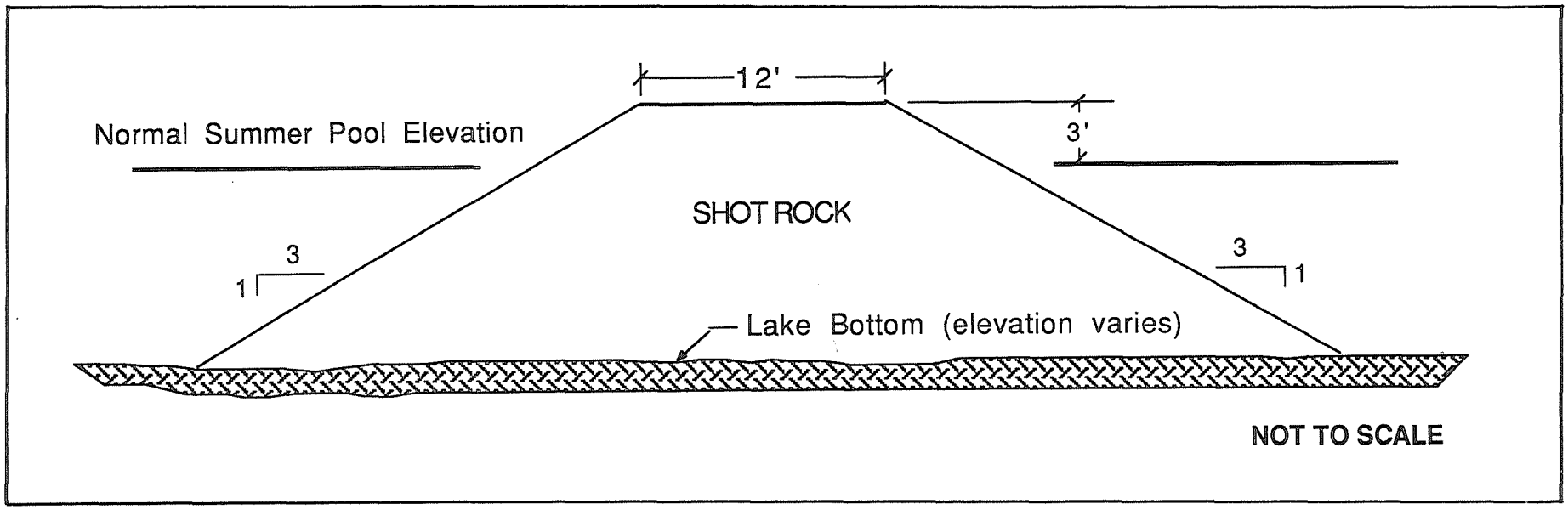


**Figure 1-6** Proposed Breakwall Cross-section

Before any of the breakwalls can be constructed, additional engineering work will be required. This would include detailed survey work, finalizing quarry selection, and obtaining easements or other land control.

## CONSTRUCTION OF BREAKWALLS AND NESTING ISLANDS

Construction techniques and materials may vary depending on building conditions, funding, and site limitations (source 1). Breakwalls will be constructed by hauling quarried limestone rock by tri-axle dump truck or barging rock to the sites. The rocks will be dumped and shaped by the trucks, back hoes, cranes or other suitable equipment.

The breakwalls will be overbuilt initially to compensate for the anticipated settlement and slumping expected as the lake bed consolidates and wave/ice action shapes the slopes. Where feasible, loaded trucks will drive onto the breakwalls at the nearest shoreline access points. After they deposit their load, the empty trucks will drive back along the breakwall or possibly drive across the frozen lake back to shore if winter construction is utilized. Several potential truck routes are shown in Figure 1-7.

Construction of the Terrell's Island loop may occur in phases. The first rubble mound breakwall segment will proceed from the mainland toward Benedict's Island and may be built using trucks and backhoes due to the possibility of land access. Subsequent segments extending east and south may be constructed using marine based techniques. Construction should span several months with truck hauling and construction activity occurring primarily during weekdays (from 7:00 am to 5:00 pm). About 10,500 round trips might occur assuming each truck carries 18 tons (12 cubic yards) of rock. The construction schedule for the proposed breakwall segments is listed in Table 1-1.

Similar marine and/or land-based construction techniques and hours are anticipated for the other proposed sites.

The six nesting islands for Terrell's Island would be constructed by dredging material from within the enclosure or the river channel and placing it at the sites of the proposed islands. Monitoring of leadshot densities at the dredge sites may be undertaken. Rock riprap would be placed on the islands as needed to minimize erosion. Each island would be 3-4 feet above mean summer pool and would be about 0.5 acres in size (See Figures 1-4, 1-5 and 1-8). The islands would be planted with a variety of grasses and shrubs to establish nesting habitat and reduce soil erosion.

## WETLAND RESTORATION

The ultimate goal of this project is to re-establish diverse wetland communities rather than building breakwalls (Figure 1-8). To this end, the Department is proposing to actively plant a variety of desired emergent and submerged species at selective locations within the restoration area (Appendix D). For example, planting tubers of submerged species, such as wild celery and pondweeds, in deeper waters (2-3 feet deep), and emergent plants, such as arrowhead and bulrush, in shallower waters (0-2 foot deep) is considered vital for wetland restoration. Seedings of wild rice in shallow areas may be undertaken as well. These plantings would supplement existing sparse beds of vegetation and would accelerate the restoration process. These plants would provide fish and waterfowl habitat, diminish wave action thus stabilizing the shores of wildlife islands, and, hopefully, would successfully out-compete less desirable plants and algae.

Once vegetation becomes re-established and recreational use patterns begin to emerge, DNR staff and lake users will examine the impact of various uses on habitat restoration. The Department can then make appropriate management recommendations and decisions. These recommendations will likely include monitoring of existing uses, modifying uses to protect sensitive areas, and controlling nuisance plants.

## PROJECT FUNDING

The breakwalls will be constructed primarily with state funds though private sources (e.g., Ducks Unlimited) and federal cost sharing (e.g., North American Wetland Conservation Act) probably will be sought also. Estimates of construction costs are shown in Table 1-1. Additional estimates for wetland restoration and site monitoring costs are included in Appendix D. Capital funding for the Terrell's Island breakwalls will be sought along with the legislative authorization during the 1992-93 biennial state budget.

## BREAKWALL AND NESTING ISLAND MAINTENANCE

DNR personnel from the Wildlife and Fisheries Management programs and Property Management will inspect and maintain all breakwalls, wildlife islands and navigation aides with funding coming from annual appropriations. Preliminary maintenance costs for the Terrell's Island breakwalls are conservatively estimated at $250,000 every decade. Structural maintenance and repair will be contracted out to local construction firms. Navigation markers or warning lights on or near breakwalls will be placed as needed according to U.S. Coast Guard specifications and DNR uniform aids to navigation regulations.

## MONITORING RESTORATION EFFECTIVENESS

DNR personnel from the Wildlife, Fisheries Management, and Research programs and U.W.-Oshkosh staff are collecting baseline water depth, sediment, water quality, aquatic vegetation, and fish and wildlife population data in Lakes Butte des Morts and Poygan near the proposed habitat restoration areas (Figure 1-9). The Terrell's Island loop will be resurveyed every year for five years after the breakwalls are installed to determine if the anticipated improvements in habitat, water quality, and wildlife populations are occurring. Similar before and after surveys will be conducted for all of the other restoration areas as the breakwalls are constructed. In addition, long-term monitoring is proposed for all sites at the rate of once every five years.

A thorough monitoring program will be needed because the remaining breakwall segments will not be constructed if the Terrell's Island loop is not successful. It will also provide DNR staff with timely information on the need for or effectiveness of Department plant management strategies and techniques.

## ANCILLARY MANAGEMENT ACTIVITIES

The following supplemental management activities are being considered by the DNR. These activities would complement the proposed restoration activities and should improve the long-term success of the project.

### Resource Management in the Habitat Restoration Areas

Specific fish and wildlife management activities in the habitat restoration areas will be dictated by the needs that emerge once habitat is re-established. Activities will, at a minimum, include monitoring fish and waterfowl populations and health, and could include stocking desirable species and/or controlling undesirable fish species. Active control of undesirable plants is being proposed. For example, if Eurasian water milfoil or purple loosestrife colonies develop in the restoration areas or on the islands, mechanical, hand removal and/or chemical means may be employed. An emphasis would be placed on mechanical or hand removal, but selective use of approved herbicides to control milfoil plants may be

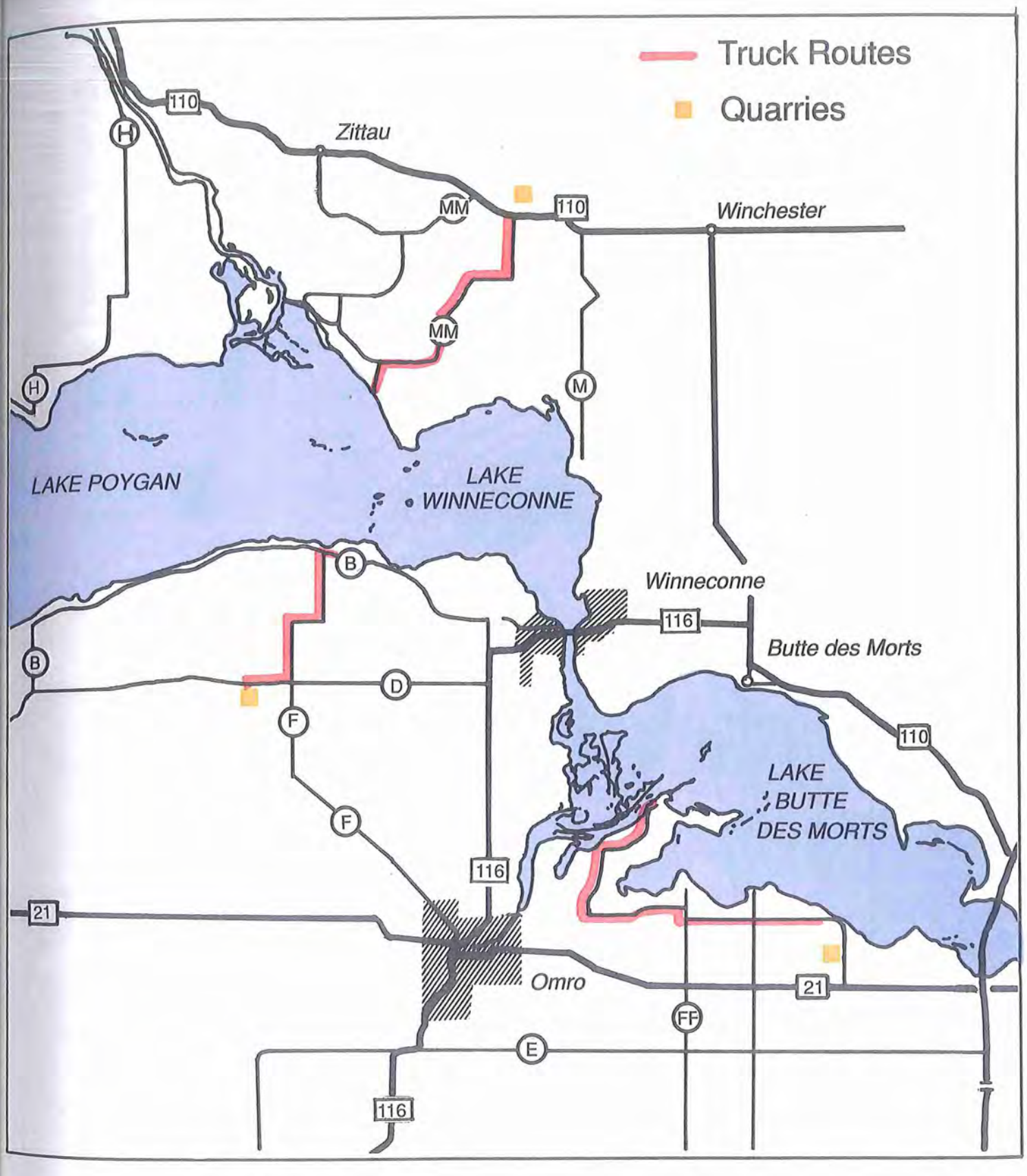


**Figure 1-7** Potential Quarry Sites and Truck Routes

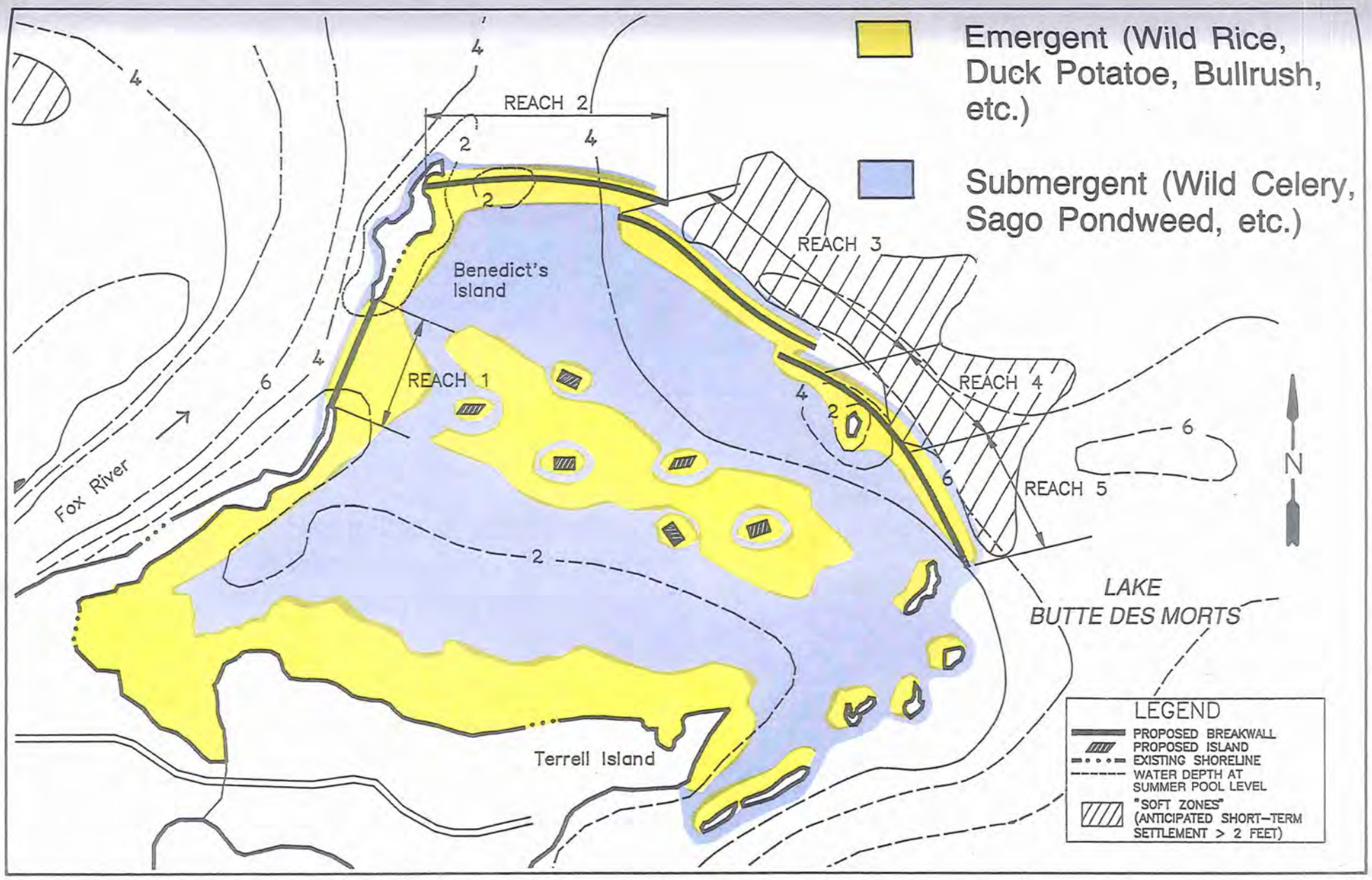


**Figure 1-8** Anticipated Wetland Plant Communities

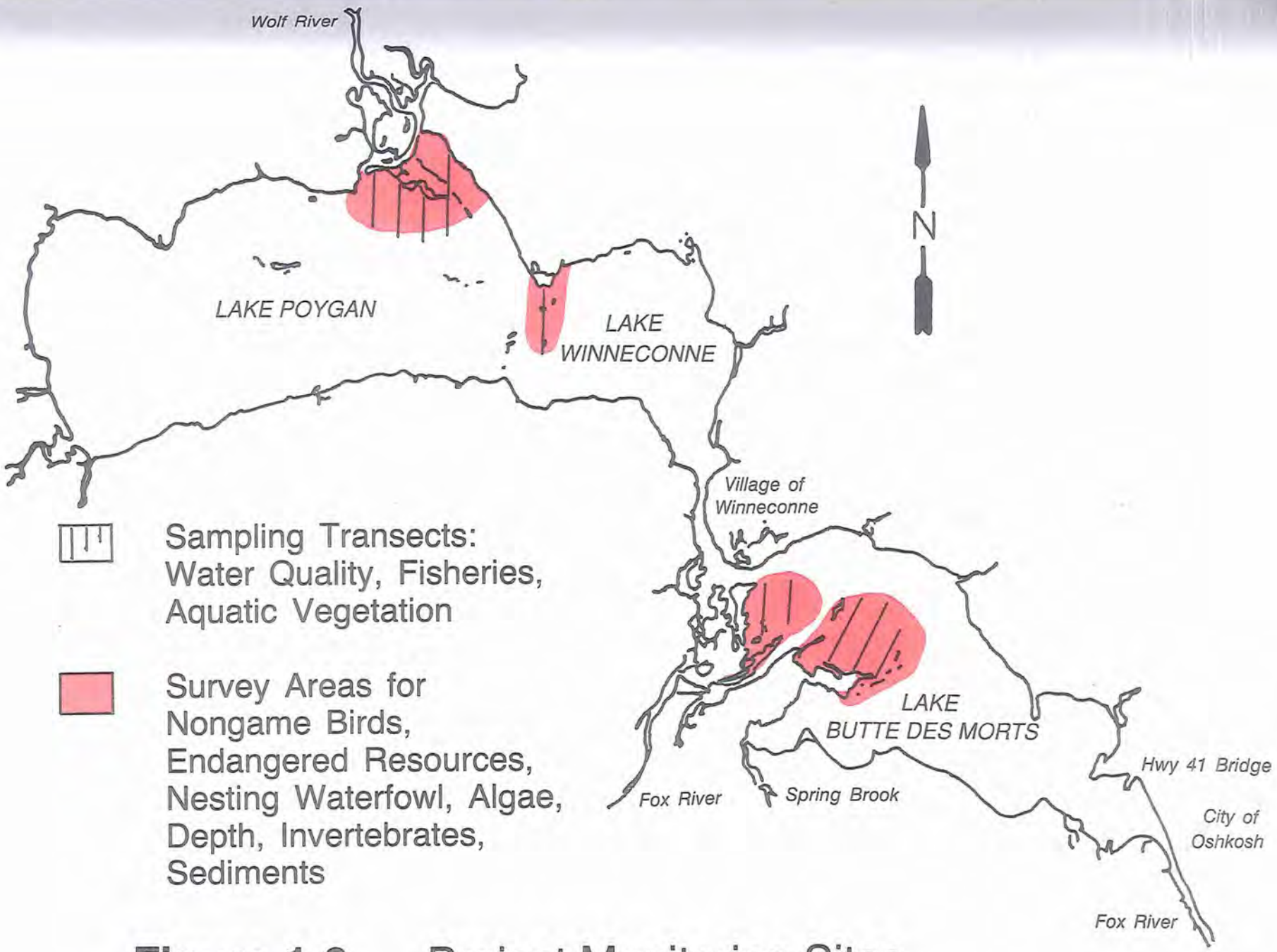


**Figure 1-9** Project Monitoring Sites

used. This integrated approach would minimize chemical use and would limit human and wildlife exposure to chemical residues.

### Land Acquisition

About 500 of the 630 acres within the Terrell's Island restoration area is owned by three individuals. DNR Fisheries Management and Real Estate staff are considering the feasibility of establishing an acquisition project in Lake Butte des Morts to facilitate project implementation. Such a project, if approved, would allow the Department to purchase parcels or obtain easements from willing sellers of properties within the designated habitat restoration area and along the breakwall alignment. Long-term leases or land management agreements by DNR with the owners are being considered also. Similar agreements may be needed at the other breakwall and wildlife island sites.

## PUBLIC USE OF THE RESTORATION AREAS

Pertinent state and federal laws permitting public access to navigable waters and upholding trespass law on private property will remain in force. Lake users will have full access to all restoration areas though certain sections may be set aside as seasonal refuges to protect dabbling waterfowl and endangered species nesting sites or migratory waterfowl staging areas. Hunting from the breakwalls will not be allowed. State law prohibits waterfowl hunting from any pier, dam, dock, breakwater or similar manmade structure. No land access to the breakwalls or restoration areas is being proposed.

# TABLE 1-1
# ESTIMATED PROJECT SCHEDULE AND CONSTRUCTION COSTS

| Breakwall Segment | Approximate Length (feet) | Approximate Quantity of Stone (tons) | Construction Technique | Total Construction Costs ($) | Construction Duration (work days) | Proposed Completion Date |
|---|---|---|---|---|---|---|
| Terrell's Island | 8,300 | 190,000 | Land based | $2,900,000 | 80-120 | 1993 |
| Boom Cut[1,2] | 1,200 | 30,000 | Marine | 480,000 | 25 | 1998 |
| Wolf River[1,2] East | 9,100 | 210,000 | Marine | 3,800,000 | 160 | 1998 |
| Wolf River[1,2] West | 2,200 | 50,000 | Land | 930,000 | 40 | 2003 |
| Poygan/[1,2] Winneconne North | 3,800 | 85,000 | Land | 900,000 | 50 | 2003 |
| Poygan/[1,2] Winneconne South | 600 | 15,000 | Land | 150,000 | 10 | 2003 |
| Total | 25,600 | 580,000 | | 9,160,000 | | |

[1]Assumes unit design, administration, and construction costs and techniques similar to the Terrell's Island loop proposal.
[2]Prices in 1990 dollars
Source: W. F. Baird and Associates Report

Note: Estimated marine based construction cost = $12/ton of rock (shot rock structure).

Estimated land based construction cost = $8/ton of rock (shot rock structure)

# CHAPTER TWO

# IMPACTS TO THE EXISTING ENVIRONMENT

## INTRODUCTION

The use of breakwalls and plant management to re-establish and/or enhance wetlands in the Upriver Lakes has several novel facets. First, literature and phone surveys by Department staff revealed few projects have sought to enhance habitat primarily through the use of physical barriers and, only secondarily, by planting desired species and managing undesirable species. Second, breakwalls have typically been used to protect boats, piers, and other shore based facilities from wind and tidal waves. Third, where wave barriers have been used, different materials and designs have been used in Wisconsin, Illinois, and U.S. Army Corps of Engineers projects on the Mississippi River to enhance/restore aquatic habitat. Except for the Corps projects, these efforts have usually been on smaller scale projects (sources 8, 9, 12, 13, 16, 17 and 18).

The vast majority of the other restoration projects utilized direct planting of vegetation, with an occasional log boom or wave deflection device, to restore habitat.

The habitat protection and restoration projects reviewed by Department staff also revealed a mixture of failures and successes. The science, and art, of aquatic plant harvesting and replanting has improved significantly in recent years (source 8, 9 & 10). Other DNR transplant projects using submerged and emergent plants have been reasonably successful. Habitat protection projects in Lake Puckaway (Marquette County) and Peoria Lake (along the Illinois River) were considered successful, though the in-lake conditions and the size of the projects were distinctly smaller than the Upriver Lakes proposal. U.S. Fish and Wildlife staff have noted improvements in water clarity in some Mississippi River backwaters after structures have been constructed to divert turbid river waters and break waves.

Restoration and protection projects, however, have not been uniformly successful. Significant efforts to protect habitat on several very large backwater lakes of the Upper Mississippi River (e.g., Weaver Bottoms) has not resulted in the desired outcome. A decline in the plant communities throughout the upper pools of the river was evident before the protection projects were undertaken. The protection provided by the structures was not sufficient to prevent or even significantly slow a dramatic decline in the submerged plants. Natural forces, such as disease, insects, waterfowl and furbearer grazing on tubers, introduction of nuisance species, high water levels and very poor water clarity, can cause very large fluctuations in plant diversity and density regardless of human intervention.

## BIOLOGICAL ENVIRONMENT

### VEGETATION

#### Upriver Lakes in General

The Upriver Lakes have very similar aquatic plant communities (sources 5, 6, 7, 11). The predominant submerged species include wild celery (Vallisneria americana), sago and other pondweeds (Potamogeton spp.), coontail (Ceratophyllum demersum), waterweed (Elodea spp.), bushy pondweed (Najas spp.), water stargrass (Heteranthera dubia) and water milfoil (Myriophyllum spp.). Floating leaf species include white water lily (Nymphaea spp.) and yellow water lily (Nuphar spp.). Predominant emergent species include cattail (Typha spp.), wild rice (Zizania aquatica), bulrush (Scirpus spp.), duck potato (Sagittaria

spp.), and cane (Phragmites australis). American lotus (Nelumbo lutea) is also locally abundant. Certain nuisance plants, such as Eurasian water milfoil and purple loosestrife, are also known to be present.

Wild celery and sago pondweed are the most abundant submerged plant species in the Upriver Lakes. Lake Poygan contains two wild celery beds of notable size; one east of the Wolf River mouth, and the other on the west end of the lake. These two areas comprise approximately 700 acres of wild celery. Both species are very sparse in the proposed Terrell's Island restoration area (Figure 2-1).

These two species have a high food value for waterfowl, especially diving ducks. Migrating diving ducks feed heavily on the winter buds (tubers) of these plants during both spring and fall. The small fruits (nutlets) and foliage of sago pondweed and other submerged plants are also consumed by many species of waterfowl. Waterfowl and marsh birds also feed on small aquatic organisms sheltered by the plants. Almost all submerged plant species are valuable as fish habitat because they provide both food, by harboring insects and other small aquatic organisms, and cover, especially for small or young fish.

Cane beds are of particular importance on the Upriver Lakes. Virtually all beds found offshore are remnants of vast, shallow marshes that were contiguous with present shorelines. The beds exist by virtue of their hardy, dense root mass imbedded in firm sand. Some of the smaller beds have gradually disappeared although the larger ones, some of which are several hundred feet in length, have remained essentially unchanged. Because of their generally elongated shape and high stem density, the beds act as natural breakwaters providing some protection for other aquatic plant species.

A rapid expansion of the milfoil beds on the south shore of Lake Poygan over the last several years has been noted by DNR staff. Milfoil colonies also are present and appear to have expanded near Terrell's Island and in Scott's Bay on Lake Butte des Morts. This expansion may be by Eurasian water milfoil which is a very aggressive, introduced species. This type of milfoil can displace more desireable native plants and can form very dense thickets which are undesirable for almost all recreational activities.

In all, the system has suffered a significant decline in the plant populations and species diversity. Most aquatic vegetation is found in shallow and/or protected areas. Current plant populations are generally present at very low densities. Fluctuating water levels, water clarity, plant succession, rough fish and other factors will continue to influence plant population diversity and density in the Upriver Lakes and the proposed restoration and protection areas. Emergent plants are believed to have declined because of long-term high water levels and periodic excessive flooding. Some well established emergent plant beds (e.g., canes) are tolerating water depths up to 4.0-4.5 feet deep in the Upriver Lakes. Physical disruption by waves and carp probably limit expansion of existing beds or re-establishment of new beds. Re-establishing balanced plant and animal communities, in even a relatively small portion of Lake Butte des Morts, will probably require a sustained effort by the Department.

## Lake Butte des Morts

The first restoration area is proposed for Terrell's Island which currently has 10-12 acres of widely scattered, sparse beds of sago pondweed, wild celery and unidentified milfoil species. Small dense beds of submerged plants (less than 0.1 acre in size) are found occasionally.

Cattails and reed canary grass are common emergent plants on the north shore of Terrell's Island with scattered wildrice plants in the open water areas. Hardy phragmites beds also are found off the north east tip of Terrell's Island.

## Anticipated Effects on the Plant Communities

The project objective is to establish 300-450 acres of shallow and deep water marshes within the Terrell's Island restoration areas. The natural expansion and contraction of plant diversity and density referred to

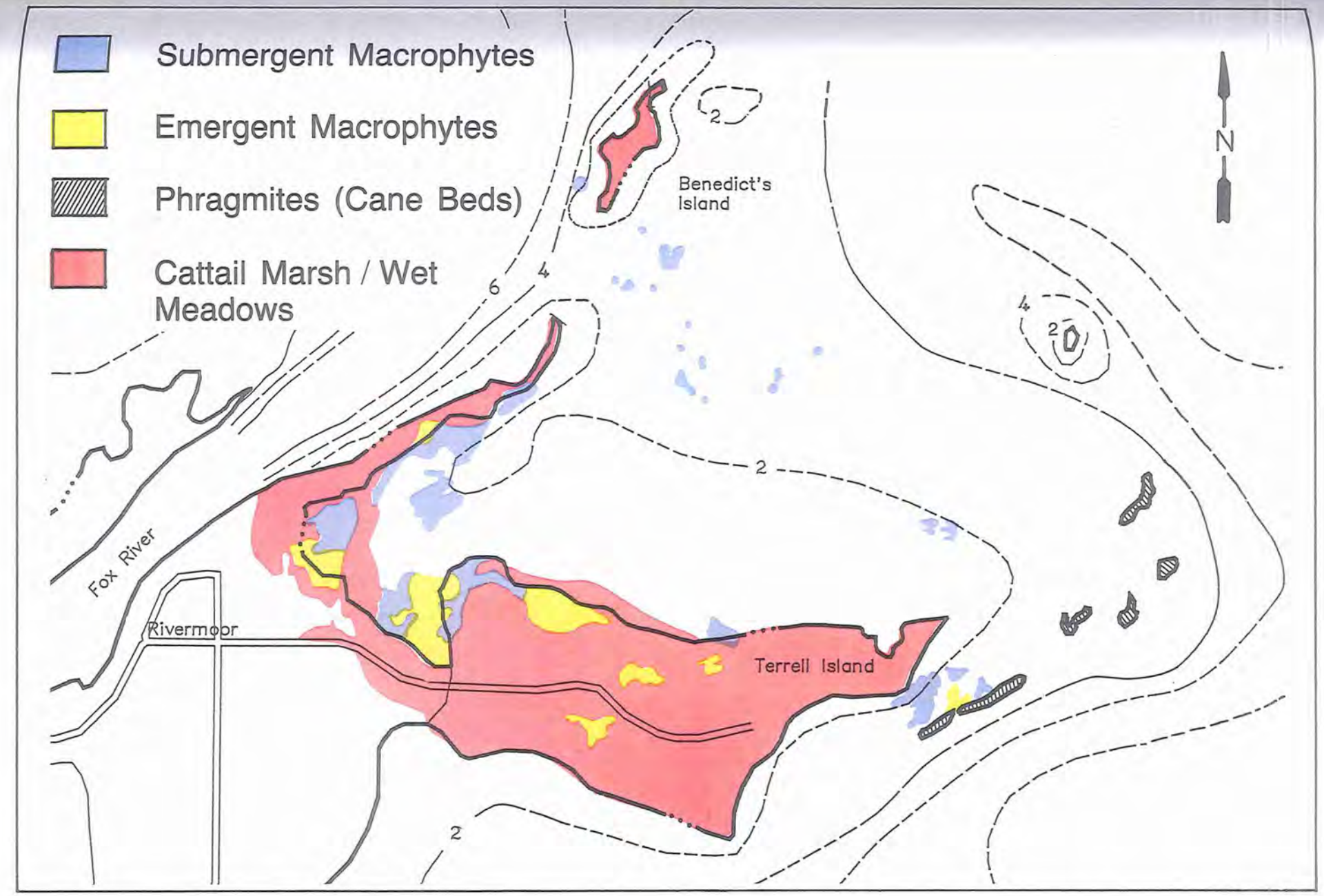


**Figure 2-1** Wetland Vegetation Western Lake Butte des Morts, 1989

earlier should be dampened and plant density should improve significantly over existing populations. These marshes should be characterized by a diversity of emergent aquatic plants, but dominated by cattail, wild rice, bulrush, and duck potato in shallow zones, and submerged species like wild celery, sago, and other pondweeds in deeper zones (greater than two feet deep at normal summer water levels).

As wave action is reduced and water clarity improves the existing plant communities should expand naturally although supplemental planting of certain desired species are proposed to speed the process. These supplemental plantings (10-12 acres) and existing sparse colonies (10-12 acres) should act as growth centers. Almost all of the desired species are already present, but are constrained by the poor water clarity and/or severe wave action. Since vegetative expansion by seed dispersal is largely unsuccessful for many aquatic plant species, the growth of roots and tubers into vegetated areas will probably be the primary means of colonization. Growth should radiate out from the edges of existing or transplanted beds. For these reasons, it will probably take at least 3-5 years for the revegetation objective to be achieved.

The projected water clarity, fisheries, and wildlife benefits will not be fully realized if the breakwalls and wildlife islands are only partially constructed (see Fiscal Impacts section). Department planting efforts and natural recolonization probably will be delayed or compromised because of continued poor water clarity and wave action. Once the Terrell's Island loop was completed and the islands constructed, the full range of restoration management activities could be implemented with the best opportunities for success.

Aquatic vegetation in areas of the Upriver Lakes not sheltered by the proposed breakwalls will not benefit from the wave protection and improved water clarity. The dynamics of the plant communities (e.g., plant succession) in the unsheltered areas should not be influenced by the breakwalls or the restoration activities. The breakwalls are not anticipated to have any significant beneficial or negative effect on the cane beds.

## Possible Adverse Consequences

The breakwalls and islands are not anticipated to have negative impacts on existing vegetation other than incidental coverage or dredge removal in any of the lakes. This should rarely occur, if at all, because the proposed breakwall and island sites have little to no vegetation.

The most serious potential threat to the wildlife island plant communities would be their colonization by purple loosestrife. If purple loosestrife invades the wildlife islands, efforts will be made to control it through hand pulling and/or spraying with approved herbicides. Purple loosestrife is an exotic plant that has invaded many wetlands in Wisconsin. This plant has little to no known value to fish or wildlife, and usually out competes native wetland plants. It is adapted to in very shallow water (less than 6 inches) and upland fields rather than the deep water marshes of the restoration areas.

Submerged species of concern include Eurasian water milfoil, coontail, and Potomageton crispus. These species have moderate to low value as fish and wildlife habitat and often form thick mats on the surface. These mats often create navigation obstructions, produce foul odors, are visually unappealing and may slow or halt the colonization of more desireable plant species. Eurasian milfoil may be present and spreading in the Upriver Lakes at present. The need for nuisance plant management such as harvesting, chemicals or other techniques to control unwanted growth is being considered as well as the selective planting of desired plants described earlier to accelerate habitat restoration.

Similar to Lakes Butte des Morts, algae blooms may develop within the Terrell's Island restoration area. The potential for sizeable algae blooms should decrease if the desired submerged and emergent plant communities develop as anticipated.

The potential for ice damage to plant populations exists in the shallow waters of the restoration areas and around the periphery of the proposed wildlife islands. Freeze out and ice abrasion or plucking of emergent plant tubers or roots as the ice rises and falls with water levels or during spring break-up may occur, but the anticipated impacts are minimal. Plant growth the following spring should fill in the scoured areas. An additional safety factor is that the ice sheets over the restoration areas will be trapped within or behind the breakwalls, particularly for the Terrell's Island and Lake Poygan loops. This substantially reduces the chances of a massive ice shove shearing off the breakwalls, islands, and vegetation in shallow areas.

## WILDLIFE

### Birds

Waterfowl and other water and marsh birds constitute most of the wildlife found utilizing the proposed restoration areas in the Upriver Lakes. Besides waterfowl, other major species include sandhill cranes, herons, egrets, bitterns, rails, coot, cormorants, gulls, and terns as well as a variety of wetland dwelling songbirds. Most, except herons, egrets, and cormorants can be found nesting in marshes on or adjacent to the lakes. Except for herons and egrets which nest in trees, many of the bird species noted should have improved nesting opportunities if the wildlife islands are constructed and wetland restoration is successful. The wildlife islands and surrounding shallow areas should provide herons, egrets, and other birds with improved feeding opportunities as plant communities develop.

### Waterfowl

Twenty-three species of waterfowl have been known to migrate through the area. Prior to the mid-1960s, the Upriver Lakes were a major stopping point for many species of migrating waterfowl, especially the canvasback duck. The lakes and adjacent marshes once furnished prime breeding and migrational habitat for many species of waterfowl and water birds, but by the mid to late 1960s, much of the aquatic vegetation and adjacent marshland had disappeared. Migrating waterfowl use declined dramatically after the habitat disappeared.

Major staging areas for migrating waterfowl on the Upriver Lakes are the west end of Lake Poygan, the north shore of Lake Poygan east of the Wolf River mouth, western Lake Butte des Morts, and the northwest shore of Lake Winneconne. These areas coincide with the major food producing habitats and all sites, except the west end of Lake Poygan, are to be protected by the proposed breakwall segments (Figure 2-2).

There are several species of ducks that breed on the Upriver Lakes, the most common of which are mallards and blue-wing teal. These two, along with wood ducks, make up the bulk of the statewide waterfowl harvest. Mallards and teal generally nest in grassy upland fields and islands instead of marshes, but they need quiet, protected marshes to raise their broods. Destruction of nesting habitat along the lake shores, and declining brood habitat in the marshes has caused a gradual decline in the number of breeding mallards and teal on the Upriver Lakes. A breeding duck survey on May 2, 1990 on western Lake Butte des Morts revealed 11 pairs of mallards and 1 pair of black ducks in or adjacent to the Scott's Bay marsh while eleven pairs of mallards were found on or adjacent to Terrell's Island.

### Impacts on Waterfowl

Migratory waterfowl usage and resident marsh dwelling waterfowl populations should increase as habitat expands within the restoration areas. The anticipated mix of emergents and submerged plants should provide both food and cover for dabbling duck broods in shallow zones, and submerged plants in the deeper zones should provide food for migrating diving ducks. Creating safe nesting habitat, such as the nesting islands, for dabbling ducks is critical if the desired population increases are to be achieved.

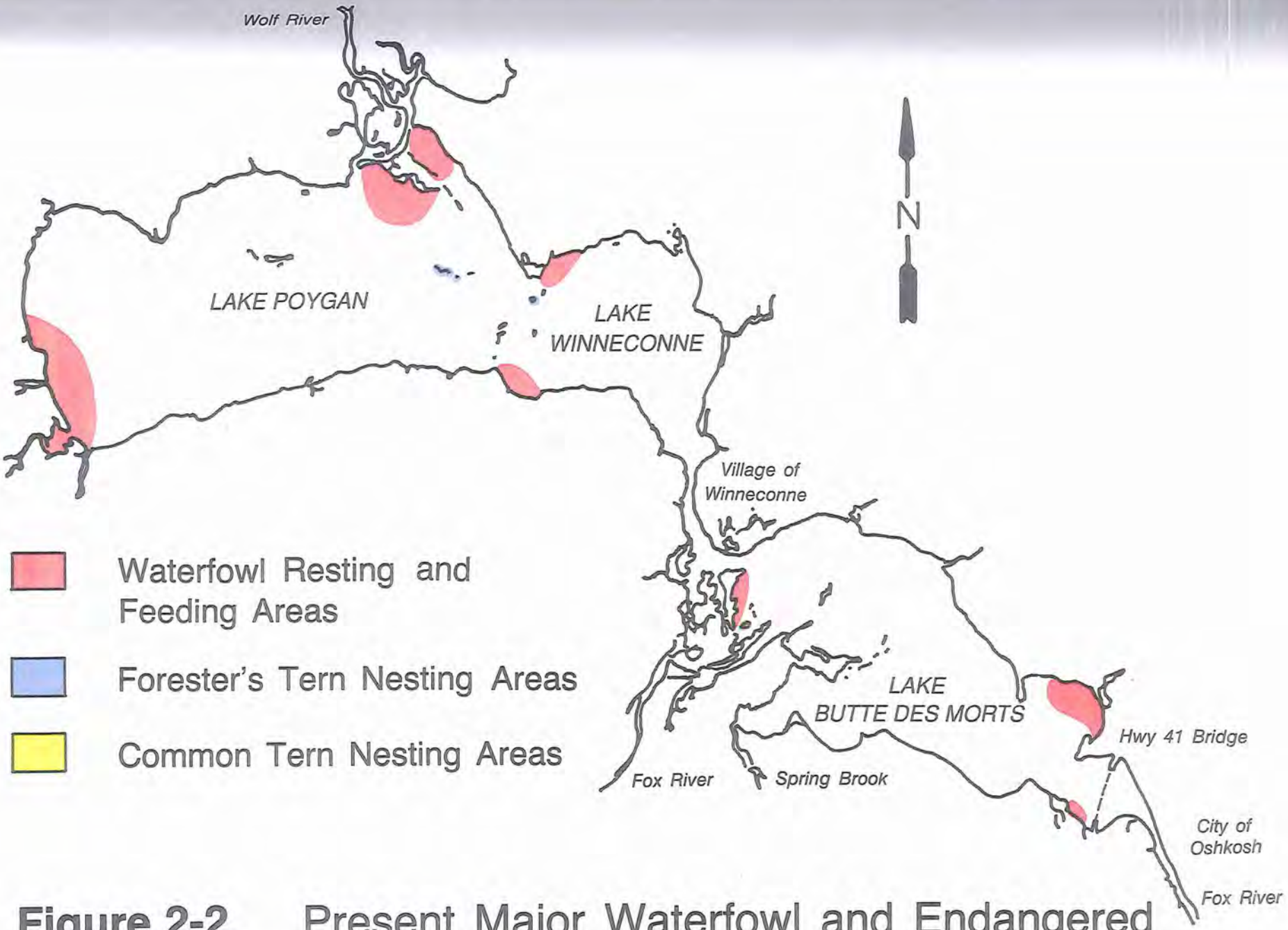


**Figure 2-2** Present Major Waterfowl and Endangered Species Use Areas

Department staff believe the six 0.5 acre wildlife islands will provide suitable nesting and brood habitat for 40-60 pairs of breeding waterfowl over a sustained period. It is also anticipated that lower predation on the islands should improve waterfowl rearing and fledgling success. The actual number of breeding pairs and reproductive success will fluctuate with duck populations, weather, disease, the success of wetland restoration, and other factors. The anticipated use of these islands by 40-60 breeding pairs is consistent with the objective of the WCMP to increase nesting waterfowl use five fold over existing levels.

A potential concern would be the development of a wetland plant community of low species diversity or dominated by undesirable plant species such as milfoil or purple loosestrife. If the dominant plants were of low food or habitat value, it may minimize the value of this project to desireable wildlife species. If such a situation developed and wildlife populations were not benefiting as anticipated, the Department could focus its resources to enhance plants and animals habitat.

## Gulls

The breakwalls and the wildlife islands may attract and provide suitable loafing and nesting habitat for gulls. Gulls may compete with waterfowl for nest sites and can be serious predators on eggs and young ducks and waterbirds, such as terns. Gulls often nest on rocky islands, and many of the islands in the Upriver Lakes currently have herring gulls nesting on them. More than 20,000 pairs of ring-billed gulls nest annually on Kidney Island in Green Bay, and the number of gulls passing through the Winnebago System in spring is in the tens of thousands, so there is a large population of potential nesters for the Upriver Lakes. Gulls could create a serious predation problem for ducks and common terns in the habitat restoration areas. They might also be a nuisance to some recreationalists and cottage owners or a hazard to low flying aircraft.

Benedict's Island has the largest nesting colony of ring-billed gulls inland from the Great Lakes in the state. In 1984, 327 pairs of ring-billed gulls and 33 pairs of herring gulls nested on Benedict's Island. In 1985, 133 pairs of ring-billed gulls and 25 pairs of herring gulls nested on this island. Department staff have observed from 300 to 400 gulls inhabiting the island in subsequent years. Both gull species may use the breakwalls if they are constructed.

White's Island, located north of Terrell's Island, is one of five locations in the state with a common tern colony. This island, however, may have increased nesting by gulls as a result of breakwall construction. If breakwall colonization by gulls occurs, management efforts may have to be initiated to prevent establishment of a gull colony on White's Island.

If significant increases in the breeding populations of gulls and/or negative impacts on other species occurs because of gull use of the breakwalls, management activities designed to limit gull populations and/or use of the restoration areas may be warranted.

## Mammals

Furbearers are the major mammalian species found in the proposed habitat restoration areas. These include muskrat and mink, followed by raccoon, and occasionally beaver and otter. Trapping of these furbearers furnishes recreation and supplements income for some local residents.

Breakwall and wetland restoration are not anticipated to significantly influence mammal populations, except perhaps for muskrats and mink. Muskrats are the major furbearing species on the Upriver Lakes. Populations have declined since the early 1960s with the large scale loss of marsh habitat. Current muskrat populations on the Upriver Lakes are believed to be artificially low due to the current water level management plan. There should be a moderate increase in muskrat populations within the habitat restoration areas if emergent vegetation such as cattail, bulrush, and duck potato expand as anticipated.

Mink populations should increase slightly as habitat for their prey base (i.e., crustaceans, fish, and muskrats) improves. The breakwalls may provide good summer foraging habitat for mink, but their value as winter habitat is questionable. The distance from the shore to the wildlife islands may limit mink use.

### Reptiles and Amphibians

The marshes of the Upriver Pool Lakes support a diverse population of reptiles (e.g., turtles and snakes) and amphibians (e.g., frogs and salamanders). Since amphibian populations have been declining due to pollution and loss of habitat, they should be favored by wetland restoration work, especially near the wildlife islands. Frogs and salamanders will provide part of the prey base for desired wading birds and fish.

Painted and snapping turtles are quite common on and around the Upriver Lakes. Wildlife islands should provide suitable turtle nesting sites, but the distance from shore may minimize their value. Quiescent waters, greater habitat diversity and development of a mixed plant community in the restoration areas would favor turtle use, though the increase in the turtle populations would probably only be moderate.

## ENDANGERED AND THREATENED SPECIES

### Endangered Species

An endangered species is a species whose continued existence as a viable component of the state's native fauna or flora is in danger and, without help, may become extirpated. Wisconsin endangered species that can be found on the Upriver Lakes include the Forster's tern, common tern, and osprey.

Nesting habitat for many marsh nesting birds, especially Forster's terns and other species that use in-lake marshes, has deteriorated dramatically since the 1950s. Except for Kidney Island on Green Bay, the largest nesting colonies of Forster's terns in Wisconsin are found on the Upriver Lakes. These birds nest in marshes on floating mats of vegetation and on marshy islands and are mostly restricted to nesting in cane beds on Lake Poygan where human disturbance is minimal. The major nest sites include the east cane beds on Lake Poygan, the Hindenberg Line canes on the Lakes Poygan/Winneconne boundary, and a large marshy island in Scott's Bay on western Lake Butte des Morts (Figure 2-2). Their nests are often washed away in these areas and the population is largely maintained by artificial nesting platforms built by volunteers, such as the Audubon Society, and installed and maintained by the DNR. Most of their current nesting sites would be enclosed or sheltered by the proposed breakwalls. The wildlife islands and accompanying dense beds of emergent vegetation should provide suitable nesting habitat for Forster's terns (source 14).

Common terns nest on sandy or rocky shorelines, often on small islands. There are only two nesting colonies in Wisconsin inland from the Great Lakes. One is on a small island in Lake Winnebago, and the other is on White's Island in Lake Butte des Morts. Since 1985 the White's Island colony has averaged 12 nesting pairs of common terns per year. White's Island would be enclosed within the Terrell's Island breakwalls under the currently proposed alignment (see Figure 1-4). Common terns may nest on the more remote sections of breakwalls, particularly if they are rubble mound structures (source 15).

The Department intends to maintain the artificial nesting platform program in the Upriver Lakes after the breakwalls are constructed. Assuming the vegetation responds as desired and gull predation does not increase substantially, this project should improve term breeding and rearing success by providing higher quality habitat. This should enable the tern population to increase. If wetland restoration is not

successful, little negative or positive influence on tern populations is expected. Severe gull predation, however, may be detrimental and will be studied as part of the project's monitoring effort.

Ospreys migrate through this area and can be occasionally seen during spring and fall. Ospreys are fish eating birds. Habitat restoration in the breakwall areas should provide additional foraging areas for osprey.

### Threatened Species

A threatened species is also one which may become endangered within the foreseeable future if appropriate protection or management measures are not taken. Threatened species are also protected under Wisconsin's Endangered Species Law. Threatened species found on the Upriver Lakes include the double-crested cormorant, great egret, bald eagle, and Blanding's turtle. Great egrets can occasionally be seen during spring and early summer, but are not known to nest in this area. The breakwalls will not provide egrets with any nesting sites because they nest in trees.

Wildlife islands, and other shallow areas should provide egrets with good forage habitat if mixed emergent/submerged plant communities develop as anticipated. Cormorants are common during spring and fall, and non-breeding birds can be seen on the lakes throughout the summer. They are not known to nest in this area at present. Cormorants will nest in trees or rocky islands so rubble mound breakwalls may provide some nesting habitat. An increase in aquatic vegetation may attract forage fish for cormorants, but dense vegetation would hinder their method of capturing fish.

### Species of Special Concern

A species of special concern is one which is suspected, but not proven to be, declining, and may become endangered or threatened if protective steps are not taken. They are not officially protected by Wisconsin's Endangered Species Law. However, they may be protected by the Migratory Bird Act, fishing regulations or some other law. Bullfrogs are a species of special concern and can be found in the marshes of the Upriver Lakes. They should be favored by wildlife islands and other shallow areas where mixed emergent/submerged plant communities develop.

## FISH

The dominant fish species in the Upriver Lakes are the rough fish, primarily carp, gizzard shad, and sheepshead. The primary sport fishery on the Upriver Lakes has historically consisted of perch, panfish and northern pike, although these populations have declined since the 1960s because of habitat loss. Other major species in the sport fishery are white bass, catfish, walleyes, and largemouth bass. Lake sturgeon are also present, but their present use of the proposed restoration is believed to be minimal based upon fisheries studies. Though sport fish abundance is down, fish surveys indicate they are in good physical health. Game fish movement between the lakes is well known and occurs for a variety of reasons (e.g., spawning runs, movement to summer and winter habitat, etc.) (Figure 2-3). All game species present in the Upriver Lakes require aquatic vegetation for at least part of their life cycle.

Carp and sheepshead comprise 75-80% of the total fish population in the Upriver Lakes. They are of little importance to anglers, and detrimentally affect more desirable fish species, either through destruction of habitat or outright competition. Carp are commercially fished in the Upriver Lakes with 20,000 to 40,000 pounds removed annually.

## Impacts To Fish

The major game fish such as perch, panfish, northern pike, walleye, and largemouth bass, require aquatic vegetation for all or part of their habitat requirements and should benefit as suitable habitat develops. Sport fish should have greater reproductive success and populations should increase. Initially, the breakwalls should attract game fish which probably will result in a redistribution of game fish in the system. Over time, however, improved reproduction and survival should provide a greater number of game fish for not only the restoration area, but other areas with suitable habitat in the system. Improved reproduction is not anticipated to result in stunting or over production of panfish.

Lake sturgeon may benefit also, but less than the other game fish. Few sturgeon have been found in the restoration areas during fisheries studies. Sturgeon generally prefer deeper waters with soft sediments rather than vegetated areas. Numerous species of forage fish that commonly associate with aquatic vegetation should also increase. Rough fish such as carp may also increase. Pelagic species such as sheepshead and gizzard shad will not benefit because they normally do not require this type of habitat.

The breakwalls are not anticipated to hinder passage of migrating game fish because of their location and the gaps between breakwall segments.

Carp could have an adverse effect on habitat restoration. They tend to uproot vegetation and stir up bottom sediments in their search for aquatic invertebrates. They can be found feeding and spawning, throughout the Upriver Lakes, including all of the proposed restoration areas. If water clarity improves as anticipated, young carp will be visible to predator fish such as northern pike, walleyes, garfish, and largemouth bass. If the activity of carp hinders the re-establishment of vegetation, techniques such as carp barriers and spot treatment (e.g., poisoning or netting) during carp breeding will be considered. One potential adverse consequence of carp control would be the loss of game fish if they were in the control area. The Department would carefully evaluate the use of netting and poisoning to reduce the loss of desirable game fish.

If dense plant communities develop as expected, decomposing plant debris may cause low oxygen conditions to occur within the habitat areas during the winter. The occurrence of this condition will depend upon the amount of plant debris and the amount of flow through the enclosures. Fish may die if they are trapped in shallow pools within the restoration areas, particularly during the winter drawdown. Wide dissolved oxygen swings naturally occur in marshes on a daily basis during the summer. The effect on fish should be minimal unless the swings are very pronounced and very low dissolved oxygen conditions persist occur over prolonged periods.

## WILDLIFE AND DISEASE CONCERNS

Whenever habitat is created/enhanced which could lead to large concentrations of wildlife, game managers become concerned about the possibility of establishing conditions conducive to the propagation of pests and diseases. Enterocecitis, an inflammation of the intestines due to infection by a parasitic flatworm, was the cause of death for a small number of coot, blue-winged teal, and scaup on Lake Butte des Morts in 1981. Type C avian botulism has caused periodic waterfowl deaths in some lakes in Winnebago County, but is not known to be a serious problem in the Upriver Lakes.

U.S. Fish and Wildlife Services and DNR animal health specialists reviewing this project do not foresee a significant increase or decrease in wildlife diseases in the Upriver Lakes if the proposed restoration projects are implemented. The potential for creating favorable conditions for disease propagation under low flow/high temperature conditions in late summer and early fall may increase slightly. The severity of any impacts obviously will depend upon the severity and length of time the low flow conditions persist, water level management, water temperature and the number of waterfowl using the habitat areas.

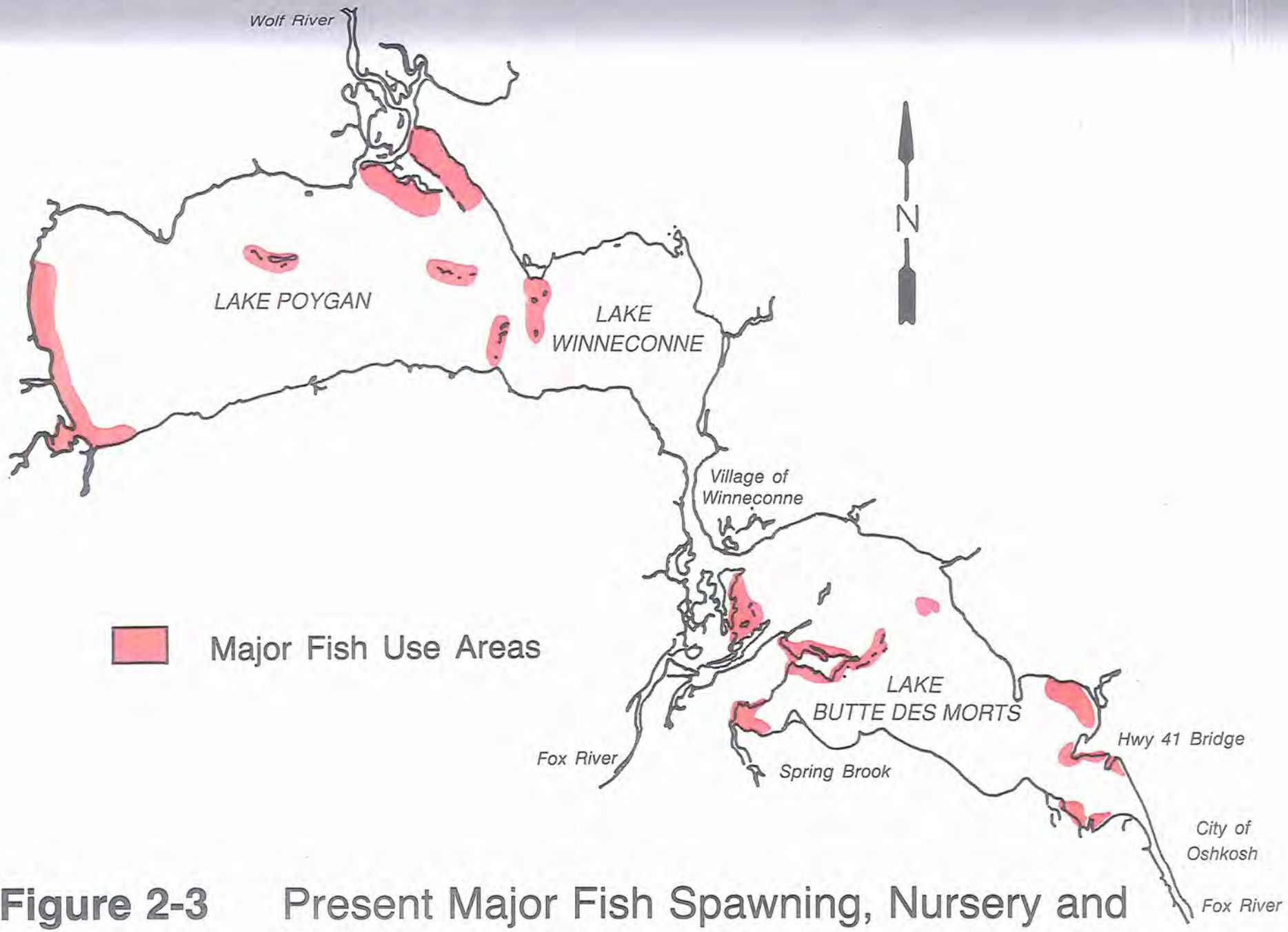


**Figure 2-3** Present Major Fish Spawning, Nursery and Feeding Areas

## LEAD SHOT

Lead shot has been documented to be present in the Terrell's Island habitat restoration area at densities ranging from 0 to 12.3 pellets per square foot with an average density of 3.8 pellets per square foot. It is highly likely, given the history of waterfowl hunting on the Upriver Lakes that similar lead shot densities can be found in all of the designated restoration areas. Waterfowl, dabbling and diving ducks, will ingest lead shot as they pick grit off the bottom sediments while feeding. The lead can then be absorbed in the digestive tract causing lead poisoning and often death.

Lead poisoning is endemic to waterfowl in east central Wisconsin and the Upriver Lakes. Older lead pellets are often more toxic than those more recently deposited. As the pellets age, the elemental lead is converted to lead oxide which is more readily solubilized and absorbed into the bloodstream of the waterfowl. No major die offs, however, have been related to lead poisoning on the Upriver Lakes.

Lead poisoning is not expected to be a significant problem within the restoration areas. Lead shot potentially present in bottom sediments used to build nesting islands is not believed to be a significant concern either. Since shot is found within the top one foot of the sediment, this would be the first material dredged up and placed as a foundation for constructing the nesting islands. These sediments would then be buried by the placement of deeper, cleaner dredge materials. During the construction of the wildlife islands, more intensive lead shot monitoring of bottom sediments may be needed to ensure the lead pellets are not readily available.

## NUISANCE INSECTS

The type of habitat being restored is not anticipated to create substantial additional breeding areas for lake flies and mosquitoes. Some increases in insect populations will occur, but this is considered desireable in that insects are a major food item in many aquatic animals diet. In fact, the WCMP calls for an increase in the population of certain desireable insect species.

Mosquitoes which carry human diseases such as encephalitis, breed in stagnant temporary pools along roadways or in tree cavities, not in large, open wetland systems as are being proposed.

## CUMULATIVE BIOLOGICAL IMPACTS

The cumulative, long-term biological impact of breakwall construction and wetland restoration is expected to be positive for desirable plant communities, game fish, water birds and other forms of wildlife. Less desireable species such as gulls, carp, and Eurasian water milfoil probably will also benefit. Bluegreen algae blooms in the restoration area should decrease over time as the wetland becomes established. Pelagic fish species, such as gizzard shad, will lose habitat though the loss will probably not significantly affect their population.

# PHYSICAL ENVIRONMENT

The Upriver Lakes and Lake Winnebago form the largest single reservoir of water within the State of Wisconsin. The 165,174 acres of surface hold in excess of 1.9 million acre feet of water. The gross physical dimensions of the lakes are shown in Table 2-1.

**TABLE 2-1**

**PHYSICAL CHARACTERISTICS OF WINNEBAGO POOL LAKES**

| | Winnebago | Butte des Morts | Poygan | Winneconne | Total |
|---|---|---|---|---|---|
| Surface area (acres) | 137,708 | 8,857 | 14,102 | 4,507 | 165,174 |
| Mean Depth (ft) | 13 | 6 | 7 | 6 | - |
| Max Depth (ft) | 21 | 9 | 11 | 10 | - |
| Volume (acre ft) | 1,790,200 | 53,140 | 76,990 | 22,860 | 1,943,190 |
| Public Frontage (miles) | 4.2 | 0.1 | 1.2 | 0.2 | 5.7 |

## WATER QUALITY

No historical water quality information exists for the Upriver Lakes. It is almost certain though that water quality was excellent in pre-settlement times due to the abundance of rooted aquatic vegetation and their capacity to filter and assimilate nutrients and sediments. Though the waters of the Upriver Lakes have always been fertile, they are now highly enriched due to poor land use practices in the 6,000 square mile watershed. This has led to increased loadings of nutrients, sediments, and other pollutants to the lakes. With large areas of rooted aquatic plants no longer available to dissipate wave action, stabilize sediments, and trap the excess nutrients, nuisance algal blooms have become more common. The algae blooms further shade the water and impair rooted vegetation growth.

The shallow Upriver Lakes do not stratify and the nutrient rich waters act as incubation chambers for algae in the fertile waters of the Wolf and Fox Rivers (source 19 and 20). Large populations of blue-green algae develop and float to the surface where they are moved about by the wind. When the algae die, they become odorous. The large size of the lakes accentuates the effect of wind drifting as accumulations of algae from large areas of open water collect on downwind shores and become a nuisance resulting in undesirable conditions.

In summary, poor water clarity and excessive fertility are the major water quality problems on the Winnebago System (sources 11, 19 and 20). The high turbidity is caused by excessive algae populations as well as resuspended lake sediments from wave action and soil transported from the watershed. The poor clarity limits light penetration (i.e., photic zone) and is the major factor limiting growth and reestablishment of submerged vegetation on the Upriver Lakes. Submerged vegetation is limited to

maximum depths of approximately 5.5 feet on Lakes Poygan and Winneconne, and 4.5 feet on Lake Butte des Morts.

### Potential Effects on Water Quality

There will be a short-term increase in water turbidity near the construction areas if the project is implemented. The soft, poorly consolidated surface material will be displaced or disturbed by the dumping of rock and dredging activities. Plumes from the construction area(s) will move with the currents and waves and eventually disperse in the lake. The effects on water clarity are not anticipated to be significant because of the poor water clarity in the lake and the short-term nature of the disturbance. Silt screens might be used when the islands are constructed to contain the turbid waters thus minimizing this impact.

After the breakwalls and islands are constructed water quality should improve significantly within the restoration areas. Water turbidity and nutrient levels should decrease, water temperature may increase (probably imperceptibly) while water clarity should improve significantly over time. This should occur because the breakwalls will significantly reduce water exchange between the lake and the restoration area and wave action will be reduced. With improved water clarity, the photic zone should increase sufficiently so that submerged aquatics can become re-established throughout the enclosure.

Wave action will be significantly reduced except during infrequent high wind conditions, particularly from the east. Algae blooms may occur within the restoration areas for the first several years, but as rooted aquatic vegetation develops, algae bloom severity and frequency should diminish as competition for nutrients rises. In time, the expected increase in rooted aquatics should lead to further improvements in water clarity.

No improvement in lake water quality outside of the restoration areas is anticipated.

The restoration areas may store nutrients when plants are actively growing in the late spring and summer. Nutrient release from the restoration area to the lake will occur as the plants die back in late summer and fall. The release should not have any meaningful effect on water quality in the Upriver Lakes since the release would occur during the dormant season.

Dissolved oxygen fluctuations probably will become more pronounced in the restoration areas if dense plant communities become established. These fluctuations would be most evident during the summer when the amount of vegetation is at its maximum and in late summer and in the winter as the vegetation dies back and decomposes. These fluctuations should not significantly affect the use of the restoration areas by gamefish and waterfowl.

## FLOOD FLOWS

Department staff worked with U.S. Geological Survey modeling specialists to study the proposed breakwall configurations in Lakes Butte des Morts and Poygan and determine whether the structures acted as barriers to flood waters (source 2).

### Lake Butte des Morts

Under current conditions, approximately 25% of the waters during a 100 year flood spills over into Scott's Bay while the remaining 75% passes down the main channel or overflows through the gap between Benedict's Island and Terrell's Island. Based on these model results, only the Terrell's Island loop can be constructed if the no increased flooding criteria established by the Department for this project is to be met. Building breakwalls on both sides of the Fox River's mouth was predicted to increase flood levels as far upstream as the City of Omro. The modeled increases ranged from 0.3 foot

near Rivermoor to 0.02 foot at the Omro City limits. To alleviate these potential impacts, individual breakwall segments from the Scott's Bay portion of the proposal were removed and the modeling repeated.

This process resulted in the virtual elimination of the Scott's Bay breakwalls as only a 1,000 foot breakwall segment along the Wolf River channel achieved the no backwater criteria. Though this 1,000 foot segment could provide some fishery habitat for game fish, it would not provide meaningful wave protection or prevent highly turbid lake and river water from entering Scott's Bay. For these reasons it was deleted.

Note to the Reader: The anticipated increase in the elevation of flood waters during a 100 year flood by the Scott's Bay breakwalls would still be below the 100 year pool elevation for Lake Butte des Morts.

### Lake Poygan

The U.S. Geological Survey also modeled the flood flow effects of the proposed structures at the mouth of the Wolf River. The study indicated no backwater impacts on the Wolf River during a 100 year flood flow is anticipated.

## LAKE CURRENTS AND WAVE ENERGY

The Upriver Lakes act as large, shallow bays and have very short hydraulic retention times. This is emphasized by a 17 day hydraulic retention time for the Poygan-Winneconne complex and only six days for Lake Butte des Morts. The normal flow of water is toward Lake Winnebago, but currents in the Upriver Lakes are strongly affected by winds, particularly those above 10 miles per hour.

Winds from the southwest through the north accentuate the river driven currents. In contrast, winds from the northeast through the southeast produce counter currents, particularly along the shorelines, creating complicated circulation patterns within the lake. The net result of the analysis indicates the breakwalls will distinctly slow water movement in the habitat restoration areas, particularly when vegetation becomes established. Virtually no influence on current direction or velocity in other areas of the lake is evident from modeling results.

The computer modeling of lake currents by W. F. Baird and Associates for the Department showed significant before and after changes in lake currents (Figures 2-4 and 2-5) behind the breakwalls, particularly during low wind conditions. As is evident in Figures 2-6 through 2-9, wind speeds of 20 miles per hour, however, can create currents and complex mixing patterns within Lake Butte des Morts and the proposed restoration area. These currents may result in turbid lake waters entering the restoration area through the breakwall gaps and the large open expanse along the southeast which is only protected by the canes.

The Baird report discusses wind speeds and directions in the region and suggest that wind speeds equal to or greater than 20 miles per hour with a duration of six hours or more occur only 10-15 times a year. Thus, these graphics portray infrequent events which may cause poor water clarity within the enclosure. Wind events as just described would have their greatest effects on reducing water clarity during the spring when the plants were just beginning to leaf out and the early years of the restoration effort when the plants were becoming re-established. In comparison, well developed plant communities should act as a substantial barrier to the movement of turbid waters into the Lake Butte des Morts restoration areas during high wind events.

Little to no change in lake currents is forecast for the remainder of Lake Butte des Morts under the modeled conditions (source 1).

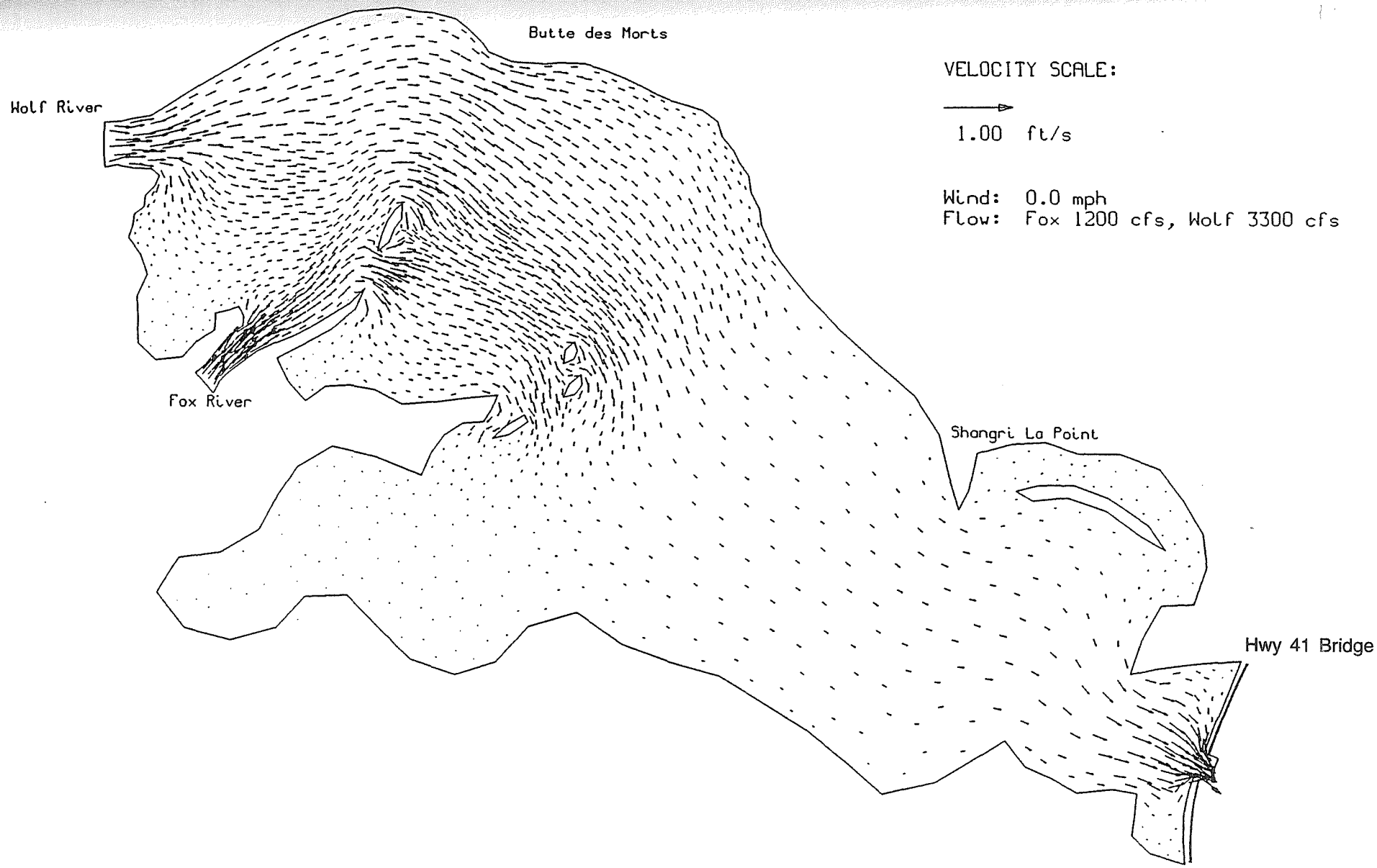


**Figure 2-4** Currents, Lake Butte des Morts, No Wind, Normal Summer Flow, Existing Conditions

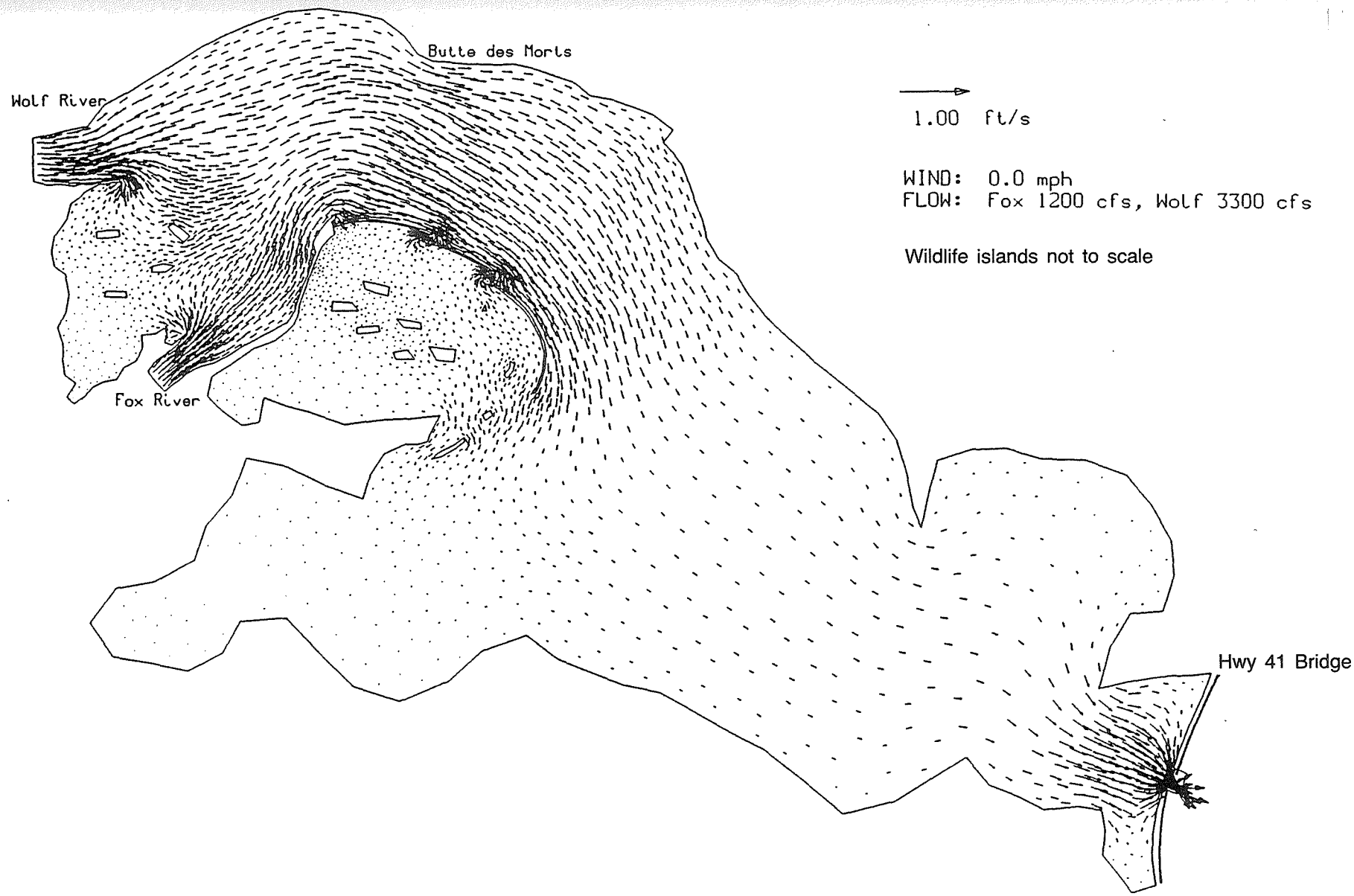


**Figure 2-5** Currents, Lake Butte des Morts, No Wind, Normal Summer Flow, with Breakwall Structures

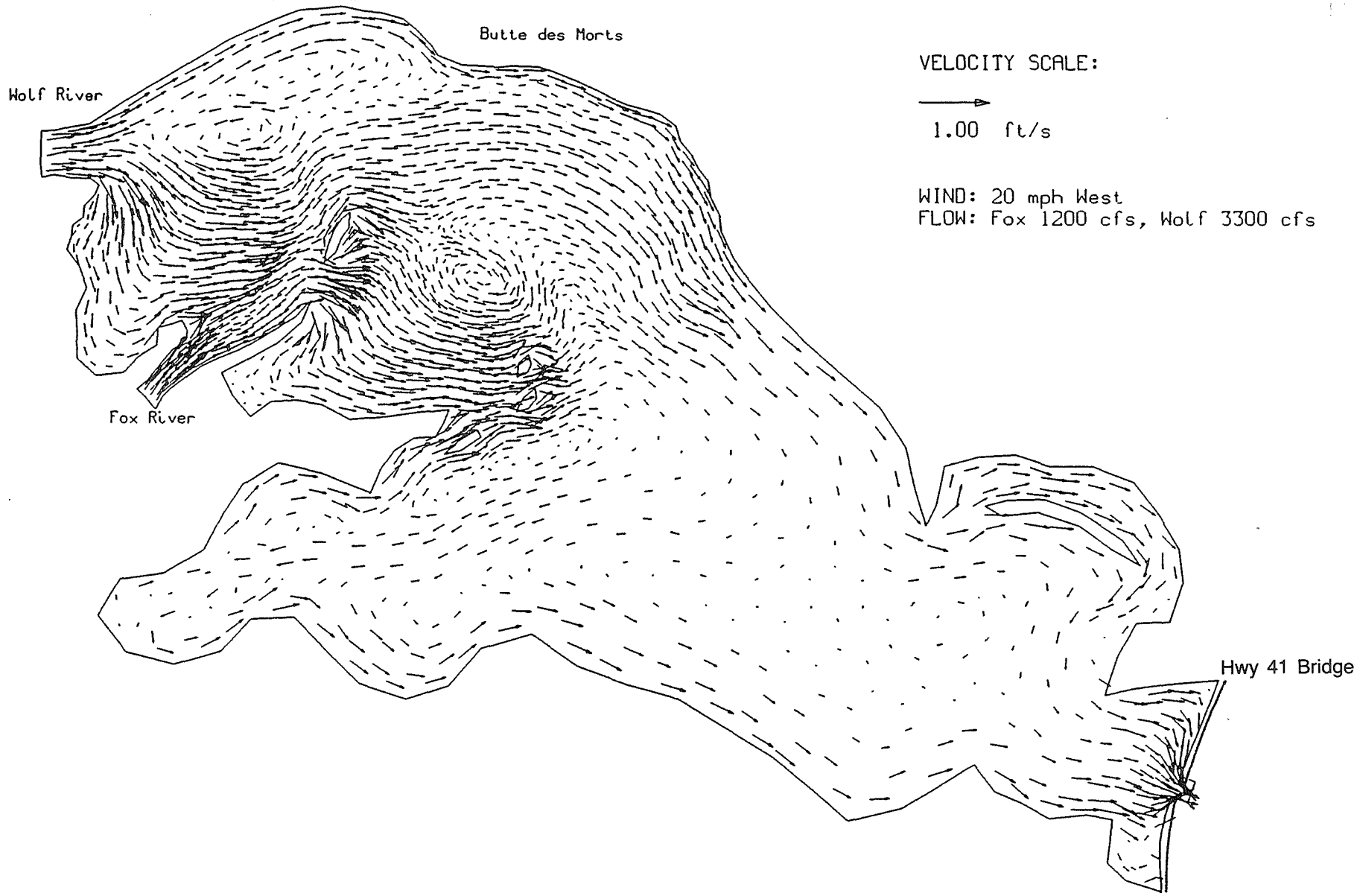


**Figure 2-6** Currents Lake Butte des Morts, West Wind 20 mph, Normal Summer Flow, Existing Conditions

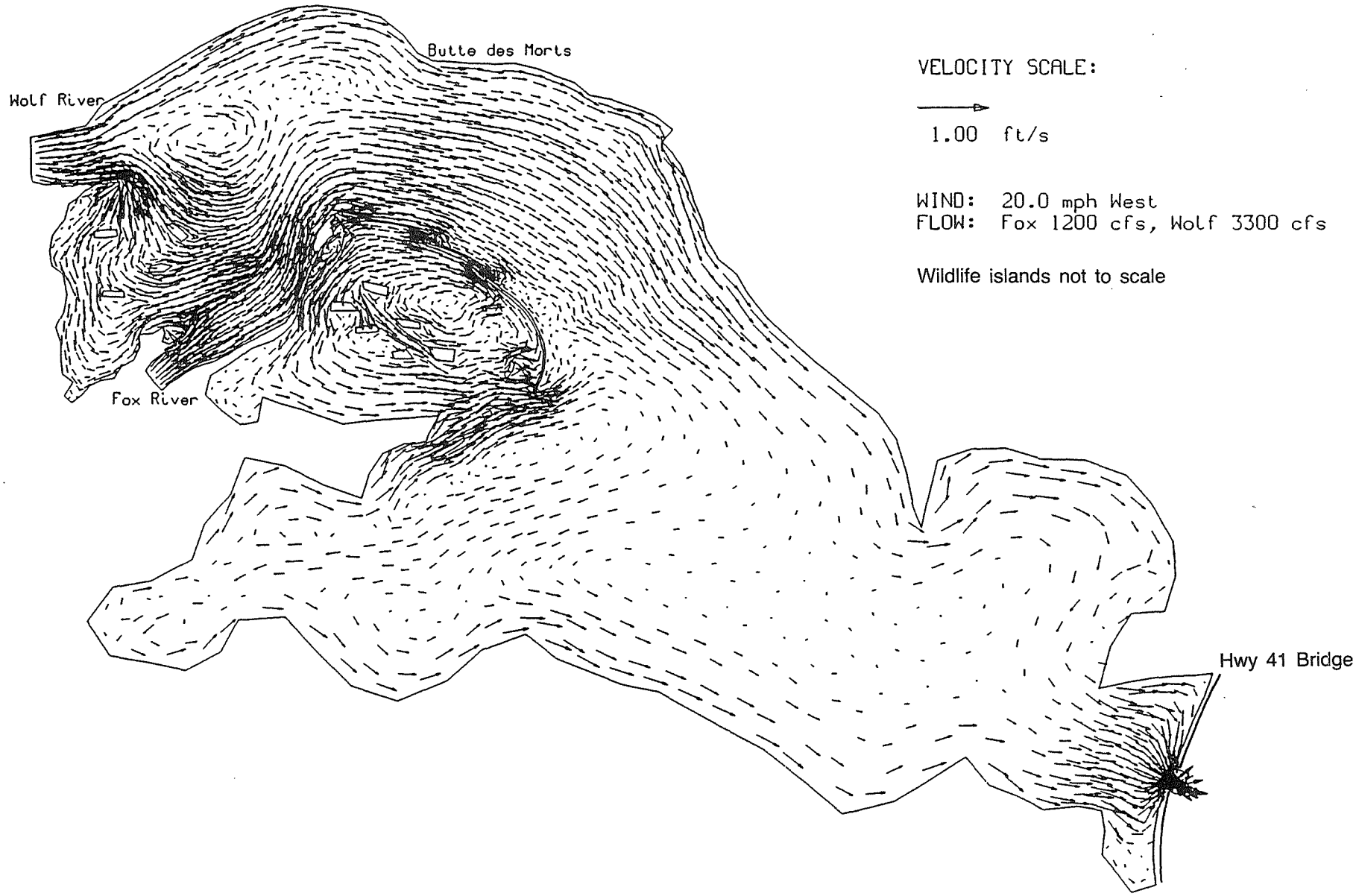


**Figure 2-7** Currents, Lake Butte des Morts, West Wind 20 mph, Normal Summer Flow with Breakwall Structures

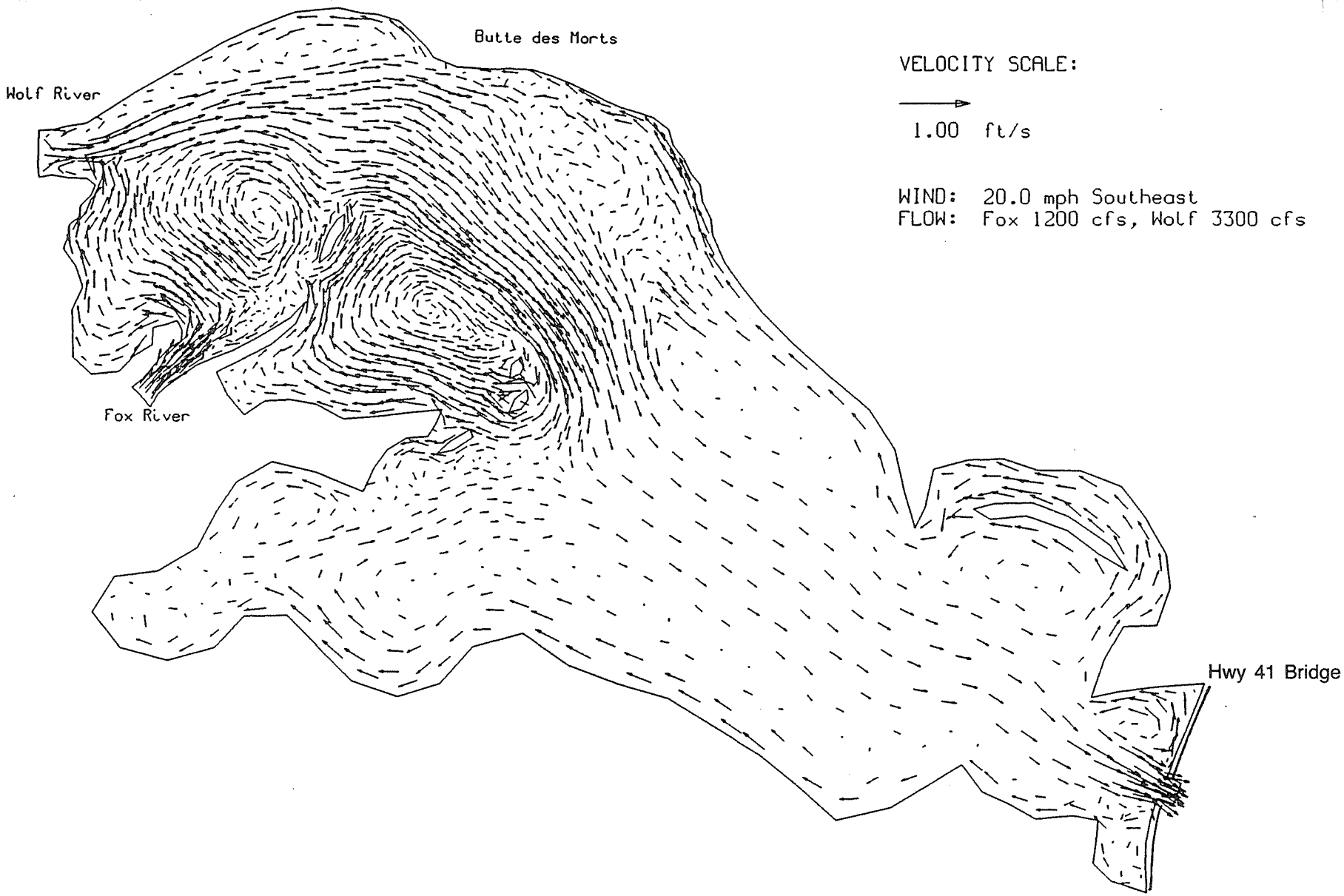


**Figure 2-8** Currents, Lake Butte des Morts, Southeast Wind 20 mph, Normal Summer Flow, Existing Conditions

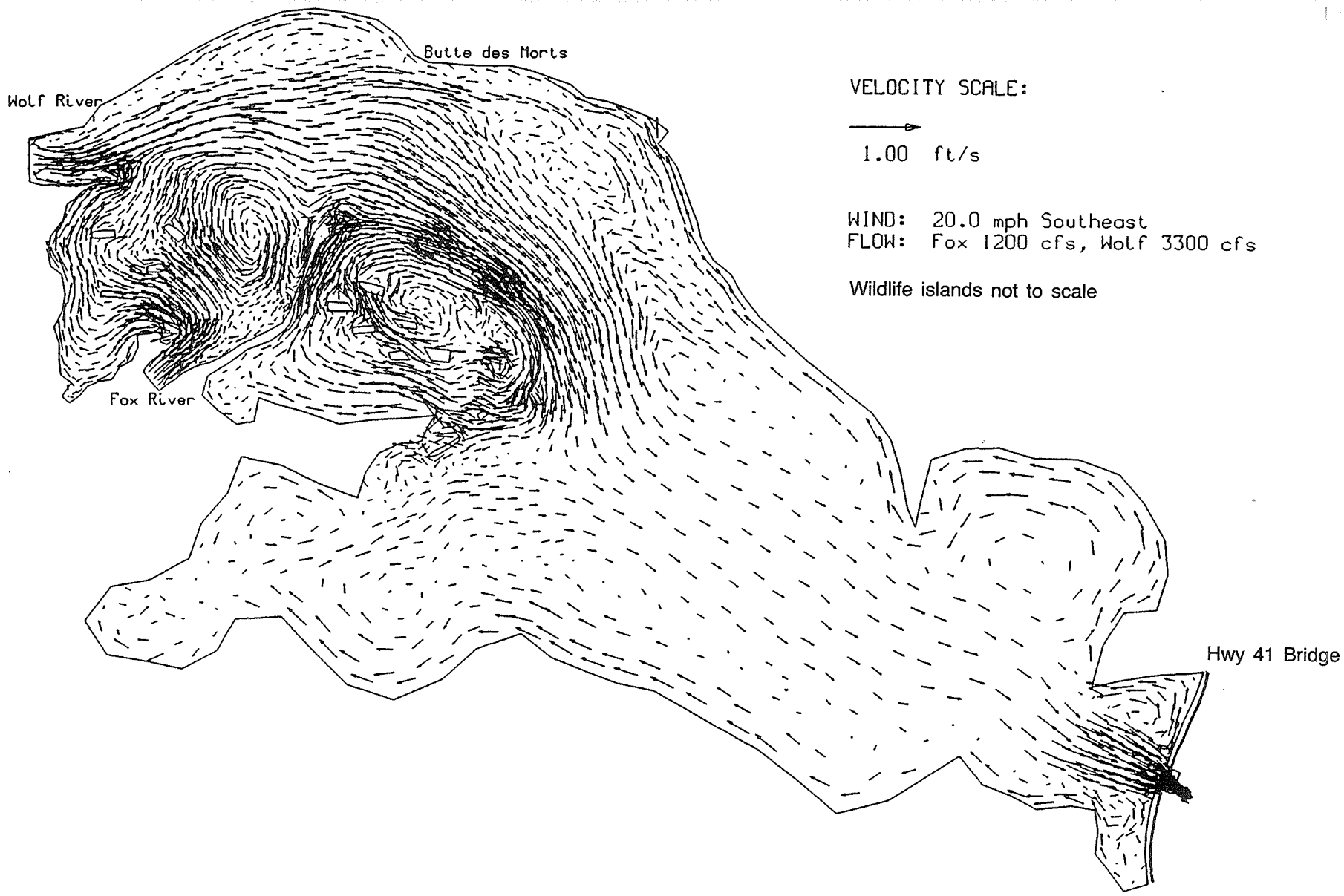


**Figure 2-9** Currents Lake Butte des Morts, 20 mph Southeast Wind, Normal Summer Flow, with Breakwall Structures

Concerns expressed to the Department that the breakwalls would severely disrupt lake currents creating stagnant pockets behind the breakwalls and other portions of the lake do not appear to be warranted. As shown in the no wind condition (Figure 2-4), the Fox and Wolf Rivers create a flow from the northwest to the southeast. Several low velocity areas are evident along the south and west shores of the lake even under existing conditions. The breakwalls had no impact on these areas during the model runs.

### Wave Energy Reduction

Besides deflecting currents, the breakwalls would break or deflect wind and boat generated waves which can resuspend sediments and injure some plants (source 31). Since the greatest fetch within the Terrell's Island restoration area for the current breakwall alignment is 6,600 feet, waves being created within the structures would be substantially smaller. Wave height, and therefore erosive power, behind the breakwalls would be substantially reduced (greater than 50%), regardless of wind speed and direction (source 1). The overlap of the breakwall segments should effectively eliminate the passage of waves into the habitat restoration area. The wildlife islands would have a negligible impact on breaking waves generated within the restoration area because of their small size. If the vegetation develops as anticipated further reductions in wave heights and currents within the Terrell's Island restoration area should occur.

## SEDIMENT CHARACTERISTICS AND BREAKWALL STABILITY

Department and W. F. Baird staff conducted two studies to assess soil stability along the proposed Terrell's Island alignment. Soft surficial sediments were found off White's Island and a smaller area near the confluence of the Wolf and Fox Rivers (see Figure 1-4). Shear tests and bearing strength studies conducted in January 1991 along the selected alignment also found subsurface layers of soft organic silt and poorly consolidated clays.

These studies as well as information from other studies (source 17) indicate soils in the area north of Terrell's Island consist of a 1-2 foot thick layer of dark silty sand overlying a firm sand layer which is from 1-4 feet thick. This firm sand layer is underlain by the previously mentioned organic silt and poorly consolidated clay layers of variable thickness. Beneath these poorly consolidated clay layers, the bearing strength of the clays increases and a very firm layer is found at a depth of 16-20 feet.

Based upon these soil conditions, the proposed breakwall design of 3:1 side slopes utilizing shot rock and land based construction provides a reasonable level of assurance against shear failure at the Terrell's Island site. Long-term settlement is anticipated to be about one to two foot according to the W.F. Baird Supplementary Report of March 1991.

Sediments under certain sections of the breakwalls, however, may consolidate more than others. This is anticipated to occur within one year of construction in most instances and may require the placement of additional rock if subsidence jeopardizes project objectives. Catastrophic failure, the complete loss of all of the breakwalls due to submergence, is an unlikely outcome. The safety factors in the breakwall design, the types and depths of sediments, and the seismic stability of the region all indicate a massive failure is not likely.

The lakeward face of the breakwalls under the proposed design would be shaped by storm and boat generated waves and ice shoves. This means the outer face would slump until a stable profile was established. This slumping would be part of the design and should not be interpreted to mean the breakwalls were washing away or sinking into the lake bottom.

Lake Poygan and Winneconne sediment characteristics have not been studied to date. Before breakwall construction is begun in any of these locations, appropriate engineering studies will be undertaken to ensure the alignments are on suitable sediments.

## SEDIMENTATION AND LAKE BOTTOM FILL

Sedimentation is a natural process in which soils and organic material washed in from the watershed accumulates within a lake. The Fox River is a major source of silt, sand and nutrient rich water for Lake Butte des Morts. By comparison, the Wolf River drops its mineral sediments in Lake Poygan. Nutrient rich waters from the Wolf River pass through Lakes Poygan and Winneconne before entering Lake Butte des Morts. These nutrient rich waters plus the internal cycling of nutrients from lake sediments contribute to the massive blue green algae blooms observed in the lakes. When the algae die their remains generally settle in the deeper and quieter parts of the lakes.

The sorting action of the waves and the high suspended solids loads have also acted to modify the surficial sediment characteristics, particularly in the former wetland areas. Sediment is no longer trapped and stabilized by the vegetation and tends to fill in boating channels, cover fish spawning areas, and further cloud the water. Sediments from former marsh areas in western Lake Butte des Morts are believed to have been washed into deeper areas in the adjacent river channels and the east end of the lake (source 22) leaving the former marsh areas deeper and less hospitable to aquatic plants.

Increased sedimentation within the restoration areas will occur as plant remains accumulate and sediment entering the gaps settles out behind the breakwalls. The rate of sedimentation will depend on the type and amount of plants which colonize the restoration area and the rate of exchange of water between the lake and the enclosure. Based upon research from other lakes, the rate would probably range from 0.2-0.4 inches per year (source 21). This should result in lower water depths and a gradual infilling of the Terrell's Island enclosure.

A similar rate of sedimentation and consequent infilling is anticipated for the Lake Poygan enclosure.

Approximately 10-12 acres of lake bottom would be covered by the breakwalls and an additional 5-6 acres would be covered by the wildlife islands. About 3-6 acres of lake bottom would be disturbed by dredging activity as borrow sources for wildlife island construction.

## SHORE AND LAKE BOTTOM EROSION

As noted earlier and in Appendix A, thousands of acres of wetlands and many miles of shoreline have been eroded because of the water level management regime on the Lake Winnebago Pool. Erosion continues to this day, but has stopped or slowed considerably where rock riprap has been placed to protect the shore. If the project proceeds as described, the breakwalls would slow or eliminate shore erosion on the north side of Terrell's Island and the north central shore of Lake Poygan.

Concern was expressed by the public as to what impact the breakwalls might have on lake sedimentation and shore erosion. More specifically, would the breakwalls accelerate down cutting of the river channel near the mouth of the Fox River and the lake bed along the north shore near the Village of Butte des Morts? The consultant analyses indicate accelerated erosion of the river's mouth and the north shore of the lake are not anticipated if the breakwalls are constructed.

The W. F. Baird modeling assumed breakwalls were constructed on both sides of the river channel, in effect a worst case modeling of potential effects. The result was a 20-40% increase in current velocities compared with existing conditions. This would result in current velocities ranging from 0.5 to 1.5 feet per second during a 100 year flood. These velocities are below those needed to scour the river channel

and transport lake sediments into the navigation channel along the north shore of the lake. Since only the Terrell's Island loop is being proposed, the anticipated increase in velocities would be less than the model predicted.

A computer model comparison of water velocities along the north shore of Lake Butte des Mort indicated the anticipated increase (20-30% greater than existing velocities) would not be sufficient to increase shore erosion on the north shore, particularly near the Village of Butte des Mort.

Localized scour at the northern tip of Benedict's Island may occur during high flow periods according to the Baird report. If this occurs, additional riprap may be needed to eliminate or reduce the scour.

W. F. Baird & Associates did not model pre and post breakwall lake currents for Lakes Poygan and Winneconne. Similar modeling will be considered if the DNR decides to proceed with breakwalls at the other locations.

### Ice Scour

Ice packs or floes on the Upriver Lakes are not anticipated to have an adverse impact on the breakwalls. The breakwalls should act as barriers to ice movement on the lakes thus minimizing the potential for large ice shoves to develop (e.g., near Boom Bay). In addition, the ice trapped behind the breakwalls will not be as mobile because of the lower current velocities within the enclosures.

## TERRESTRIAL DISTURBANCE

The difference in the amount of terrestrial disturbance between land based and marine based construction is relatively insignificant. Constructing the Terrell's Island breakwalls would result in 1-2 acres being disturbed under the marine based option while 3-4 acres would be disturbed by land based construction. The difference is the need for cutting vegetation and/or preparing an access corridor for truck traffic. This impact would be minimized if already disturbed areas were traversed and/or haulage was done in the winter when the soils were frozen.

For the project in total, about 6-12 acres would be disturbed by quarry activity. An additional 4-6 acres might be disturbed when establishing land access for constructing several of the breakwall segments.

# SOCIOECONOMIC ENVIRONMENT

## POPULATION CHANGES

Population growth since 1960 is illustrated by Table 2-2 below (source 18). Long-term projections of population growth suggest that by the year 2000 Winnebago County will grow 6%. In comparison, it is projected that the total state population will grow by 11% during the same period of time. Long-term projections of population growth are not available for the unincorporated towns and incorporated villages and cities located next to the lakes.

The long term projections of population growth also suggest changes in the age structure of the population. Population projections prepared by the Wisconsin Demographics Center indicate a significant increase in the percent of the population in the 25 to 44 age group by 1990 and then some decline in this age group by the year 2000. By the year 2000, people between the ages of 45 and 64 will comprise a larger percentage of the population in the region and the state than they do now. A significant decline in the percent of their populations in the 18 to 24 age group by the year 2000 is anticipated.

The "65 and over" age group in most of the region is projected to grow.

TABLE 2-2

POPULATION OF WINNEBAGO COUNTY

| | 1960 Census | 1970 Census | 1980 Census | 1990 Census | 2000 Est. |
|---|---|---|---|---|---|
| Winnebago County | 108,000 | 130,000 | 132,000 | 140,000 | 148,000 |
| Town of Algoma | 2,200 | 3,200 | 3,250 | 3,350 | N/A |
| Town of Oshkosh | 4,300 | 4,900 | 4,400 | 4,720 | N/A |
| Town of Omro | 1,200 | 1,450 | 1,700 | 1,720 | 1,800 |
| Town of Poygan | 600 | 730 | 900 | 830 | 850 |
| Town of Wolf River | 700 | 900 | 1,050 | 1,110 | 1,200 |
| Town of Winneconne | 900 | 1,400 | 1,600 | 1,660 | 1,800 |

N/A - No figures available.
Source 23

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The project is anticipated to have an insignificant impact on the region's population. If the restoration projects are highly to moderately successful, lake users may experience greater user satisfaction. To the extent this retained existing residents, enticed non-residents to relocate to the area or increased tourism/water related jobs, some very minor population growth might occur. If the project is unsuccessful, anglers, hunters and nature study users will not be attracted to these areas. Since the areas adjacent to the restoration areas are primarily wetlands and therefore not developable, the impacts on property development and value will probably be minor.

Development of properties with suitable soils will be driven more by economic conditions and a general desire by many residents to own lakefront property rather than the success of the wetland restoration and protection projects.

## SHORELAND USAGE

### Private Land Use

The lake frontage currently contains a variety of uses (Figure 2-10). Extensive shoreland areas have been developed for recreational and home/cottage ownership. Substantial areas of wetlands and fallow land, however, still exist along the north and west shores of Lake Poygan and west shore of Lake Butte des Morts.

Development for cottages and homes tends to occur in densely settled, narrow strips along the lake frontage. These developments are backed by cultivated pasture or fallow land. Lake Butte des Morts is the most heavily developed of the three lakes. Platting for new subdivisions and individual lots is increasing, particularly along the north, east and south shores of Lake Butte des Morts. The proposed locations for the breakwalls will not enclose developing portions of lake frontages on any of the Upriver Lakes.

### Existing Public Recreational Facilities

The location of public parks and access points is shown in Figure 2-11.

Lake Winneconne Park - This 28 acre park in the City of Winneconne has facilities for boating, swimming, fishing, picnicking and boat launching. A shelter is available for large groups or organizations.

Big Lake Butte des Morts Park/Boat Landing - This park is 40 acres in size and is located on the south shore of Lake Butte des Morts in the Town of Omro. Facilities and activities include a boat launching area, picnic area, and nature study.

Lasley Point Archeological Site - This park is still under development. It covers 47.7 acres and is a heavily wooded Indian burial site with ceremonial pits. Many Indians artifacts were discovered in earlier archeological expeditions. Further plans for this area include hiking trails and nature studies. This site is located 0.5 miles east of Lake Winneconne on Lasley Point Road, west of County Trunk M.

Lake Poygan Boat Landing - A 2 acre park with facilities for boat launching, a picnic area and trailer parking area. The landing is located 8 miles west of Winneconne.

Boom Bay Boat Landing - The landing has one large launching ramp, docks, and breakwater. It is located southwest of Winchester.

Eureka Locks - The locks, located about 6.5 miles west of the Village of Eureka on the Fox River, are owned by DNR but operated and maintained by the Berlin Boat Club.

Recreational Trails - The county maintains 18.5 miles of trails for hiking, bicycling and snowmobiling. None of these trails crosses the lakes or would otherwise be affected by the breakwalls.

In general, these facilities would not be directly affected by the restoration projects, though increased boat launchings, traffic and attendant impacts may occur if the restoration areas become attractive to a broader segment of the boating public.

## LAND OWNERSHIP, MANAGEMENT EASEMENTS AND PROPERTY RIGHTS

Easements or fee title land purchases of private and county lake bed properties will be necessary to construct the breakwalls and habitat islands as well as to conduct the anticipated management activities (Figure 2-12). There are three private land owners who own 80-90% of the proposed restoration area in Lake Butte des Morts. The costs of obtaining easements or fee titles are not known, but Department staff expect it will be $20,000 or less.

If the property owners are willing to donate the easements or properties, the cost could be lowered significantly. The Department would be legally and financially responsible for all land eased or purchased for this project.

Several parcels of submerged land along the proposed alignments in Lakes Poygan and Winneconne (Figure 2-13) will require purchase or permanent easements. The Department will pursue either approach, depending upon the preference of the landowner. If the desired access cannot be obtained, the breakwall alignment will be re-configured to achieve project objectives.

Property owners of submerged properties, islands or shorelines within or adjacent to the habitat restoration areas will retain all of their current rights and responsibilities. No abridgement or modification of these rights (e.g. use, structures and management of the property) will happen as a result of this project.

The Department does not intend to provide public access to the breakwalls across adjacent riparians property. Breakwall construction is intended solely for the purposes of wetland restoration. Incidental use of the breakwalls by anglers or sightseers in boats is expected to occur.

## RECREATION

### Water Recreation Management - Regulatory Authority

While state statutes establish rules which are generally applicable to waters throughout the state, state agencies are not empowered to adopt regulations for a particular water body unless authorized by the legislature. Through general statewide conservation regulations, however, the Department has the authority to directly regulate recreational activities on and along the breakwalls and habitat restoration areas that are state owned or under state easement or lease.

Towns, cities and villages have the authority to regulate type of use, area of use, time of use, speed or numbers of users on the waterbody in general. Towns, rather than counties, have been delegated the power to adopt boating regulations in rural areas. The statutes prevent the adoption of non-uniform regulations for a single water body. As a result, all regulating units must adopt identical regulations. Since reaching agreement is often difficult when multiple towns are involved, this has severely limited the establishment of water use regulations on large water bodies. Consequently, local water use restrictions are not anticipated or sought as an outcome of this project.

### Seasonal Influences On Lake/River Recreation

The Upriver Lakes are used throughout the year for recreation. Department creel surveys have counted up to 245 fishing boats at one time using the Upriver Lakes. Fishing in late April or early May is clustered near spawning areas, but disperses over the lakes in the summer and fall. DNR surveys indicated fishing and hunting are quite popular on all the lakes. Pleasure boating may exceed fishing as the dominant recreational activity on pleasant summer weekends, and holidays. Swimming, wading, water

**Figure 2-10** Existing Shoreline Land Use, Upriver Lakes

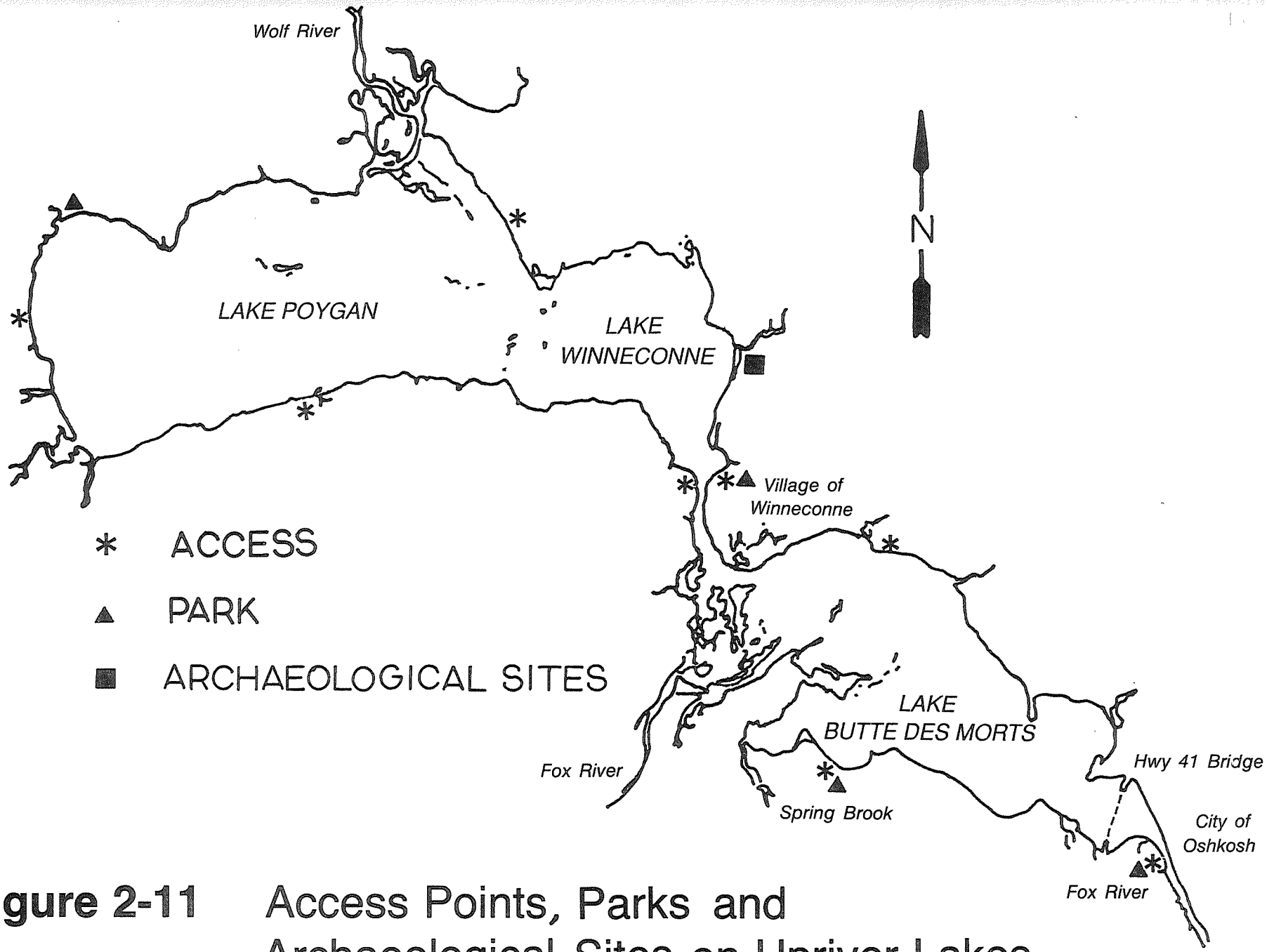


**Figure 2-11** Access Points, Parks and Archaeological Sites on Upriver Lakes

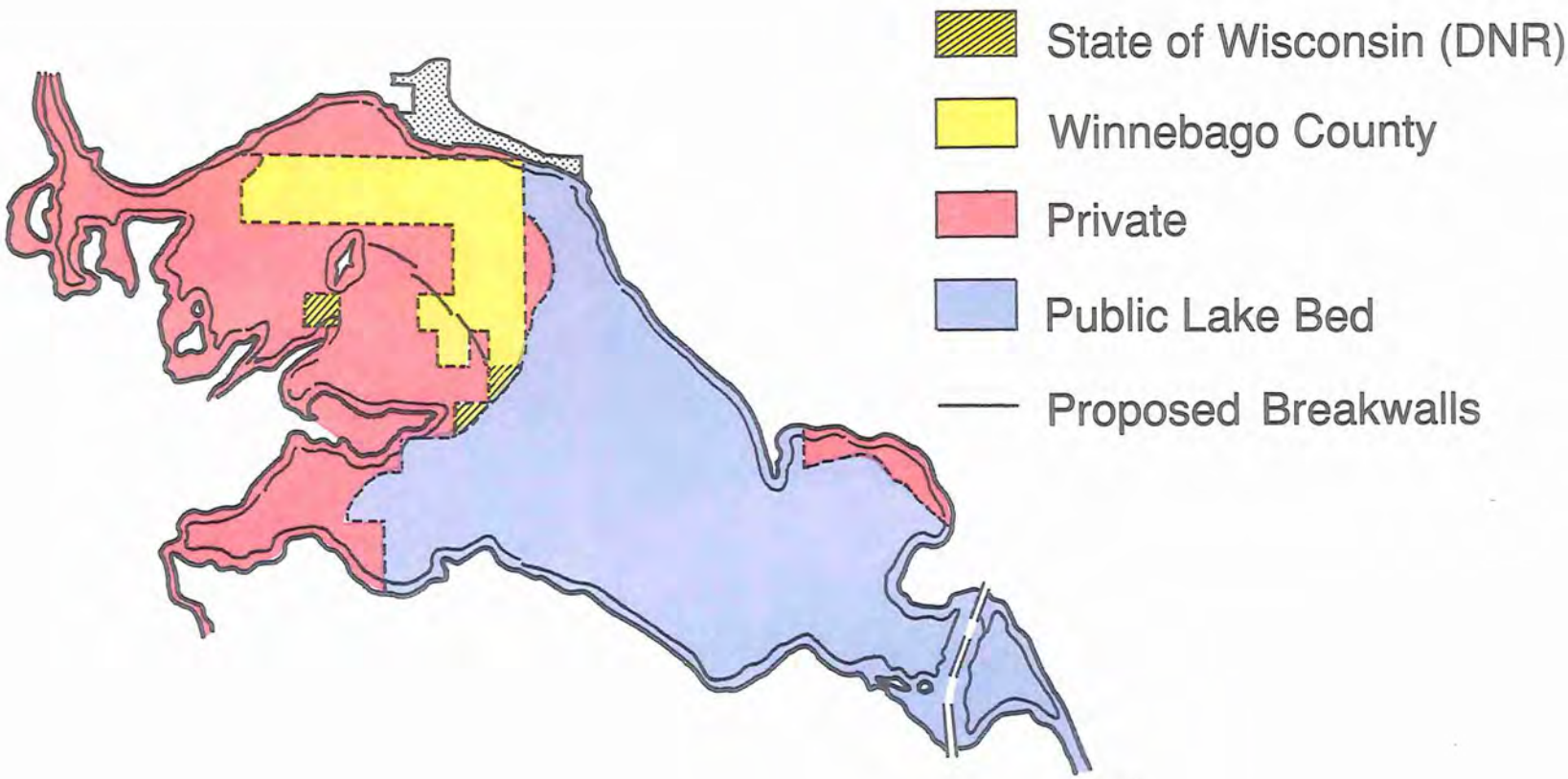


**Figure 2-12** Lake Bed Ownership, Lake Butte des Morts

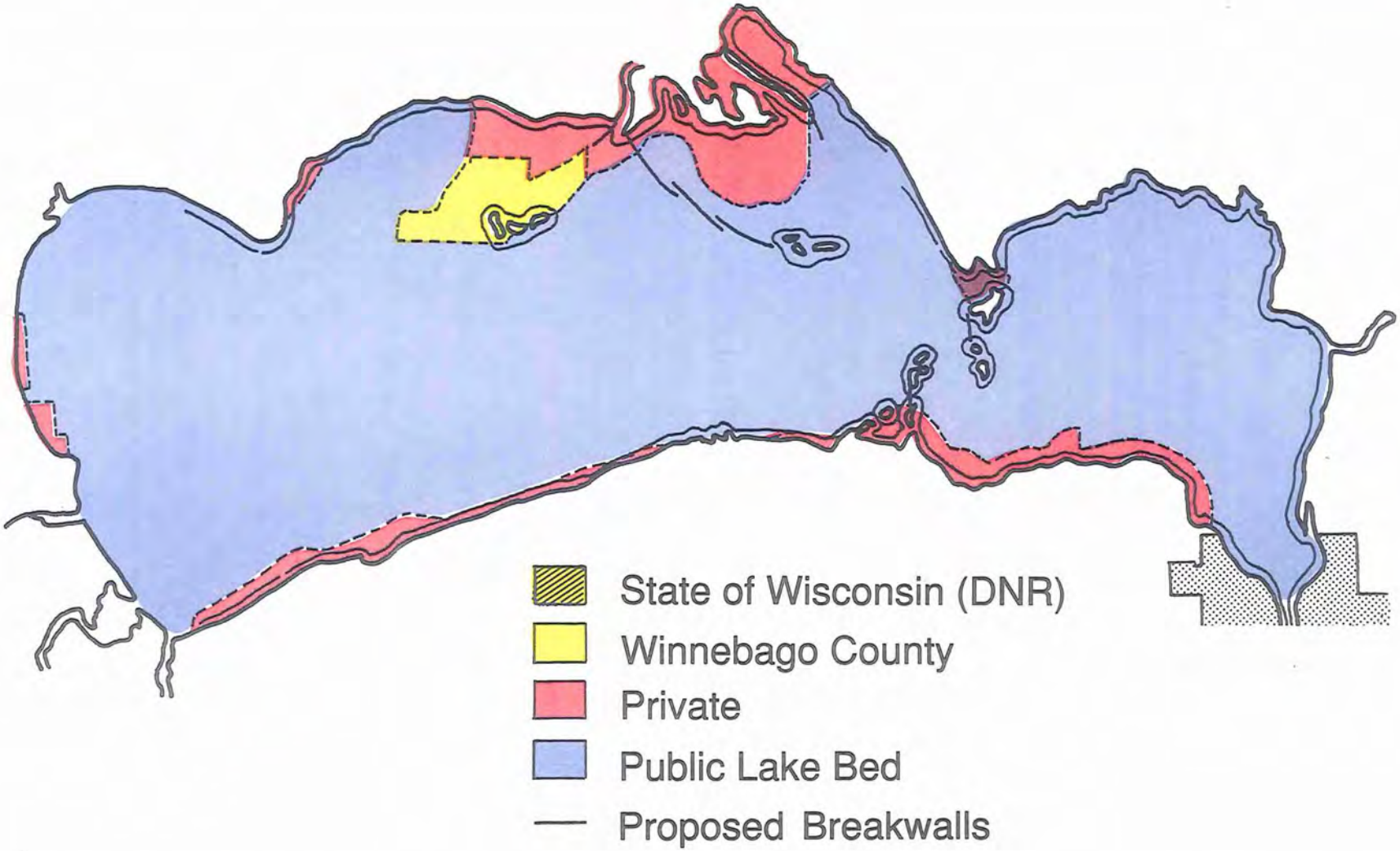


**Figure 2-13** Lake Bed Ownership, Lakes Poygan and Winneconne

skiing, sailboating, canoe activity and sunbathing are particularly popular on weekends with good weather from late June through August.

Pleasure boating begins in April, and is greatest on weekends and holidays with favorable weather. A very popular route is from the City of Oshkosh, through the lakes and up the Wolf River to Fremont (See Figure 2-14). Boat traffic up the Fox River to Omro and Berlin is limited by shallow depths and shifting channels. Since pleasure boating is heavily influenced by weather, it peaks in July and August and is substantially reduced by late September.

In many ways, autumn lake use parallels spring use. After mid-September, recreational use is comparatively low and occurs mostly on pleasant weather weekends. Boat fishing increases with the cooler temperatures. Hunting (primarily for ducks)season brings a new user group to the system with cane beds, wetlands and sloughs being favored over the open lake. Hunting and trapping use continues until freeze up when the lakes become the domain of those who ice-fish, ice boat and snowmobile (Figure 2-15).

## Recreational Boating Patterns on the Upriver Lakes

Table 2-3 reveals boating activity on the Upriver Lakes varies over the seasons. According to Department surveys, pleasure boating is greatest between the hours of 10 A.M. and 5 P.M. with holiday weekends usually the busiest. Pleasure craft and beach use peaks on Saturday with usage typically somewhat lower on Sunday. Pleasure boating drops off considerably during the week. For example, weekday usage is only about 10-15% of the weekend use levels. In comparison, weekday fishing traffic is 30-50% of weekend use. Lakes Poygan and Winneconne are used more extensively by anglers while Lake Butte des Morts has approximate parity between pleasure boaters and anglers during the weekends.

### TABLE 2-3

### UPRIVER LAKES BOATING USE SURVEY[1,3]

WEEKEND BOATING USE (boats/flight)[2]

| Lake | Pleasure Craft | | Fishing Craft | |
|---|---|---|---|---|
| | Average | Range | Average | Range |
| Poygan/Winneconne | 33 | 0-160 | 66 | 5-199 |
| Butte des Morts | 27 | 0-115 | 28 | 4-65 |

WEEKDAY BOATING USE (boats/flight)[2]

| Lake | Pleasure Craft | | Fishing Craft | |
|---|---|---|---|---|
| | Average | Range | Average | Range |
| Poygan/Winneconne | 4 | 0-19 | 27 | 5-74 |
| Butte des Morts | 3 | 0-15 | 9 | 2-23 |

[1]This information was derived from an aerial survey of the Lake Winnebago system undertaken from May 20, 1989, through September 30, 1989.

[2]Number of boats counted during randomly scheduled flights following standardized routes throughout the open water fishing season. The flights were run from 8 A.M. - 11 A.M. and 1 P.M. - 5 P.M. so early morning and evening boating use has not been studied.

As Figures 2-14 and 2-15 show, the various uses appear to occur in distinct, and usually separate, zones. Anglers and hunters typically use bays and other protected wetlands with good submerged and emergent vegetation. Lake Poygan receives about twice the weekend angler use as does Lake Butte des Morts. Lake Butte des Morts, near the City of Oshkosh, is used extensively for water skiing, sail boating and other uses.

Angler and hunter boating patterns will probably not be affected to any meaningful extent by the construction of the breakwalls, although the number of fishing and hunting boats is likely to increase in the restoration areas. The areas proposed for enclosure are already prime destinations for sporting activities. Entry and exit points will be limited to the breakwall gaps and traffic cutting through the habitat areas to other parts of the lake may have a slightly more circuitous route. Another consideration regarding access is the possibility of seasonal (spring and/or fall) refuges being established for waterfowl and the terns. If established, refuge rules may limit hours of access, create no wake zones, seek to reduce noise levels or utilize other management techniques to enhance waterfowl use and benefit from these areas.

Pleasure craft use of the habitat areas would face the same restrictions (e.g., limited entry points and refuge rules) as sporting craft. Since these areas are not presently used for sailing and water skiing, no affects on these activities or boating safety are anticipated. Large pleasure craft do not currently use the proposed habitat areas due to fear of grounding because of shallow water depths. To the extent any construction utilizes channel materials, traditional navigation routes will be safer and have a longer useful life. If the wetlands restoration is successful, it may produce an attractive visual edge with a variety of plants and wildlife observable to boaters as well as provide an aid to navigation in the Upriver Lakes.

## Hunting And Trapping

Hunting for waterfowl and trapping are also popular. Estimates of the number of outings per year devoted to these activities each year are not available. Use, however, is focused on areas with habitat suitable for wildlife with Lake Poygan receiving the greatest hunting pressure. These users should benefit from the increased wildlife populations the restoration areas are expected to support.

## Recreation Demands And Trends

Recreational needs, activity preferences, and demand levels change as our society changes. Some of the key social elements affecting recreation demand are population growth, age structure, health of the economy, and whether the population is rural, suburban, or urban. Also important is the social makeup of the population, including ethnic background, family and household structure, income and education level. Technology trends, such as new types of crafts (e.g.,jet skis) may create new and totally unanticipated user pressure on the resources. The number of slips at marinas on the Lake Winnebago system has increased dramatically since the early 1980s. Predicting long-term changes in these factors and their effect upon Wisconsin's future recreation trends is difficult. Forecasting how they may impact a local area, such as the Upriver Lakes, is even more difficult.

Several demographic trends occurring in our society, however, may have a significant influence on future recreation demands in the Upriver Lakes. These trends include:

* Wisconsin's population is growing older. The "baby boom" generations is aging, the fertility rate is low and a longer life expectancy forecast a rise in the median population age. Over the next 25 years there will be about a 70% increase in the number of people in the 45-64 year old group. The over 65 age group will increase substantially as well. Consequently, there will likely be increasing demand for the more passive forms of outdoor recreation such as, fishing, picnicking, and sight-seeing and less demand for active pursuits (e.g., snowmobiling). This trend is expected to be dominant even though more people are likely to pursue active sports to an older age because of better physical fitness and

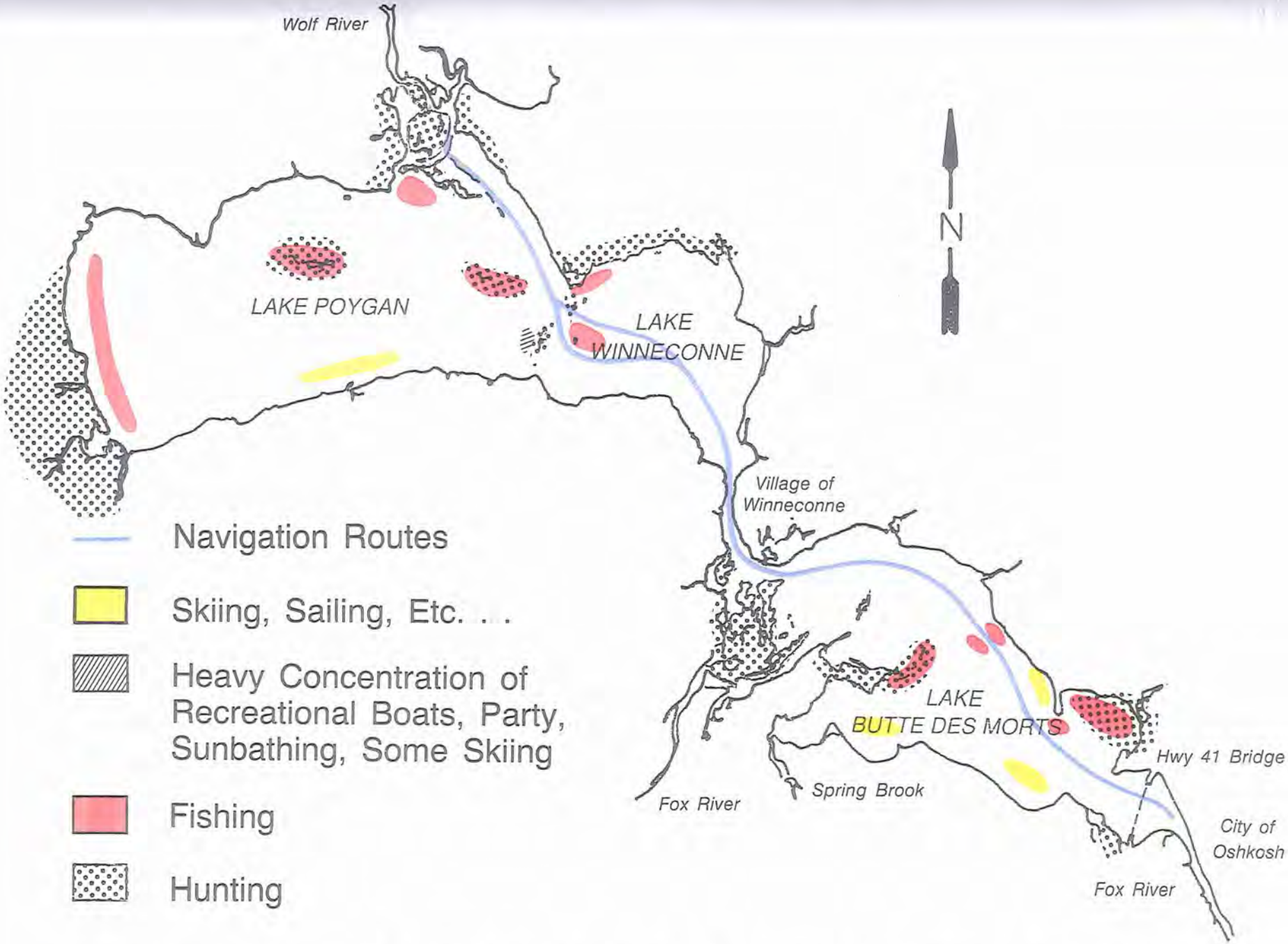


**Figure 2-14** Present Major Summer and Fall Use Areas

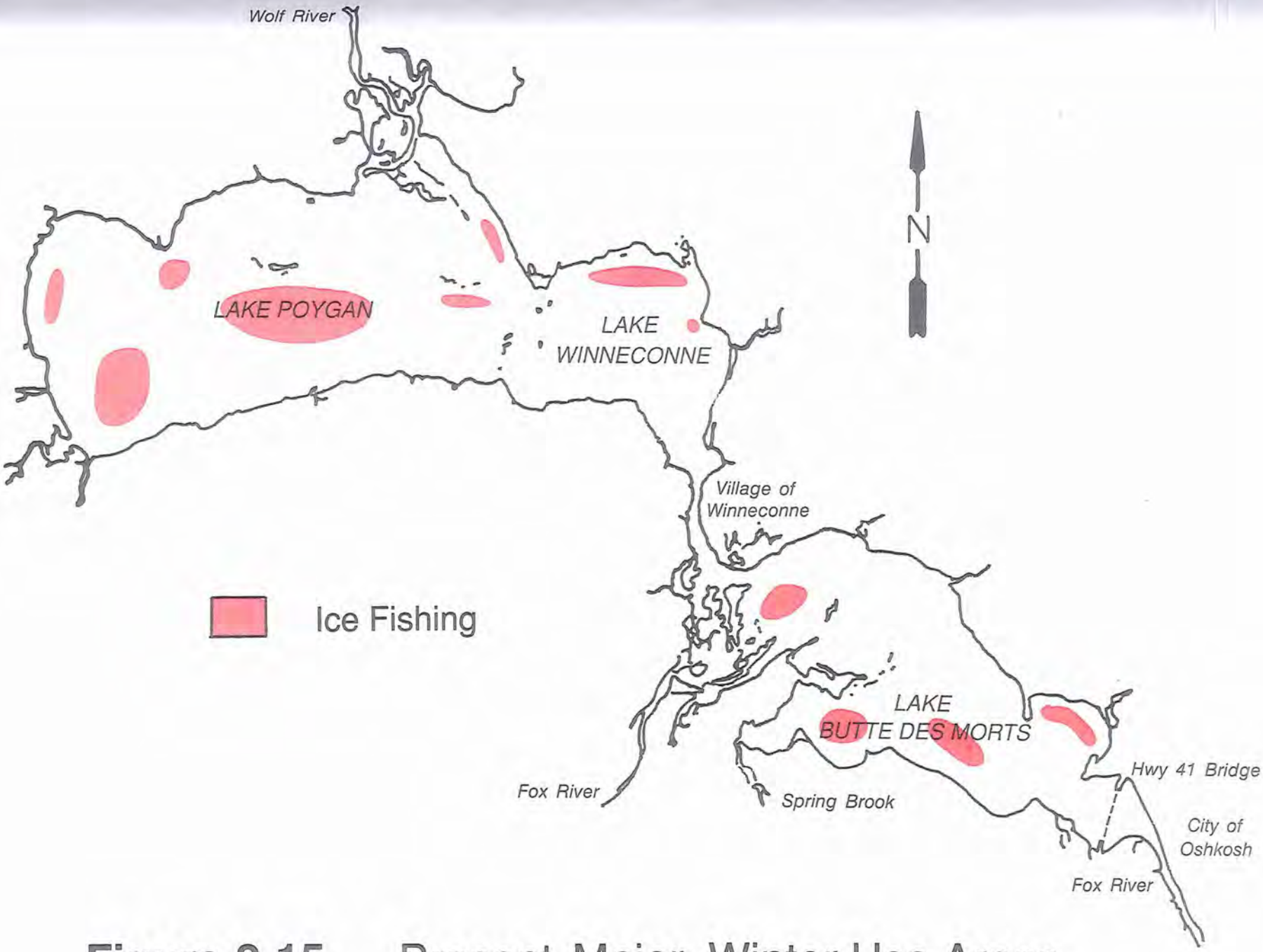


**Figure 2-15** Present Major Winter Use Areas

more early experience with active sports. A successful wetland restoration project would provide a wider array of environmental settings for recreationalists to visit as well as a higher quality experience for the visitor.

* Many of the social changes that began in the 1970s are expected to continue. For example, couples are having children later, single parent households are increasing, and more women are working outside the home. The "traditional family" and "traditional family activities" no longer solely shapes recreation patterns in Wisconsin: The changing and more hectic life styles increases demand for a broader range of recreational opportunities close to home. Again, a successful project would provide a broader array of water based recreational opportunities closer to urban centers (e.g., City of Oshkosh).

* National trends indicate people will seek weekend escapes to relatively nearby state parks, forests, and recreation areas found in southern and eastern Wisconsin. Millions of people live in the metropolitan areas of northern Illinois and southeastern Wisconsin. They may create a substantial demand for outdoor experiences in southern and eastern Wisconsin. A successful project would have some appeal to certain segments of the boating public (e.g., anglers and nature study enthusiasts) and thus might attract some tourists. Boaters with large craft would probably have little benefit from this project.

How might the changing social factors specifically influence trends in lake recreation, especially in areas like the Winnebago Pool lakes? The following factors may play a dominant role in shaping general lake and river recreation over the next 10 to 20 years.

1. A wider segment of society is participating in lake and river recreation. With a wider segment of society participating there will be:

   * Increased demand on urban/suburban water resources, especially for day trips on weekends.

   * Continued growth in the popularity of "quiet sports" (e.g., sail boarding, canoeing and kayaking) near population centers.

   * Large growth in the number of recreationalists seeking a social experience compared to those who view enjoying the water as their primary objective. The social user sees the waterbody as a backdrop for the chosen activity.

   * The demand for services will remain high and conflicts between users are expected to increase. There will be more displacement pressure in response to these demands as new users may displace many past or present users (e.g., anglers vs. swimmers). Certain behaviors (e.g., littering, noisy activities, etc.) may increase conflicts. For example, increased jet ski usage may be in conflict with quiet sports in the wetland areas.

2. The recreational clientele is changing as the population ages. With a larger segment of the population in older age brackets, the following changes are likely:

   * A disproportionate growth in the numbers of family groups pursuing water-based recreation. Throughout the rest of this century the "baby boomers" (now age 30-49) and their families will predominate. People in the younger age class will make up a smaller percentage of river users than in the past.

   * Increased growth in demand for cottages and residences, access points and picnic sites on rivers and lake frontage.

* People will participate longer in water based or related recreation because of improved physical fitness and more emphasis on physical activities. However, increasing numbers of older users will bring more people with health problems or physical limitations. Facilities and services to accommodate these changes will be needed.

* Increased demand for high quality river trips. (A greater demand for solitude and pressure to find places now being lightly used.)

* Greater political clout by an increasingly informed clientele. Users will demand more involvement in management decisions. Managers will be called on to ensure an appropriate mix of recreational opportunities and experiences within a region.

* Demand for boat launches and marina slips and other related public and commercial services may level off in some areas. However, it should remain steady or grow in areas close to population centers where access is easy and relatively few resources of similar character are available. The people using the services will increasingly be older, more informed about lake and river opportunities and management. The various user groups will be interested in a broad array of high quality recreational experiences. They often do more comparative shopping for services, so local business competition may increase.

If the restoration activities are successful, it should improve the experience of those engaged in fishing, hunting, trapping, nature study, quiet sports and pleasure boating with small craft. The breakwalls will probably have little to no effect on large power boats, skiing (water or jet), swimming or sailing, particularly if the breakwalls are well marked. Winter activities are not anticipated to be affected, except ice fishing might improve if fish concentrate near the breakwalls or in deeper pools created near the wildlife islands.

Sporting activities, nature study and aesthetic appreciation would not significantly improve if vegetation restoration is unsuccessful. For example, if restoration is unsuccessful, wildlife numbers would probably remain similar to present levels. Present uses within the Terrell's Island enclosure would probably remain the same unless the restoration areas became so plant choked that navigation, fishing, and other outdoor activities were not feasible. A negative aspect of a successful restoration effort might be crowding at boat launches and water traffic near the breakwall gaps.

## State Comprehensive Outdoor Recreation Plan Forecasts

The Wisconsin State Comprehensive Outdoor Recreation Plan (SCORP) identified recreation demand estimates for various regions of the state (source 24). The predictions in SCORP are based on an analysis of area demand for specific recreation activities and a survey of private and public recreation facility managers and park directors. SCORP's predictions about recreational growth and facility needs for the East Central Wisconsin region, which includes Winnebago County, are shown in Table 2-4.

### TABLE 2-4

### SCORP PREDICTIONS FOR GROWTH IN RECREATIONAL USES AND FACILITY NEEDS

| ACTIVITY | GROWTH EXPECTED | FACILITY DEVELOPMENT PRIORITY |
|---|---|---|
| Bicycling | Moderate | Moderate |
| Camping | Moderate | Moderate |
| Walking/Jogging | High | High |
| Cross-country Skiing | High | High |
| Canoeing | Moderate | Moderate |

| | | |
|---|---|---|
| Picnicking | High | High |
| Hiking/Backpacking | Moderate | Moderate |
| Fishing | Moderate | Moderate |
| Swimming/Beach | Moderate | Moderate |
| Ice Fishing | Low | Moderate |
| Motor-boating/Water-skiing | Little or none | Moderate |
| Horseback Riding | Little or none | Low |
| ATV (all terrain vehicles) | Little or none | Low |
| Snowmobiling | Little or none | Low |
| Hunting | (Not included in SCORP) | |

The underlined activities would most directly benefit from the project. As shown, the SCORP predicts a moderate need for additional facility development.

Other sources indicate that hunting participation levels will most likely continue to parallel general population growth. More significant than the slightly increasing numbers of hunters may be the trend of more hunters seeking higher quality hunting experiences and an upswing in demand from both hunters and non-hunters for non-consumptive types of wildlife recreation. If these trends are correct, successful restoration projects would help to meet the expectations of future recreationalists.

**Consistency with Recreation Plans** - Department staff believe the proposed wetland restoration project is consistent with existing county, regional and state recreation plans (source 25-28). The goals and objectives of these plans often call for increased opportunities for outdoor recreation and nature appreciation activities. Successful restoration projects would provide a suitable setting for both of these activities.

## Financial Effects Of Recreation/Tourism

As Table 2-5 indicates Winnebago County is a destination for some tourists who have outdoor recreation as a major pursuit. Unfortunately, the information source did not categorize the recreational pursuit as to whether it was hunting, pleasure boating, bird watching, hiking, or so on. Therefore it is not feasible to say with certainty whether a successful project will significantly affect water-related tourist revenues. Given the relatively small size of the potential visiting population compared to the resident population, the anticipated effects on the economy should be minor.

**TABLE 2-5**
**POTENTIAL OUTDOOR RECREATION POPULATION IN THE OSHKOSH AREA**

| | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| Hotel/Motel Visitors | 2,181 | 4,903 | 2,554 | 1,711 |
| Campground Visitors | 1,772 | 1,101 | 2,009 | 0 |
| Seasonal Home Visitors | 1,213 | 3,498 | 1,256 | 296 |
| Day users | * | * | * | * |
| Resident Population | 364,514 | 364,514 | 364,514 | 364,514 |
| Potential Recreation Population | 369,680 | 383,926 | 370,333 | 366,521 |

Source 30

Detailed estimates of the economic contributions of boaters, hunters and anglers, campers, sunbathers, swimmers, hikers, and other user groups for the Winnebago Pool are not available. The University of Wisconsin Department of Agricultural Economics, however, has studied economic impacts related to water based recreation on the Lower Wisconsin River. The study found the average recreationalist (mostly people boating or canoeing) responding to the survey spent about $10.30 per day. Of this approximately (50.8%) was spent on canoe rentals, (20.2%) was spent in grocery stores, (14.5%) in restaurants and bars, and the remaining (6.7%) on lodging fees.

## FISCAL IMPACTS

The proposed funding for the project for fiscal years 1992 and 1993 would amount to about $2.3 million for construction of the Terrell's Island breakwall. As noted earlier, this is $1.2 million less than the projected construction cost of $3.5 million. Unless the project comes in under cost or state funds are supplemented with private and federal funds, breakwall construction and habitat development will require additional financing in fiscal years 1994-1995 through state, federal and/or private sources to complete the Terrell's Island initiative.

The breakwalls will be constructed and maintained with state funds and private contributions. Ducks Unlimited, for example, is interested in the restoration project and has indicated a willingness to provide some financial support. Federal monies will be sought, but are not expected to provide any sizable fraction of the funds needed. Direct appropriations or bonding for the construction funds will be sought from the Legislature with maintenance funding built into the Department's ongoing appropriations. No county appropriations are proposed for the construction and maintenance of the breakwalls, thus no direct impact on local property taxpayers is anticipated. To the extent the breakwalls have positive impacts on tourism and property values, county property tax payers will benefit. The overall capital costs of the project are shown in Table 1-1.

Speculating on the positive or negative effects of the restoration area on property values is problematic at best. The analysis would be highly skewed by the assumptions used. Forces such as interest rates, housing prices, general economic activity, population growth, housing preferences, taxes, etc. may exceed the relative impact the breakwalls would have on most property sales on the Upriver Lakes. Specific areas, such as along Boom Cut in Lake Poygan and Rivermoor near the proposed Terrell's Island loop, probably would be more influenced than more distant areas.

Depending upon the construction techniques used and the final alignment selected, several jobs will be created/maintained for quarrying the rock and constructing and maintaining the breakwalls. The greatest long-term potential for job creation would be for employment in the recreation or recreation services businesses if the wetland restoration is successful.

## LAW ENFORCEMENT

Hunting will be prohibited on the breakwalls. Hunting will be allowed on the wildlife islands unless the Department designates them as refuges during the fall migration. No permanent hunting blinds on the islands would be allowed. Additional law enforcement and education efforts will probably be needed by Department staff to ensure compliance. Some enforcement efforts may also be needed to minimize intrusion of boaters into seasonal refuge areas or endangered species nesting areas. Trespassing onto White's and Benedict's Islands probably will occur, but it is not expected to be significantly different than what is occurring presently. Since the breakwalls will not directly link up with these islands, trespassers will need to gain access by boat. Restrictions on commercial plant harvesting in the habitat restoration area may be required to ensure the successful establishment of desirable plant communities.

## PUBLIC PERCEPTION OF THE BREAKWALLS

If the habitat restoration areas develop as anticipated, the increased fish, waterfowl and wildlife populations should enhance the image of these lakes. This may accelerate demand for lake front property thus increasing the value of existing homes and parcels. The demand for services supplied by water based recreation businesses may also increase. If the wetland restoration is not successful, homes and properties closest to the project areas may be adversely affected, particularly during the summer and no benefit to local business would occur. The closest homes to the Terrell's Island restoration area and breakwalls are about 0.15 and 0.75 miles to the southwest respectively.

In reality, the habitat restoration project will probably be viewed both positively and negatively by lake-front property owners and lake users. Perceptions will undoubtedly change over time, the seasons, water levels and other influences. Some will view the enhanced habitat and outdoor recreation opportunities as positive. Others will perceive the breakwalls as unattractive and will regard the restoration areas, whether rightly or wrongly, as a source of lake problems. To the extent one perception is more widely held than the other, the restoration areas and breakwalls will be seen as either a source of good and prosperity or a blight on the lakes.

To date, extensive citizen participation efforts have shown strong local, public support for the wetland restoration concept and project implementation.

## CULTURAL RESOURCES

No historic sites, buildings of architectural significance or archaeological sites are known to exist along the proposed breakwall alignments according to State Historical Society staff. The known Native American sites (predominantly burial mounds and associated villages) are clustered around the lakes with Lasley Point Park of particular importance (Figure 2-11) (source 29). None of the sites are located along or adjacent to the proposed breakwall boundary. The present compilation of cultural resources data represents a sizable, although not exhaustive, inventory of prehistoric and historic sites located around the lakes.

## MISCELLANEOUS IMPACTS

Damage to local roads should not be a major problem during the construction phrases if weight limits are observed. Much higher truck traffic, up to 30-32 truck passes/hour, could occur under a land based construction scenario. Traffic congestion, noise, dust and fumes along the route, particularly near Terrell's Island, would increase. This impact would be short-term (about 80-120 working days) and would be confined to the truck routes. Dredging noises during wildlife island construction would be confined to the open water season and would probably last less than 60 working days.

Liquid fuels, such as gas and diesel, would be consumed during breakwall construction. The actual energy usage would depend upon the construction option and alignment selected and the quarry sites.

The breakwalls are not anticipated to be a hazard to users in that mandatory navigation should provide adequate warning to boaters and hunting off the structures is not allowed. The only risk perceived at this time is the possibility of a sudden shear failure during construction. This would be a hazard to the construction equipment operators rather than the public at large or boaters.

# CHAPTER THREE

# ALTERNATIVES

Alternatives to the proposed breakwalls include doing nothing, doing additional pilot studies, constructing alternative structures or considering other management options to meet the objectives established by the WCMP.

## NO ACTION

Before contemplating the impacts of the no action alternative, several factors influencing breakwall construction should be considered. The proposed breakwalls might not be constructed for three primary reasons. First, on-going engineering analysis may uncover site characteristics which could compromise the longevity of the breakwalls. Such physical and/or engineering difficulties may occur, but appear to be unlikely given the analyses conducted to date by the DNR and its consultants. An outcome with somewhat more probability is that a specific breakwall segment may be quite expensive to build or maintain. A decision will have to be made at that time as to whether the segment is essential, expendable, or requires additional analysis.

Second, strong and widespread public opposition to the project could result in no action. For example, private landowners of the lake bottom along the proposed breakwall alignments may not sell their property or easements to the Department. This scenario appears unlikely given the expressions of support for the project to date.

Third, the legislature or the US Army Corps of Engineers could deny their respective authorization, permits and/or funding for the project. Such an action could kill the project or might delay its implementation for many years. Again, initial contacts with legislators and the Corps imply general support for this project.

Other factors (e.g., severe adverse environmental impacts) unanticipated to date might occur after the Terrell's Island breakwalls were constructed. This might affect the viability of the other breakwall segments. This appears to be highly unlikely compared to the other three considerations.

Under the no action alternative, degradation of the aquatic habitat will continue. Unprotected shorelines will continue to erode, desirable emergent and submerged plants will not flourish and habitat loss will accumulate. The rough fish populations will persist and waterfowl usage and furbearer populations would remain low. Degraded habitat for endangered terns and other non-game organisms on the decline will not improve either.

The implications of no action would be no need for short-term staff, financial, material, and energy commitments. Long-term maintenance and management considerations would also be avoided. These resources could possibly be redirected to achieve some of the benefits of this proposal in a different manner (See Alternative Habitat Improvement Techniques). For example, funds could be expended to riprap remnant wetlands and unprotected shoreland at Terrell's Island or other sites.

## REMNANT WETLAND PROTECTION

Several lake shore residents suggested the Department consider establishing a fund which could provide monetary grants or cost sharing for the riprapping of unprotected wetlands or eroding shorelines in the Upriver Lakes, rather than constructing breakwalls. Such a grant and/or cost sharing program could be pursued independently of the breakwall proposal and would probably cost substantially less than the breakwalls (about $500,000 for riprap versus $9.16 million for the breakwalls) for all the Upriver Lakes. Specifically relating this option to the Terrell's Island area yields a cost of $50,000-100,000 for riprap compared to $2.9 million for the breakwalls and wildlife islands.

This option would protect some of the existing emergent wetlands, minimize shoreline erosion, and eliminate potential obstructions to existing navigation patterns and/or influence vistas on the lakes. This would also eliminate the need for long-term maintenance of the breakwalls. DNR staff would be free to pursue other habitat improvement projects in or around the lakes.

This alternative would protect some of the habitat that remains today but it does not address the extensive losses that have occurred. It would likely result in little to no habitat enhancement and no restoration which is a major objective of the proposal. The fisheries, waterfowl, endangered species, and other game and non-game wildlife populations probably would not increase under this scenario. Furthermore a grant/cost sharing program would be of greatest benefit to landowners with eroding wetlands and only a secondary benefit to the public at large. Such a program would also require Legislative authorization and funding.

## WETLAND RESTORATION BY LOWERING WATER LEVELS

Permanently lowering water levels would be a viable means of restoring many hundreds of acres of wetlands. Drawdowns might range from one foot to 2.5-3.0 feet (predevelopment levels). It would create more shallow water areas for emergent species and would allow light penetration to a greater depth, possibly expanding the area of lake bottom suitable for submerged species.

In general, a lowering of water levels would probably favor rapid colonization of exposed beds with cattails, bulrush, arrowhead and other grasses and forbs adapted to such conditions. Shrubs and trees (e.g., dogwood and willow) would probably also colonize these areas. A rapid influx of undesirable reed canary and purple loosestrife plants probably would occur too. If the viability and contents of the seed bank is favorable, a desireable vegetation community of high value to wildlife could develop. Broadcast seeding of high value plants could be undertaken to supplement natural sources. Control of nuisance plants could be undertaken, but the cost could be high and the potential for successful control limited. A carefully executed restoration program that drew down the lakes over a period of years might have a higher chance for success.

Submerged plants probably would not be favored initially because plants in shallower areas would be desiccated and wave action may stifle growth and reproduction. Over time, the plants should colonize deeper waters and pools protected by emergent vegetation.

Lowering water levels would probably slightly favor fish species which utilize marshy, riverine habitats rather than large, open water habitats. Most game fish species would be favored while gizzard shad should not. Carp and sheepshead would probably still dominate the fish communities because of the poor water quality conditions and the abundance of suitable nesting and feeding sites.

Large expanses of marshes would also benefit many songbirds, furbearers and waterfowl. The actual benefit in terms of nesting and rearing success would depend upon the nature of the plant community, predator populations and other variables (e.g. weather, disease). On the whole, however, a net benefit would be anticipated because hundreds of acres of habitat would be created.

Though this option would be highly desireable from an ecological perspective, the political and social ramifications make it unlikely that it would be actively pursued. Lower water would affect lakeshore property owners and businesses throughout the Winnebago Pool and it would influence recreational uses and the navigability of many areas. Downstream users of Winnebago Pool waters (e.g., industry and wastewater treatment plants) would probably be affected also.

## NON-STRUCTURAL HABITAT IMPROVEMENT OPTIONS

### Replanting Vegetation

Without the breakwalls, it is unlikely that replanting vegetation would result in long-term success. Long-term experience, on-going monitoring efforts and research conducted in the Upriver Lakes on the growth and survival of aquatic plants indicates high water levels, poor water clarity and/or wave action adversely affects vegetation. Past planting efforts have had limited success establishing perennial beds of vegetation. Maintaining and enhancing vegetation requires controlling the limiting factors of water clarity and wave action in the restoration areas. The evidence to date indicates physical structures can most effectively control these two limiting factors. Water level management of the Winnebago pool will remain a long-term factor limiting revegetation efforts.

### Fisheries

Fish populations diversity and abundance in the Upriver Lakes reflects the available habitat. Additional efforts to control carp, such as chemical treatment of carp spawning areas or more aggressive netting programs could be made to minimize the negative effects carp have on aquatic vegetation. This might result in some habitat enhancement, but water level management wave resuspension of sediments, land use practices and other factors also degrade water quality and fishery habitat.

Restocking game fish populations would not result in a long-term solution to the lack of gamefish abundance and diversity. Without adequate habitat, game fish reproduction will be continually limited by a lack of spawning, nursery, food producing and feeding areas. Furthermore, stocked fish may migrate out of the system or suffer higher mortality if conditions are not suitable.

### Waterfowl

#### Dabbling Ducks

At this time there are no feasible non-structural management alternatives which would yield a permanent net gain in wildlife resources in the targeted habitat restoration areas. Properly designed and located wildlife islands have been proven to be a successful, though relatively expensive, means of protecting or improving nesting habitat. Improving shore habitat could also provide nesting habitat; but the depauperate near shore plant communities, primarily cattails and reed canary grass, and high predator populations would minimize the desired benefits.

Dabbling duck production can also be enhanced by purchasing or obtaining easements on lowland farm fields in the vicinity of the Upriver Lakes. The tile lines and drainage ditches could be plugged to re-create wetlands, adjacent upland vegetation re-established for nesting cover, and predator populations managed, as needed, to boost duck production. This has been a very effective habitat improvement activity. In fact, the Department's Glacial Habitat Restoration Area initiative would widely utilize these techniques in portions of Dodge, Fond du Lac, and Winnebago Counties. Alternative habitat restoration projects could be substantially less expensive $250 to $1,000/acre compared to a cost of about $4,600/acre for the present proposal.

Abandoning the existing proposal would, for all practical purposes, eliminate one of the WCMP's most important objectives - re-establishing high quality dabbling duck habitat in the lakes. Since the breakwalls themselves would provide little, if any, nesting habitat and the remnant wetlands are often predator infested, eliminating the islands would significantly reduce the breeding benefits of the restoration activities. Additionally, the ecological benefits of creating a diversity of habitats ranging from shrubby grasslands on the islands to deeper pools with submerged plants would be lost. The islands would also provide a range of benefits for other waterfowl, such as geese which might not otherwise be available. Benefits to fish, waterbirds and non-game species also would not be realized.

### Diving Ducks

The anticipated increase in migratory diving duck use of the wetland restoration areas should be relatively unaffected by the ultimate decision as to whether islands are worth building. Diving duck use would be seriously affected if the breakwalls are not constructed and vegetation management is not implemented.

### Endangered Species

Potential breeding habitat for endangered terns would not be created if the breakwalls and islands are not constructed. However, to improve tern reproduction, managing the wildlife islands to provide both ducks and terns nesting habitat could be undertaken. Maintaining the existing artificial nesting program will continue, but this will neither protect or create tern habitat on the Upriver Lakes. Gull management may be required if gull nesting and predation increases.

## PILOT RESTORATION OPTIONS

Rather than building the entire Terrell's Island loop, a much smaller experimental area (40-60 acres) could be created in the bay in the southwestern corner of the proposed restoration area. Such a study area has some appeal because it would substantially cut capital and maintenance costs. It would also allow Department staff to more closely manage this bay to determine the benefits and adverse consequences on plants, fisheries, and wildlife activities. The Department could also study the management effectiveness and longevity of several types of physical structures. If results indicated system dynamics would provide little benefit, the larger scale proposal could then be modified to increase the potential for success or abandoned altogether if achieving project objectives was not deemed practicable. The cost of removing, if necessary, 1,000 to 2,500 feet of breakwall in a test section would be substantially less than having to remove the 8,300 feet of breakwall proposed for the full loop if it proved unsuccessful.

The pilot section concept has several potential drawbacks which must be carefully weighed. For example, a completely or substantially isolated experimental area probably would not provide a similar enough setting to accurately forecast the plant and fishery response one might expect in a more expansive, less isolated restoration area. In effect, it might result in a quicker and more complete plant re-establishment than anticipated for the larger restoration area. Consequently, fisheries and waterfowl responses might be skewed. The wave energies, lake currents and shallow depths may not be suitable for drawing conclusions applicable to open lake, deeper water conditions. It would cost at least $300,000 to build the test sections and perhaps $20,000 to $40,000 a year to manage and study the biological responses.

## ALTERNATIVE BREAKWALL ALIGNMENTS

### Terrell's Island

The Lake Butte des Morts breakwall alignments have been modified several times since first being proposed in 1987. The initial breakwall proposal was approximately 20,000 feet in length and would have resulted in the structures being less than one-half mile south of the Village of Butte des Morts. A further reduction occurred when two soft zones were discovered and the potential flooding impacts were revealed. As a result, the breakwall alignment for the Terrell's Island loop has been moved south to an area of firmer soils to minimize anticipated construction and maintenance costs (Figure 1-4).

The Department considered three optional configurations for the Terrell's Island area. Option 1 was considered because it avoided the soft zone and would enclose an extensive habitat area. This option is also the most expensive and would extend farther into the lake than the others shown on Figure 3-1. This option would probably raise aesthetic concerns from some members of the public and encroach on boating use area.

Option 2 is the least expensive, both from an initial construction and long-term maintenance perspective. It also potentially provides an opportunity for constructing the Scott's Bay breakwalls because flood waters would be allowed to flow between the Terrell's Island breakwalls and Benedict's Island. The size of the restoration area, however, is reduced and valuable shoal habitat lost. Option 2, with slight modification near White's Island would provide greater isolation and privacy to the owners of White's and Benedict's Islands but it may also reduce the anticipated fishing benefits the restoration activities might provide to the owners. Table 3-1 has summary comparisons of the three options shown in Figure 3-1.

**TABLE 3-1**

**SUMMARY COMPARISON OF TERRELL'S ISLAND BREAKWALL ALIGNMENT**

| | Option 1 | Option 2 | Selected Alignment |
|---|---|---|---|
| Restoration Area | 910 acres | 515 acres | 630 acres |
| Length of Breakwall | 11,300 feet | 7,400 feet | 8,300 feet |
| Construction Cost[1] | $4.2 million | $2.2 million | $2.9 million |
| Maintenance Cost[1] | $320,000 | $240,000/10 years | $250,000/10 years |
| Number of Wildlife Islands | 6 | 6 | 6 |

[1] This is an estimate only and is subject to revision based upon final engineering details. These costs assume 3:1 side slopes, 12 foot top width, quarry run stone and land based construction.

Option 3 consisted of breakwalls fully encircling the Terrell's Island restoration areas, and possibly even the cane beds. This would require the construction of about 2,500 feet of additional breakwall along the east and southeastern approaches to the restoration area. This would further restrict navigation even though gaps would be provided for boater access. It would minimize the inflow of turbid lake and river waters as well as provide greater potential control of the fisheries.

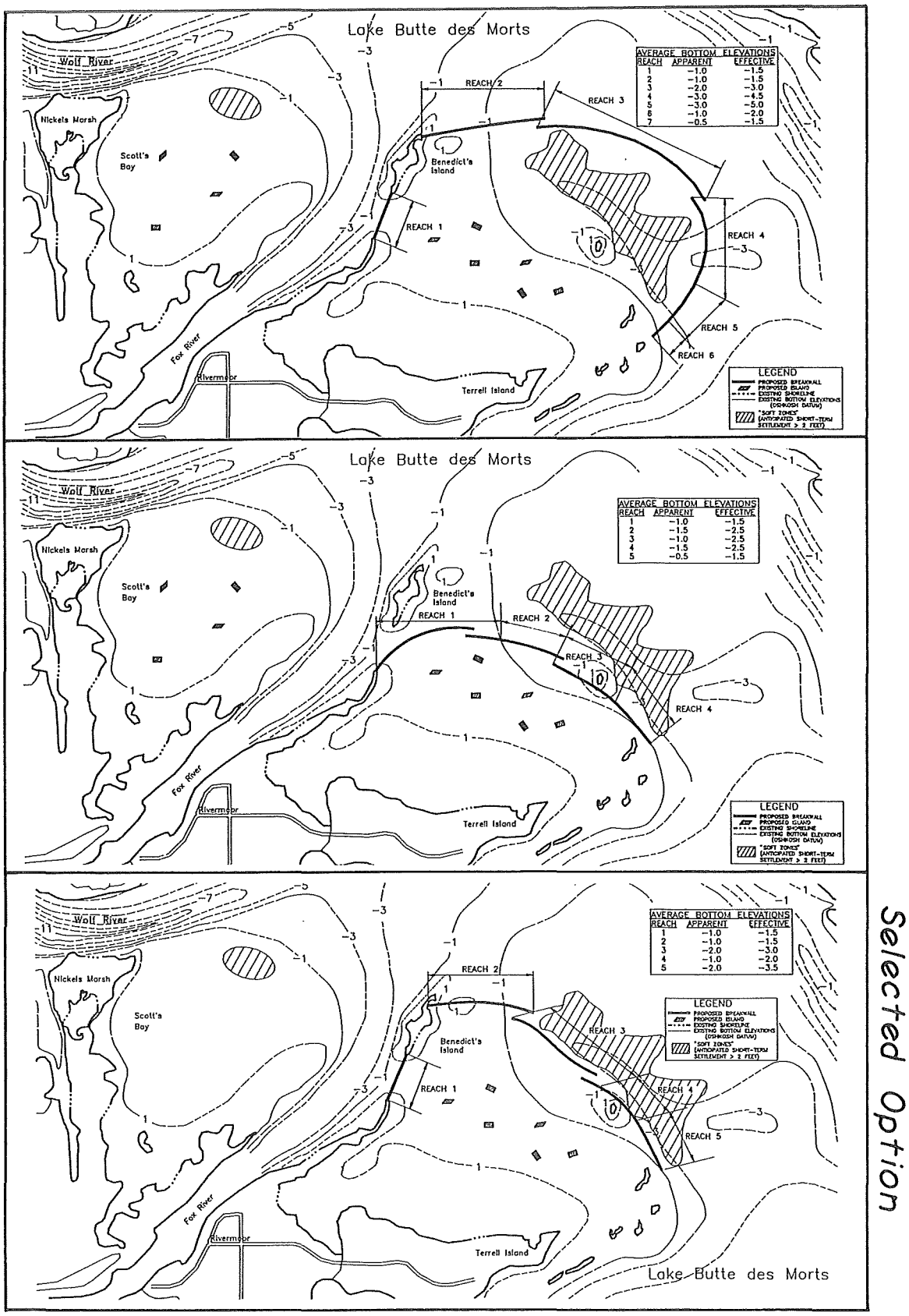


**Figure 3-1** Alternative Breakwall Locations
Lake Butte des Morts

The benefits would be reduced inflow of turbid river/lake water, easier control of nuisance fish and plants if they are compromising wetland restoration efforts, reduced wave energies, and improved water clarity thus enhancing submerged plant recolonization. Negative aspects would include the increased capital cost (about one million dollars to build an additional 2,500 feet of breakwall and modify the gaps) plus long-term maintenance expenses, less access for boaters, and potential obstruction for gamefish moving into and out of the restoration area.

## Scott's Bay

Building the Scott's Bay breakwalls rather than the Terrell's Island loop is a viable alternative. The cost would be less ($1.4 to $1.8 million versus $2.9 million), there would be less potential conflict with navigation patterns, maintenance costs would be less, and plant management costs should be lower because this area already contains relatively high quality habitat. This choice would restore a substantially smaller area (125-175 acres) of wetland, but a large, intact wetland would be protected. It would also result in continued loss of wetlands on Terrell's Island would and probably be of less value to the fisheries and endangered resources ( i.e., terns) protection efforts.

If the Department chose to pursue both the Terrell's Island and Scott's Bay breakwalls, several courses of action are available. First, more detailed flood flow modeling might show no impact or some configuration which might result in a nonsignificant flood flow increase thus defining the extent to which structures could be built in Scott's Bay. Second, the Department could seek easements from all property owners who would have a greater than 0.01 foot increase in flood flows during a 100 year flood if the original flood modeling is not disproven. County zoning maps and ordinances would have to be changed accordingly. Obtaining such easements could be a major work effort for district staff, assuming all landowners would agree to the easements.

A third course of action would be to dredge portions of the river channel to improve the capacity of the main channel to conduct flood flows. This option is attractive in that it would minimize flooding, improve navigation and could be a source building material for the wildlife islands and breakwalls. On the negative side, a significant portion of the channel probably would require dredging to have a meaningful effect on flooding. The environmental impacts of such a dredging project may be unacceptable and preliminary estimates indicate the quantity of material needing to be dredged vastly exceeds the need for this material.

Elements of all three of these approaches could be used to minimize flood impacts while maximizing habitat improvement. Specific Scott's Bay proposals could be refined if the project is approved by the Legislature, detailed engineering estimates on material needs are developed and appropriate environmental surveys completed.

Even if breakwalls are ruled out, construction of small wildlife islands in Scott's Bay is a possibility. The islands would partially act as wave barriers, should not influence flood flows, and would improve waterfowl and fishery habitat. The cost of island construction in Scott's Bay has been estimated at $50,000 a piece.

## Lakes Poygan and Winneconne

Alternative alignments for structures in these lakes were not examined in any detail. The Lake Butte des Morts restoration efforts will need to prove this management approach is successful before the other elements are constructed. If construction is pursued, the Department will conduct sediment, engineering and environmental studies similar to those conducted at Lake Butte des Morts to ensure the alignment is suitable. Alternative alignments will be discussed in environmental documents prepared for those breakwall segments chosen for construction.

## ALTERNATIVE BREAKWALL DESIGNS

The two most feasible designs for the breakwalls are rubble mound or dredge cored breakwalls with the Department preferring the merits of a rock rubble breakwall (Figure 3-2). Both types of breakwalls can be constructed to withstand the anticipated wave and ice conditions on the lakes. Rubble mound structures are less likely to erode, sustain animal damage (e.g., burrowing beavers or muskrats), and support trees (e.g., willows and cottonwoods). Dredge core structures can be very stable, would provide some nesting habitat, and may be visually more appealing. They would also require more maintenance (e.g., tree and brush removal) to prevent damage to the core of the dike. Either type of breakwall would be expected to have a long (in excess of 50 years) though undefined life span if properly constructed and maintained.

The considerations for a rubble mound structure include:

| Advantages | Disadvantages |
|---|---|
| • Engineering failure less likely. | • Greatest noise, road damage, and terrestrial impacts. |
| • Maintenance costs are probably lower. | • Fewer ecological niches created. |
| • Would not provide suitable growth for willows and purple loose strife. | |
| • Rock rubble would create suitable habitat for some insects, crustaceans and fish. | |

The advantages and disadvantages of a dredge core structure include:

| Advantages | Disadvantages |
|---|---|
| • Uses in-lake materials primarily. | • More susceptible to burrowing animal activity which could lead to erosion and would have higher maintenance costs. |
| • Dredging could improve navigation lanes. | • Would require greater sediment analysis and ecological surveys of proposed dredge areas. |
| • Capital cost is similar to the proposed rubble structure. | • May support nuisance populations of willows and purple loose strife, thus, increasing management costs. |
| • Would minimize truck traffic and terrestrial impacts - less quarrying, noise and road damage. | • If large-scale dredging were to occur local property owners and boaters may want the Department to dredge areas close to their property or establish a maintenance dredging program. The potential long-term staffing and fiscal implications of a maintenance dredging program may not be desirable from an agency perspective. |
| • Construction could occur throughout the ice free season. | |
| • Dredging could be used to create pools of varying depths and navigation lanes could be created in and around the habitat restoration areas - this would favor a wide variety of game and non-game species. | |

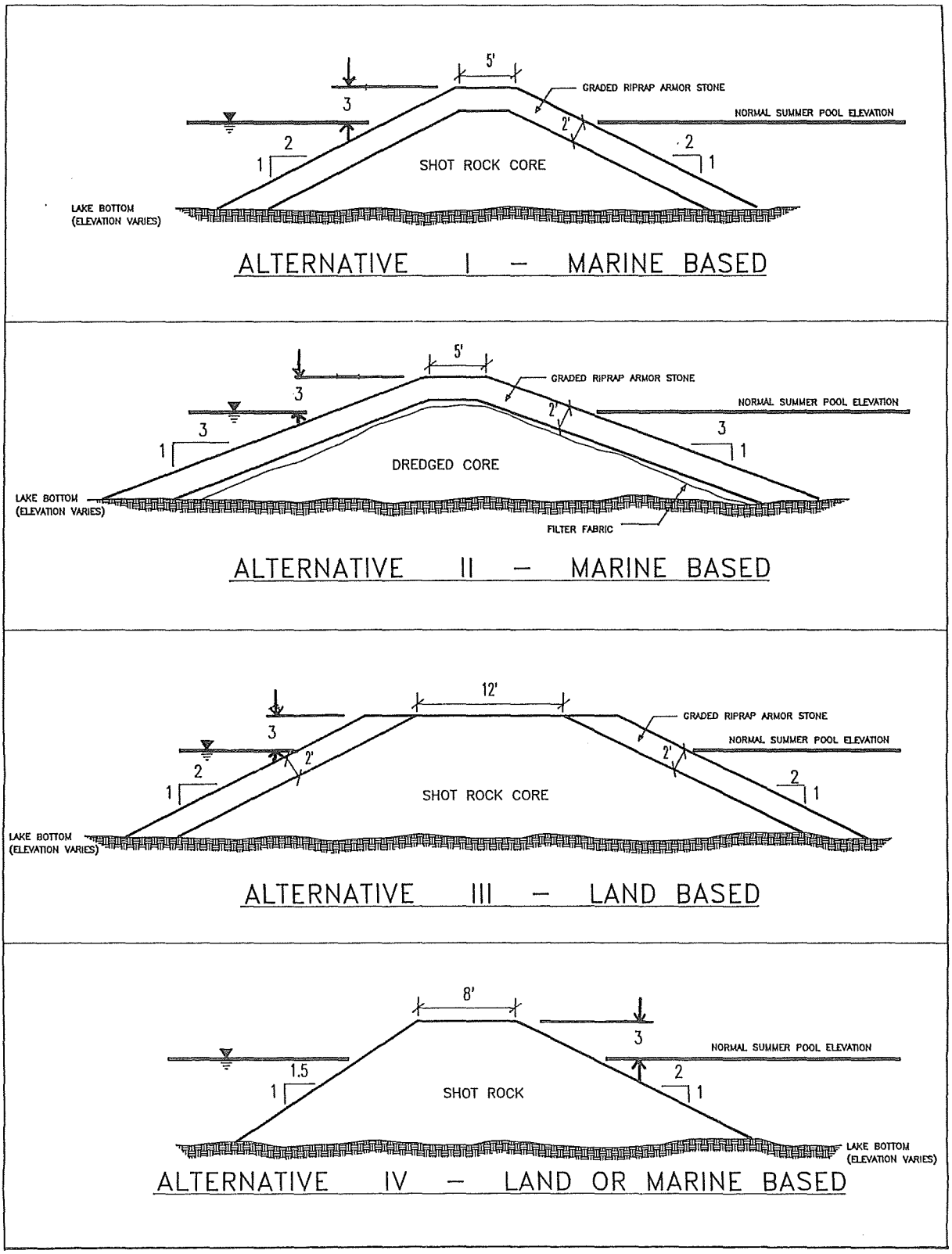


**Figure 3-2** Alternative Breakwall Designs

A number of creative construction options were also considered by the Department's consultant. They include breakwalls backed with a gradually sloped dredge bank to create additional wildlife habitat. A second idea was to construct a test segment of the Terrell's Island breakwall loop where the breakwall slopes could be varied (e.g., 2:1 rather than 3:1) or construction techniques modified to determine if the desired biological response was achieved and/or capital and maintenance costs were acceptable for wider application. This second idea has merit in that the proposed alignment and construction techniques could be studied for 1-2 years before the remaining breakwalls were built. It would provide valuable information on breakwall stability and construction constraints with minimal effects on the project schedule and costs.

Other designs for permanent structures were also considered. For example, sea walls would provide better mooring sites and would have a long effective life span, but they are extremely expensive and readily reflect waves, thus, creating very choppy conditions in gaps and near the breakwalls.

Temporary structures, such as log booms, floating tires, hinged wave barriers and other designs, were considered but eventually discarded. Some have the advantage of lower capital cost and ease of construction. Unfortunately, they would also have, lower life span (20 years or less), some are untested in real world settings, and often have high annual maintenance and management costs. Most importantly, though they might stop wave action; they would not prevent turbid lake and river water from entering the habitat restoration area. This would compromise the intent of the project. Submerged reef structures were also examined but discarded because of navigation safety, aesthetics and their limited capacity to meet project objectives.

## MITIGATION OF ADVERSE IMPACTS

As noted in the impact sections, little to no adverse impact on lake users, property owners, plant communities or fish and wildlife populations is foreseen from breakwall construction. In the event that severe, unanticipated adverse effects occurred or the desired objectives were not achieved, the draft authorizing legislation specifies that the breakwalls shall be removed. Given that the cost of removing the breakwalls could be at least as much as breakwall construction (approximately $2.4 million), the Department might choose to remediate the adverse effects rather than remove the breakwalls. For example, if accelerated erosion of Benedict's Island occurs because of the breakwalls, the Department may offer to buy the island or compensate the owner by adding or paying for additional riprap to eliminate the problem. A second example might be the extremely slow recolonization of the habitat restoration area. The Department could expand or revise its replanting program to accelerate the restoration process.

If removal of the breakwalls was required, the rock could be used for a variety of purposes. For example, the rock could be used as rip rap on the lake shores or for other construction purposes. They could also be used to construct additional wildlife islands in the Upriver Lakes or the proposed Harris Island in Lake Winnebago.

# INFORMATION SOURCES

Department staff considered numerous Department, Army Corps of Engineers, University of Wisconsin, Fox Valley Planning Agency, Fish and Wildlife Service habitat evaluation models, and other scientific studies or agency reports. A review of agency (state, local and federal) file materials and inter-agency task force results were also used extensively. Numerous phone contacts and/or personal meetings with concerned local citizens and professional staff were conducted. For example, experience from on-going habitat restoration activities by DNR and U.S. Fish and Wildlife Service on the Mississippi River was utilized to critically examine this project. Information sources used most extensively are listed below.


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## PERSONAL COMMUNICATIONS

### Department Staff

| | |
|---|---|
| Ron Bruch | Area Fish Manager |
| Art Techlow | Lake Winnebago Biologist |
| Rich Kahl | Wildlife Research |
| John Dunn | Wildlife Management |
| Gary Jolin | Wildlife Management |
| John Wetzel | Wildlife Management |
| Sarah Hurley | Wildlife Management |
| Ron Fassbender | Water Regulation and Environmental Analysis |
| Ken Johnson | Water Regulation |
| Reuel Rettig | Engineering |
| Linda Penalozza | Research |
| Bill Engfer | Law Enforcement |
| John Sullivan | Water Resources |
| Ron Benjamin | Fisheries Management |
| Dave Heath | Endangered Resources |
| Diane Mochon | Endangered Resources |
| Sumner Matteson | Endangered Resources |
| Bob Hay | Endangered Resources |

### Other Agencies

| | |
|---|---|
| U.S. Geological Survey | Leo House, Bill Krug |
| U.W. - Oshkosh | Bill McKee, Bill Sloey |
| U.S. Army Corps of Engineers | Dan Krumholts |
| U.S. Army Corps of Engineers | Hannibal Bolton |
| U.S. Fish and Wildlife Service | Rick Barry |
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| U.S. Fish and Wildlife Service | Keith Breske |
| Winnebago County Parks and Recreation | Jeff Christianson |
| Winnebago County Sheriff's Lake Patrol | Don Bender |
| Wisconsin Department of Health and Social Services | Wendy Schell |
| University of Wisconsin-Madison Extension Entomologist | Charlotte Quist |
| Winnebago County Zoning | Jerry Bougie |
| Wittman Field Manager | Richard Stokel |
| U.S. Federal Aviation Administration | Gene Le Boeuf |

# APPENDIX A

# HISTORICAL LAKE CHANGES

## Wetland Plant Communities

The first major change in plant communities occurred from the 1850s to the 1920s and was caused primarily by increased water levels and extreme water level fluctuations after impoundment, especially in years of severe flooding. Impoundment of the Winnebago Pool increased summer water levels by an average of two feet in the 1850s, and subsequent modifications to the dams raised summer water levels an additional 0.5 feet in 1937.

The two foot rise in water levels in the 1850s flooded thousands of acres of lowland marsh, sedge meadow, and prairie creating large expanses of floating bogs. These floating bogs were eroded by wave and ice action and the small, floating islands of emergent vegetation eventually sank or were readily swept away. As floating bogs and emergent vegetation declined, the area of open water expanded, allowing greater wave action which attacked the edges of the remaining marshes. Total bog and marsh loss prior to 1961 approximated 5200 acres on Lake Poygan, 1500 acres on Lake Winneconne, and 3800 acres on Lake Butte des Morts (Figure 1-2). Most of the bog and marsh is believed to have disappeared prior to 1937, with the greatest losses occurring in years with exceptionally high spring-summer water levels.

During the late 1800s and early 1900s, submerged vegetation apparently colonized deeper areas while emergent species became established in shallower areas. Lakes Winneconne and Poygan supported a greater profusion and diversity of aquatic vegetation than most other large wetlands in Wisconsin with the exception of the Upper Mississippi River. Wildrice, bulrush, and duck potato colonized many shallow zones. Wild celery was apparently the dominant submerged species, and was supposed to have covered the entire bottom in the open waters of Lake Poygan and Winneconne as well as much of Lake Butte des Morts.

The second major change in aquatic vegetation occurred after 1937 when an additional 0.5 foot increase in water level was implemented. Submerged vegetation and deep-water emergent species slowly declined through the 1950s. The decline in aquatic vegetation, especially submerged species such as wild celery, accelerated rapidly in the early to mid 1960s, marking the third, and last, major phase in the loss of aquatic vegetation.

Significant floods occurred three times within 14 years from 1960-73. In particular, severe flooding in late spring-summer 1960 resulted in higher water levels (1.6 feet above normal) that persisted longer (31 days) than in any year since 1929. Furthermore, high turbidity due to erosion from run-off and wave action on previously unexposed shorelines likely accompanied flooding. These conditions are believed to have greatly reduced the photic zone (the depth at which there is enough sunlight penetration to allow plants to grow) during May-June, eliminating aquatic vegetation from most areas except the shallowest and most protected areas.

## Water Clarity

Poor water clarity causing low light availability is believed to be the major limiting factor influencing the long-term, system-wide decline of submerged vegetation. The low water clarity, especially exacerbated by high water levels in May-June, limits the distribution of submerged vegetation to maximum depths of 5.5 feet or less in Lake Poygan and 4.5 feet or less in Lake Butte des Morts. Maximum depths of light penetration to stimulate plant growth are much less, 1.5 to 2.5 feet, near the mouths of the upper Fox

and Wolf Rivers due to the direct influence of turbid river water flowing and back eddying through the shallow estuaries.

The factors causing poor water clarity are turbidity, high nutrient concentrations, and late spring - early summer water levels which affects the amount of lake bottom with sufficient light to support rooted plants and thus the abundance of submerged vegetation. Primary sources of turbidity include the Fox and Wolf Rivers, and in-lake algae populations. Wave action and rough fish may have a greater impact on submerged vegetation in the Upriver Lakes by contributing to turbidity than through direct physical damage to plants. Nutrients stirred up from sediments by waves and rough fish -- primarily carp and sheepshead -- may be more important sources of nutrients for nuisance algae than external sources.

Emergent plants are believed to have declined because of long-term high water levels and periodic excessive flooding. Physical disruption by waves and carp probably limit expansion of existing beds or re-establishment of new beds. Certain well established emergent plant beds, such as the canes, are tolerating water depths up to 4.0-4.5 feet deep on the Upriver Lakes.

## Waterfowl Usage

In addition to wetland losses, the resident and migratory waterfowl use of the lakes has declined dramatically. Peak fall duck populations prior to the 1960s reached 108,500, of which 42,300 were canvasbacks, in 1956. These populations dropped to 15,000 in 1962 and rebounded to 45,000 in 1964 and 1965. But by 1968 peak fall populations had dropped to 2200, of which 820 were canvasbacks. Peak migratory canvasback populations during fall averaged 723 from 1985 to 1989, with a high of 1500 in 1989. Peak migratory canvasback populations during spring averaged 4,416 from 1986 to 1990, with a high of 6,150 in 1987. Peak migratory scaup populations during fall averaged 550 from 1985 to 1989, with a high of 1,000 in 1985, and peak populations during spring averaged 1,923 from 1986 to 1990, with a high of 2,920 in 1988. Returning to peak waterfowl populations of the 1950s is unlikely in the foreseeable future due to major habitat losses in the breeding and wintering areas of migratory waterfowl.

# APPENDIX B
# AGENCY PLANNING EFFORTS

## FOX-WOLF LAKES TASK FORCE

In response to severe habitat degradation and uncertainty about the causes, the Lake Michigan District of the Wisconsin Department of Natural Resources formed the Fox-Wolf Lakes Task Force in 1974. This task force assembled information on habitat deterioration, assessed the impacts of habitat loss on fish and wildlife resources, and discussed problems associated with water level fluctuations and improved water level management. Findings of the task force, subsequently reinforced by more current investigations, revealed the primary factors limiting overall abundance of aquatic vegetation in the Upper Winnebago Pool Lakes are low water clarity, high spring-summer water levels, and water level fluctuations.

## WINNEBAGO COMPREHENSIVE MANAGEMENT PLAN (WCMP)

The WCMP is the most recent lake planning effort. It is a conceptual plan that identifies resource use and management needs for the system, sets clear objectives to address those needs, and lists options for management activities. Some of the activities outlined in the WCMP are already part of either a DNR or some other agency's programs. Other activities will require various legal permits, possibly legislation, or at least further study to fully implement. Most of the activities taken from the plan will require involvement by citizens, local governments, and interested groups in the scheduling, funding or constructing of specific projects. A portion of this involvement will occur through the WCMP User Committee which will continue to function as a formal group responsible for providing input to the DNR on Winnebago system resource management. Implementation of various management options, over time, should move the system's users collectively towards accomplishing the objectives stated in this plan.

## TECHNICAL PLANNING COMMITTEES

The project coordinator began the planning process by conducting an extensive appraisal of the interests and concerns of individuals, agencies and organizations with a stake in the management and/or use of the Winnebago system's resources. This appraisal resulted in the formation of three technical planning committees as well as an ongoing citizens participation program. The three technical planning committees were formed to address fish and wildlife, water quality, and user conflict problems. They were charged with identifying problems that impair the ecological diversity and quality and/or the use and management of the Winnebago system's resources; drafting goals and objectives for the desired state of the system; and proposing and evaluating alternative management strategies that would achieve the intentions of the project goal. Technical planning committees and their membership include:

### Biota and Habitat Committee (BHC)

Problem Areas:

* Habitat restoration, management and protection
* Fisheries, wildlife and endangered resources management and research

Membership:

DNR Winnebago Management Project
DNR Winnebago Fisheries Management
DNR Winnebago Wildlife Management
DNR Fisheries Research
DNR Wildlife Research
DNR Water Regulations and Zoning
DNR Bureau of Endangered Resources
DNR Bureau of Fisheries Management
DNR Bureau of Information Management
DNR Bureau of Wildlife Management
Corp of Engineers-Fox River Project
University of Wisconsin-Oshkosh

## Nutrient and Eutrophication Committee (NEC)

Problem Areas:

* Nutrient and sediment management

Membership:

DNR Winnebago Management Project
Calumet Co. Land Conservation Dept.
DNR Bureau of Water Resources Management
Wisconsin Paper Council
Outagamie Co. Land Conservation Dept.
Waupaca Co. Land Conservation Dept.
Soil Conservation Service
Fox Valley Water Quality Planning Agency
DNR Water Quality Planning
Green Lake Co. Land Conservation Dept.
Wis. Dept. of Agriculture, Trade & Consumer Protection
Oshkosh Water Supply and Treatment
Columbia Co. Land Conservation Dept.
Waushara Co. Land Conservation Dept.
Fond du Lac Co. Land Conservation Dept.
Institute of Paper Chemistry
Shawano Co. Land Conservation Dept.
DNR Industrial Wastewater Bureau
DNR Bureau of Information Management
University of Wisconsin-Oshkosh
Adams Co. Dept. of Land Conservation
Winnebago Co. Land & Water Conservation Dept.
Portage Co. Land Conservation Dept.

## User Committee (UC)

Problem Areas:

* User conflicts
* Public Information/Education
* Access and public use areas

Membership:

Wis. Conservation Congress
Winnebago Waterways Association
DNR Winnebago Management Project
Winnebago Area Conservation Alliance
DNR Law Enforcement
Wis. Council of Sport Fishing Organizations
DNR Citizens Participation Specialist
Harbormaster - Winneconne
Winnebago Co. Parks
DNR Public Information Specialist
Resort Owner/Operator - Eureka
DNR Area Land Agent
Lakeshore Property Owner - Lake Butte des Morts
Oshkosh Boat Club
East Central Wis. Regional Planning Commission
Waupaca Co. Board
Marina Owner/Operator - Winneconne
Winnebago Audubon Society
DNR Environmental Education
League of Women Voters
Farmers
DNR Community Services Specialist
Businessman/Lakeshore Property Owner - Omro
Fond du Lac Co. Board
Wolf River Boating Interest
Outagamie Co. Board
Winnebago Co. Land & Water Conservation Dept.
Wisconsin Furfarmers Association

## CITIZENS PARTICIPATION PROGRAM

The WCMP project coordinator, with the help of members from the User Committee, conducted a citizens participation process in parallel with the technical planning committee process. Extensive efforts were made to ensure citizens had opportunities to become involved in the Winnebago planning and decision making process. Specific techniques used to ensure participation included:

* developing a computerized mailing list of over 1,100 individuals and groups to facilitate mailing project information, public information meeting announcements, news releases, etc.;

* conducting dozens of personal interviews with a wide range of user interests to introduce the project and gain an understanding of various views on management and use of the system's resources;

* establishing the User Committee with membership primarily composed of citizens and planning responsibilities on an equal level with the other planning committees;

* holding 19 public information exchange meetings throughout the region to discuss various planning products with the public, as they were developed. Meetings were moderated by a volunteer from the User Committee and were run to facilitate maximum information exchange with the attendants through small working groups. All information received at the meetings was recorded, summarized and used in plan development. Summaries were then sent out to all meeting attendants;

* making project presentations to dozens of citizen organizations including sportsmen's clubs, boating clubs, business development organizations, Kiwanis, Rotary Clubs, church groups, etc.;

* developing a poster series describing the project which was displayed at area sport shows, planning and citizens meetings, and other places;

* working closely with the media to maintain area and statewide exposure and understanding of the project.

# APPENDIX C

# EIS ISSUE IDENTIFICATION

A special workshop was held in the Village of Winneconne on August 25, 1988 to allow citizens to voice their concerns, questions, and comments on the proposed breakwalls. Key issues identified by the 286 people present included:

* potential effects breakwalls will have on sediment deposition and water quality
* location of breakwalls
* cost of the project
* maintenance of breakwalls
* impacts on boating, flooding, and property values
* impacts on fish and wildlife populations and habitat
* access to the restoration areas
* effectiveness of breakwalls on achieving desired objectives

A second public meeting was held in January 1990 to describe the scope of the EIS and seek out any additional concerns. Department staff have also had numerous phone and personal contacts with lake users, Lake Butte des Morts property owners, and others interested in this project.

# APPENDIX D

# PROPOSED WETLAND RESTORATION ACTIVITIES AND ESTIMATED COSTS

The Department is proposing the following planting program for the Lake Butte des Morts restoration area.

## SUBMERGED PLANTS

1. Department staff would plant 2-3 tubers of wild celery or sago pondweed in a mesh bag per every square meter in about 20 0.5 acre plots inside the Terrell's Island enclosure in Lake butte des Morts. Such a scheme would result in a moderately dense planting of 35,000 tubers/hectare.

2. The plantings would be done in a scientific manner to enable Department researchers to evaluate the effects of water depth, water clarity, substrate type and planting density on restoration success.

3. Tuber harvesting and planting would be done in the early spring for two to three years following breakwall and island construction. The success of the plantings would be monitored over a five year period.

4. Tubers of desired plants would be harvested by Department staff from lakes in central and southeastern Wisconsin where excess plant populations of the desired species are available. Wisconsin sources of these plants are considered best because the plants should be adapted to the conditions (e.g., water chemistry, climate, etc.) found in the Upriver Lakes.

5. Plantings may be predominantly wild celery because the supply of readily harvestable tubers is believed to be much more abundant.

6. Harvesting and planting staff costs for a 2-3 year restoration effort could range from $10,000-$15,000/year.

## EMERGENT SPECIES

- Department staff would plant rootstock of hardstem bulrush river bulrush and arrowhead along the shoal and margins of the wildlife islands at a rate of 20,000 rootstock/acre. One 0.5 acre plot would be planted next to each island. The rootstock would be harvested by Department personnel from Wisconsin wetlands.

- The planting format would be by scientific design to study depth, substrate, planting techniques, and planting density interactions.

- Harvesting and planting in early spring over a 2-3 year period following construction would be best.

- The planting zone would be from waters edge to approximately 2.0 feet deep.

- The shoal areas may be seeded with wild rice also.

- The estimated time and cost of the emergent planting effort over the recommended 2-3 year period is approximately 1,800 hours with overall staff, travel and equipment costs of $50,000.

## Nuisance Plant Control

- No control of cattail, elodea, coontail, lotus or algae is proposed.

- If Eurasian water milfoil and purple loosestrife are present, the Department will attempt to manage these populations before, during and after the breakwalls are constructed.

- Early control efforts for milfoil while populations are low, would be preferred so that more extensive control effort may be avoided later.

- Cost of nuisance plant control is estimated to be $3,000-$6,000/year over the first two years.

Additional expenses such as travel, equipment and supplies could cost an additional $2,000-$4,000/year. If a special harvesting boat is needed this could add an additional one time cost of $10,000. Long-term monitoring, research analysis and write-up could add $30,000-$40,000 per year over the five year study period.

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