

Lauderdale Lakes (Walworth County, Wisconsin) Integrated Sensitive Area Report

Assessment Dates: June 14, 1990 - Areas 1-5
July 7 and September 2, 2004 - Areas 6-7

Number of Sensitive Areas Surveyed: 7

Site Evaluators: 1990:
Jerry Collins, Water Resources Specialist
Doug Welch, Fisheries Biologist
Bob Wakeman, Water Resource Manager
Mark Anderson, Wildlife Biologist

2004:
Pam Schense, Water Resources Specialist
Doug Welch, Fisheries Biologist
Heidi Bunk, Lakes Biologist
Jim Jackley, Wildlife Biologist
Dave Heilmeyer, Town of LaGrange
Scott Mason, Lauderdale Lakes
Management District
Rick Callaway, Town of LaGrange

Authors: Pat Campfield, Water Resources Specialist
Gabe Powers, Water Resources Specialist
Heidi Bunk, Lakes Biologist

General Lake Information

The Lauderdale Lakes consist of a chain of three lakes - Green, Middle, and Mill Lakes - located in north-central Walworth County (Township 4 North, Range 16 East, Sections 25-26, 34-36 and Township 3 North, Range 16 East, Sections 1-2). The Lakes have a total surface area of 807 acres with maximum depths ranging from 42-55 feet. Middle and Mill Lakes are characterized as drainage lakes, fed primarily by groundwater, precipitation, and runoff. They have no major surface inlets. Green Lake is spring fed. Lake level of the Lauderdale Lakes is controlled by a dam and weir at a single surface-water outlet, Honey Creek.

The Lauderdale Lakes serve as “all sports” lakes, withstanding intense anthropogenic pressure. The shoreline is approximately 70 percent developed, including 1,010 houses. Three public boating access sites are located on the western shores of Green and Middle Lakes and the eastern shore of Mill Lake, meeting the requirement of “adequate public access” defined by NR 1.91(11), Wis. Adm. Code. There are five

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private recreational facilities offering boating access to the general public (SEWRPC 2001).

The Lakes have multiple recreational uses. These include fishing, water skiing, swimming, and small craft sailing in summer months and ice fishing, cross-country skiing, ice-skating, and hunting during winter. Throughout the year, the Lakes provide natural scenic beauty and opportunities for walking and jogging, bird watching, and picnicking.

Overall, the Lauderdale Lakes have a diverse fish population, including multiple “forage” and “non-game” fish species, and several “game” species. In a 1999 survey, the Wisconsin Department of Natural Resources observed 19 fish species: northern pike, grass pickerel, longnose gar, walleyed pike, largemouth bass, yellow perch, warmouth, bluegill, pumpkinseed, green sunfish, black crappie, rock bass, golden shiner, yellow bullhead, brown bullhead, bowfin, brook silverside, white sucker, and lake chubsucker (Welch 2000).

The lake chubsucker (*Erimyzon sucetta*) is listed as a State **species of special concern** (Lyons et al. 2000). Special Concern species are those in which reduced abundance or distribution is suspected but not yet proven. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. *E. sucetta* relies on dense vegetation for cover throughout its life history. Large and small beds of aquatic moss and filamentous algae are preferred for spawning between late March and early July. Young lake chubsuckers feed on copepods, cladocerans (e.g., *Daphnia*), and midge larvae. Adult lake chubsuckers prey upon these same items, as well as algae, molluscs, and both larval and adult insects. It is a valuable forage fish and fry are a preferred food of largemouth bass (Becker, 1983). In areas where lake chubsucker habitat exists, preservation is highly recommended.

Fish habitat in the Lauderdale Lakes consists mostly of aquatic vegetation. Minimal woody debris, overhanging vegetation, and fallen timber exist along the lakeshore. The lack of natural fish habitat is due to the largely developed shoreline and associated “urbanized lakefront landscapes”. Remaining undeveloped shoreline provides critical habitat for fish, reptiles, amphibians, waterfowl, and small and large mammals.

Prime wildlife habitat exists on the Lauderdale Lakes where shoreline and waterfront areas remain natural or in areas where waterfront owners kept “natural corridors” in place. During urbanization of the Lakes, most developed properties retained some large trees, conserving the canopy. However, these owners also eliminated the sub-canopy and associated shrubbery. The sub-canopy provides important nesting, feeding, and cover habitat for multiple species. Consequently, most wildlife remaining in and around the Lauderdale Lakes are urban-tolerant species. The resident mammal population includes white-tailed deer, muskrats, cottontail rabbits, and some squirrels. Songbirds, wood ducks, mallards, and Canada geese are representative avian species. The remaining undeveloped areas associated with the Lakes provide the only balanced cover for a number of wildlife species.

The Lauderdale Lakes Lake Management District is the primary sponsor for aquatic plant management goals/plans on the lakes, currently controlling nuisance plants by harvesting and chemical treatment. In past aquatic plant studies of the entire Lauderdale Lakes chain, approximately 25 plant species were observed (SEWRPC 2001). In 1990, Department surveyors observed 10 native aquatic plant species in sensitive area 1, 8 native plant species in sensitive area 2, 18 native species in sensitive area 3, 13 native species in sensitive area 4, and 10 native species in sensitive area 5. In the 2004 survey, 10 native species occurred in sensitive area 6 and 12 native species in sensitive area 7. Three exotic species were observed in these sensitive areas. Eurasian watermilfoil (*Myriophyllum spicatum*) was observed in areas 1-6. Curly-leaf pondweed (*Potamogeton crispus*) was observed in sensitive areas 2-6, and purple loosestrife (*Lythrum salicaria*) was observed in sensitive areas 6-7.

Exotic Species

Southeastern Wisconsin lakes have been invaded by aquatic exotic species, most notably zebra mussels, Eurasian watermilfoil, and purple loosestrife. Most exotic species are introduced to a waterbody anthropogenically (e.g., transient boaters). The disturbance of lake substrate from human activity (boating, plant harvesting, chemical treatments, etc.) plays a significant role in the colonization and/or expansion of exotic species, particularly exotic plants.

Eurasian watermilfoil has established itself as one of the most common and abundant plants in the Lauderdale Lakes. It occurred in all but one of the sensitive areas. Eurasian watermilfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monocultures and out competed many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of Eurasian milfoil is yet another obstacle when attempting to control this species. Fragments of Eurasian watermilfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling Eurasian watermilfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective “treatment” of exotic milfoil is prevention through public education.

Curly-leaf pondweed is another submerged, exotic species found in the Lauderdale Lakes. Like Eurasian watermilfoil, curly-leaf grows into large, homogenous stands. It also crowds out native vegetation, creates navigational problems, and limits fish movement. Also, a unique life history characteristic of curly-leaf pondweed is that the

plant dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly-leaf pondweed makes management difficult. The plant germinates as temperatures decrease in Fall. Curly-leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice-off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly-leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly-leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, was desirable primarily as an ornamental plant but also marketed for bee keeping. It was transported in soil used as ballast during shipping. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Monotypic stands of purple loosestrife out compete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius transversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources (Woodford and Meyer 2003, Garn 2002). Therefore, many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this

report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, the reader also should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat (see A. Greene 2003). This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

Introduction

Department personnel conducted Lauderdale Lakes sensitive area designation surveys on June 14, 1990 and July 7 and September 2, 2004, following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation, water chemistry, fisheries, lake biology, and wildlife.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) as *areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water*. Department resource managers determined that five areas met this definition in 1990. Two additional areas were added in 2004 (Fig. 1). Their recommendations on future management of these areas are included below.

The companion document, *Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas*, provides additional information to help interpret lake sensitive area reports. This document is designed to help people understand the important factors that determine the health of a lake's ecosystem. It discusses aquatic plant sensitive areas, shoreland use and lakeshore buffers, gravel and coarse rock rubble habitat, large woody cover, and various water regulation and zoning issues.

Overview of Sensitive Area Designations

Sensitive areas often have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or

logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A designated sensitive area alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem or may feature an endangered plant or animal. Information presented in a sensitive area report may discourage certain permits from being approved within these sites.

Whole Lake Recommendations:

Several recommendations from Department staff pertain to the Lauderdale Lakes chain as a whole rather than to individual sensitive areas:

1. The aquatic plant community in the Lauderdale Lakes is not highly diverse outside of the sensitive areas. Native aquatic plant beds should be protected and maintained.
2. Prevent the spread of exotic species through sign postings, education, etc. and control exotic species where established.
3. Comply with State and Local Shoreland Zoning standards by maintaining no-cut buffers and setbacks, removing non-conforming structures, and limiting impervious surfaces.
4. Create shoreland buffers and maintain existing buffers, especially in areas not currently developed.
5. Monitor water quality for early detection of changes and possible degradation.

Resource Value of Sensitive Area Site 1 – Lauderdale Lakes

Sensitive area 1 is located on the southwest end of Green Lake and is unique to the Lauderdale Lakes (Fig. 2). Water lilies in the bay may shade out Eurasian watermilfoil. Eurasian watermilfoil only is present on the outer edge of the bay. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes. The substrate in the bay is muck. This area has not been the target of plant control activities.

The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. Aquatic vegetation (Table 1) helps control shoreline erosion. It also provides northern pike, largemouth bass, bluegill, and forage fish (suckers and minnows) with spawning, nursery, and foraging habitat (Table 2).

The extensive development of the Lauderdale Lakes area has reduced available wildlife habitat. However, ducks, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake the majority of the year.

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Table 1. Plants observed in sensitive area 1.

| | | | | |
|-----------------------------|--|---|--|--|
| PRESENT (0-25% Cover) | Emergent <i>Typha</i> (cattail) <i>Scirpus</i> (bulrush) <i>Carex</i> (sedges) | Submergent <i>Utricularia</i> (bladderwort) <i>Ceratophyllum</i> (coontail) <i>Stuckenia pectinata</i> (sago pondweed) <i>P. praelongus</i> (white-stemmed pondweed) | Free-floating <i>Nymphaea odorata</i> (white water lily) <i>Nuphar advena</i> (yellow water lily) <i>Lemna</i> (duckweed) | Exotic <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) |
| COMMON (26-50% Cover) | | | | |
| ABUNDANT (51-75% Cover) | | | | |
| DOMINANT (76-100% Cover) | | | | |

Table 2. Sensitive area 1 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|----------------------------------|---|--|--|
| Northern Pike | cattail | cattail, water lily, coontail, milfoil, sago | water lily, coontail, milfoil, sago | water lily, coontail, milfoil, sago |
| Largemouth Bass | coontail, milfoil | cattail, water lily, coontail, milfoil, sago | water lily, coontail, milfoil, sago | water lily, coontail, milfoil, sago |
| Rock Bass | coarse sand or gravel | cattail, water lily, coontail, milfoil, sago | sago, milfoil | sago, milfoil |
| Bluegill and Pumpkinseed | sand/gravel | cattail, water lily, coontail, milfoil, sago, clasping leaf | water lily, coontail, milfoil, sago, clasping leaf | water lily, coontail, milfoil, sago, clasping leaf |
| Black Crappie | fine gravel and sand | water lily, coontail, milfoil, sago | sago, milfoil | sago, milfoil |
| Yellow Perch | cattail, coontail, milfoil, sago | water lily, coontail, milfoil, sago | sago, milfoil | sago, milfoil |

* Shaded rows identify fish species found in the Lauderdale Lakes but not specifically observed in this SA.

Management Recommendations for Sensitive Area #1

1. No chemical treatment will be permitted.
2. Mechanical control allowed with the following condition:
Restrict harvesting to a 25-foot wide navigational channel from the boat launch to open water.
3. None of the following in-lake activities allowed:
 - Filling
 - Aquatic plant screens
 - Wetland alterations
 - Boardwalks
 - Pea gravel/sand blankets
4. The following in-lake activities may allowed with conditions:
 - Dredging only in navigational channel from boat launch.
5. Strictly enforce shoreland and wetland ordinances.
6. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A “No-Wake Zone” should be implemented.

Resource Value of Sensitive Area Site 2 – Lauderdale Lakes

Sensitive area 2 consists of a small bay on the north shore of Middle Lake that is dominated by *Decodon* (water willow) (Fig. 3). Its quiet water and proximity to upland areas are important to the Lakes. *Decodon* acts as a buffer for runoff entering the bay. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. The substrate is primarily silt and muck in open water areas. Aquatic vegetation helps control shoreline erosion (Table 3). It also provides northern pike, largemouth bass, and bluegill with spawning, nursery, and foraging habitat (Table 4). The bay is often not navigable by boat.

This area is not critical to fisheries in the Lakes. It is extremely important to wildlife. The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake during the majority of the year. The upland woods located west of the bay are valuable to migratory songbirds.

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Table 3. Plants observed in sensitive area 2.

| | | | | |
|-----------------------------|-----------------|--|--|-----------------------------------|
| PRESENT (0-25% Cover) | Emergent | Submergent <i>Vallisneria</i> (wild celery) <i>P. praelongus</i> (white-stemmed pondweed) <i>P. zosteriformis</i> (flat-stemmed pondweed) <i>Elodea</i> (waterweed) | Exotic <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) <i>P. crispus</i> (curly-leaf pondweed) | Algae filamentous algae |
| COMMON (26-50% Cover) | | Submergents <i>Chara</i> (muskgrass) | Free-floating <i>Nuphar</i> (yellow water lily) | |
| ABUNDANT (51-75% Cover) | | | | |
| DOMINANT (76-100% Cover) | | <i>Decodon</i> (water willow) | | |

Table 4. Sensitive area 2 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|-----------------|--|---|---|
| Northern Pike | <i>Chara</i> | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Largemouth Bass | milfoil | water lily, <i>Chara</i> , wild celery, milfoil | water lily, wild celery, milfoil | water lily, wild celery, milfoil |
| Rock Bass | | water lily, <i>Chara</i> , wild celery, milfoil | milfoil | milfoil |
| Bluegill and Pumpkinseed | | water lily, <i>Chara</i> , wild celery, milfoil | water lily, wild celery, milfoil | water lily, wild celery, milfoil |
| Black Crappie | <i>Chara</i> | water lily, <i>Chara</i> , wild celery, milfoil | milfoil | milfoil |
| Yellow Perch | milfoil | water lily, <i>Chara</i> , wild celery, milfoil | milfoil | milfoil |

Management Recommendations for Sensitive Area # 2

1. No chemical treatment will be permitted.
2. No mechanical harvesting will be permitted.
3. None of the following in-lake activities allowed:

| | |
|-----------------------|--------------------------|
| Filling | Pea Gravel/Sand Blankets |
| Aquatic plant screens | Dredging |
| Wetland alterations | Boardwalks |
4. Strictly enforce shoreland and wetland ordinances.
5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion.

Resource Value of Sensitive Area Site 3 – Lauderdale Lakes

This is the largest of the sensitive areas on the Lakes, consisting of the western third of Middle Lake (Fig. 4). The area contains the greatest diversity of emergent, submergent, and floating plants within the Lakes, including wild rice. Water lilies, logs, stumps, and vegetation provide cover for fish. The abundance and diversity of native pondweed species (*Potamogeton* spp.) provide essential cover for a variety of fish species. This is excellent spawning and nursery habitat for largemouth bass, bluegill, and pumpkinseed. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The area acts as a sediment and nutrient trap for the lake, enhancing water quality. The substrate is sand, silt, and muck. The area is unique because it contains valuable spawning habitat for sunfish. Aquatic vegetation (Table 5) also provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 6).

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, ducks, geese, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake during certain periods of the year. The boundaries of this sensitive area expanded between the study conducted in 1990 and the study conducted in 2004. The wild rice bed expanded to the north and the east. This change will affect 13 riparian landowners.

Table 5. Plants observed in sensitive area 3.

| | Emergents | Submergents | Free-floating | Algae |
|-----------------------------|--|--|--|-------------------|
| PRESENT (0-25% Cover) | <i>Decodon</i> (water-willow) <i>Typha</i> (cattail) <i>Scirpus</i> (bulrush) <i>Carex</i> (sedges) | <i>Myriophyllum sibiricum</i> (northern watermilfoil) <i>Elodea</i> (waterweed), <i>Najas flexilis</i> (slender naiad) <i>Chara</i> (muskgrass) <i>Vallisneria</i> (wild celery) <i>Utricularia</i> (bladderwort) | <i>P. natans</i> (floating-leaf pondweed) <i>Nuphar advena</i> (yellow water lily) <i>Nymphaea</i> (white water lily) Exotics <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) <i>P. crispus</i> (curly-leaf pondweed) | filamentous algae |
| COMMON (26-50% Cover) | | <i>P. zosteriformis</i> (flat-stemmed pondweed) <i>Stuckenia pectinata</i> (sago pondweed) <i>P. illinoensis</i> (Illinois pondweed) | | |
| ABUNDANT (51-75% Cover) | <i>Zizania</i> (wild rice) | | | |
| DOMINANT (76-100% Cover) | | | | |

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Table 6: Sensitive area 3 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|----------------------------------|--|---|---|
| Northern Pike | <i>Chara</i> | <i>Chara</i> , water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Largemouth Bass | milfoil sand | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds, woody debris | water lily, wild celery, milfoil, pondweeds, woody debris |
| Rock Bass | | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Bluegill and Pumpkinseed | sand | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Black Crappie | <i>Chara</i> sand | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil, woody debris | pondweeds, milfoil, woody debris |
| Yellow Perch | woody debris, milfoil, pondweeds | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |

Management Recommendations for Sensitive Area # 3

1. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.
2. Restrict mechanical harvesting to a navigational channel along the developed shoreline but only after spawning activities have finished.
3. A DNR permit should not be issued for any of the following:
 - Filling
 - Aquatic plant screens
 - Dredging along the undeveloped area
 - Wetland dredging, filling or cutting
 - Boardwalks
4. The following in-lake activities may be allowed with conditions:
 - Dredging a navigational channel along the currently developed shoreline
 - Pea gravel/sand blankets along the currently developed shoreline
5. Maintain the “No-Wake Zone”.

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6. Recommendations regarding **local zoning** along the currently undeveloped shoreline:
- Strictly enforce shoreland and wetland ordinances
 - Restrict/limit subdivision of existing undeveloped parcels
 - Require a buffer/"no touch" zone for grading projects. This buffer/"no touch" zone should be at least 200 feet from the edge of the wetland back into the (landward) upland portion of parcels.
 - Require a buffer/"no touch" zone for grading projects located along steep slopes. The zone should extend at least 200 feet from the edge of a steep slope towards the landward side of the parcel.
 - Grading proposals should be strictly examined for superior erosion control and nutrient management plans.

Resource Value of Sensitive Area Site 4 – Lauderdale Lakes

This is a shallow (<5 feet) area adjacent to a wetland on the southwestern shore of Mill Lake (Fig. 5). Large-leaf pondweed is abundant here. The aquatic plant community is not unusually valuable, except for the large-leaf pondweed (Table. 7). However, the proximity of aquatic plants to the wetland improves the overall value of this area. See Appendix 1 for a complete list of aquatic plants found in the sensitive areas of the Lauderdale Lakes.

Northern pike use the area for spawning, while the large amount of cover provides shelter for waterfowl. Aquatic vegetation provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 8).

The wetland provides a buffer for runoff entering the lake. It traps sediment and nutrients, enhancing water quality. Aquatic vegetation helps control shoreline erosion.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this area is locally important as fish and wildlife habitat. Herons, bittern, songbirds, muskrat, and opossum inhabit this portion Mill Lake during the majority of the year.

Table 7. Plants observed in sensitive area 4.

| | | | |
|-----------------------------|--|--|---|
| PRESENT (0-25% Cover) | Emergents <i>Decodon</i> (water-willow) <i>Typha</i> (cattail) <i>Scirpus</i> (bulrush) <i>Carex</i> (sedges) | Submergents <i>Elodea</i> (waterweed), <i>Najas flexilis</i> (slender naiad) <i>Chara</i> (muskgrass) <i>Vallisneria</i> (wild celery) <i>P. zosteriformis</i> (flat-stemmed pondweed) <i>P. illinoensis</i> (Illinois pondweed) | Free-floating <i>Nuphar advena</i> (yellow water lily) <i>Nymphaea</i> (white water lily) Exotics <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) <i>P. crispus</i> (curly-leaf pondweed) |
| COMMON (26-50% Cover) | | | |
| ABUNDANT (51-75% Cover) | <i>P. amplifolius</i> (large-leaf pondweed) | | |
| DOMINANT (76-100% Cover) | | | |

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Table 8: Sensitive area 4 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|--------------------|--|---|---|
| Northern Pike | <i>Chara</i> | <i>Chara</i> , water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Largemouth Bass | milfoil | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Rock Bass | | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Bluegill and Pumpkinseed | | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Black Crappie | <i>Chara</i> | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil, woody debris |
| Yellow Perch | milfoil, pondweeds | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |

Management Recommendations for Sensitive Area # 4

1. No chemical treatment permitted.
2. Restrict mechanical harvesting to a navigational channel extending from piers.
3. None of the following in-lake activities allowed:
 - Filling
 - Aquatic plant screens
 - Wetland alterations
 - Boardwalks
 - Dredging
 - Pea gravel/sand blankets
4. Strictly enforce shoreland and wetland ordinances.
5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A “No-Wake Zone” should be implemented.

Resource Value of Sensitive Area Site 5 – Lauderdale Lakes

This area of the Lauderdale Lakes is located between Treasure Island and the Lauderdale Country Club Golf Course (Fig. 6), in Don Jean Bay. The area has large beds of large-leaf pondweed. The pondweed bed on the extreme western shore of the island should be protected from any removal activities. There is good shoreline cover consisting of woody growth and the north side of the island is excellent for wildlife.

There is little water flow through the area and the substrate is soft muck/silt. The area acts as a sediment and nutrient trap for the lake, enhancing water quality.

Aquatic vegetation (Table 9) controls shoreline erosion and provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 10). See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. Ducks, geese, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of Mill Lake during the majority of the year.

Table 9. Plants observed in sensitive area 5.

| | Emergents | Submergents | Free-floating | Algae |
|-----------------------------|------------------------|---|---|-------------------|
| PRESENT (0-25% Cover) | <i>Typha</i> (cattail) | <i>Elodea</i> (waterweed) <i>Najas flexilis</i> (slender naiad) <i>Chara</i> (muskgrass) <i>Vallisneria</i> (wild celery) <i>P. zosteriformis</i> (flat-stemmed pondweed) | <i>P. natans</i> (floating-leaf pondweed) <i>Nuphar advena</i> (yellow water lily) | filamentous algae |
| COMMON (26-50% Cover) | | | Exotics <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) <i>P. crispus</i> (curly-leaf pondweed) | |
| ABUNDANT (51-75% Cover) | | | | |
| DOMINANT (76-100% Cover) | | <i>P. amplifolius</i> (large-leaf pondweed) | | |

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Table 10: Sensitive area 5 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|--------------------|--|---|---|
| Northern Pike | <i>Chara</i> | <i>Chara</i> , water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Largemouth Bass | milfoil | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Rock Bass | | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Bluegill and Pumpkinseed | | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds | water lily, wild celery, milfoil, pondweeds |
| Black Crappie | <i>Chara</i> | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Yellow Perch | milfoil, pondweeds | water lily, <i>Chara</i> , wild celery, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |

Management Recommendations for Sensitive Area # 5

1. No chemical treatment permitted.
2. Restrict mechanical harvesting to a navigational channel extending from piers and only after spawning has ended. No large-leaf or floating-leaf pondweed may be harvested.
3. None of the following in-lake activities allowed:
 - Filling/dredging
 - Aquatic plant screens
 - Wetland alterations
 - Boardwalks
 - Pea gravel/sand blankets
4. Strictly enforce shoreland and wetland ordinances.
5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A “No-Wake Zone” should be implemented.

Resource Value of Sensitive Area Site 6 – Lauderdale Lakes

Sensitive area 6 is located on the northwest corner of Mill Lake and is unique to the Lauderdale Lakes (Figure 7). The area consists of a shallow bay with abundant *Sagittaria* (arrowhead), an emergent plant providing cover for young fish and valuable food for migratory waterfowl. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The substrate is primarily silt and muck in open water areas with more detritus along the shoreline. The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. Aquatic vegetation helps control shoreline erosion (Table 11). It also provides northern pike, largemouth bass, bluegill, yellow perch, and forage fish with spawning, nursery, and foraging habitat (Table 12). The area is not favorable to bluegill spawning due to the silt present. However, submergent vegetation provides excellent sites for northern pike and yellow perch to deposit eggs.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this sensitive area is extremely important for wildlife. Ducks, herons, bittern, songbirds, reptiles, frogs, muskrat, mink, shrews, and voles inhabit this portion of the lake during the majority of the year. The wetland is quite diverse, containing jewelweed, boneset, sedges, sweet flag iris, mannagrass, canada bluejoint grass, marsh fern, bulrushes, bidens, great blue lobelia, blue flag iris, marsh dock, willow, dogwood, cattails, mint, marsh milkweed, arrowhead and coreopsis.

Table 11. Plants observed in the open water area of sensitive area 6.

| | Emergents | Submergents | Free-floating | Exotics |
|------------------------------------|---|---|---|--|
| PRESENT (0-25% Cover) | <i>Alisma</i> (water plantain) <i>Scirpus</i> (bulrush) <i>Decodon</i> (water-willow) | <i>Ceratophyllum</i> (coontail) <i>P. richardsonii</i> (clasping-leaf pondweed) | <i>Lemna</i> (duckweed) <i>Nuphar advena</i> (yellow water lily) <i>Nymphaea odorata</i> (white water lily) | <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) <i>P. crispus</i> (curly-leaf pondweed) <i>Lythrum</i> (purple loosestrife) |
| COMMON (26-50% Cover) | <i>Carex</i> (sedges) <i>Typha</i> (cattail) <i>Sagittaria</i> (arrowhead) | <i>Najas flexilis</i> (slender naiad) <i>Utricularia</i> (bladderwort) <i>Vallisneria</i> (wild celery) | | Algae filamentous algae |
| ABUNDANT (51-75% Cover) | | <i>Chara</i> (muskgrass) | <i>Spirodela</i> (large duckweed) | |
| DOMINANT (76-100% Cover) | | | | |

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Table 12. Sensitive area 6 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|---------------------------------------|---|---|---|
| Northern Pike | cattail | cattail, water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds |
| Largemouth Bass | coontail, milfoil | cattail, water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds |
| Rock Bass | | cattail, water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Bluegill and Pumpkinseed | | cattail, water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds | water lily, wild celery, coontail, milfoil, pondweeds |
| Black Crappie | | water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |
| Yellow Perch | cattail, coontail, milfoil, pondweeds | water lily, <i>Chara</i> , wild celery, coontail, milfoil, pondweeds | pondweeds, milfoil | pondweeds, milfoil |

Management Recommendations for Sensitive Area #6

1. No chemical treatment, mechanical harvesting, mowing, or clear-cutting permitted in the wetland. Submergent vegetation within the existing channel (open water area only) may be harvested.
2. A DNR permit should not be issued for any of the following:

| | |
|-----------------------|--------------------------|
| Filling | Dredging |
| Aquatic plant screens | Pea gravel/sand blankets |
| Wetland alterations | |
3. No alteration of littoral zone unless the activity improves spawning habitat.
4. Boardwalks will be permitted on a case by case basis to provide open water access only for a riparian landowner.
5. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.
6. Efforts should be undertaken to create and enforce shoreland and wetland ordinances, as well as educate developers on preventing erosion during construction. A “No-Wake Zone” should be implemented.

Resource Value of Sensitive Area Site 7 – Lauderdale Lakes

Sensitive area 7 consists of a shallow, sinuous waterway surrounding an island located between Middle and Mill Lakes (Figure 8). The area has a diverse plant community, including several emergent wetland species (sedges, rushes, and asters). It is unique in that it lacks Eurasian watermilfoil, an exotic species common elsewhere in the Lakes. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The bottom is composed of a few inches of silt with firm substrate underneath. Aquatic vegetation helps control shoreline erosion (Table 13). It also provides northern pike, largemouth bass, bluegill, yellow perch, and forage fish with spawning, nursery, and foraging habitat (Table 14). Submergent vegetation provides excellent sites for northern pike and yellow perch to deposit eggs. Limited but valuable spawning habitat is available for bass, bluegill, and pumpkinseed in substrate uncovered by the thin layer of silt.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this sensitive area is extremely important for wildlife. Ducks, herons, bittern, songbirds, reptiles, frogs, muskrat, mink, shrews, voles, and beaver inhabit this portion of the lake during the majority of the year. The island contains a high diversity of wetland plants. Plants observed include marsh fern, mannagrass, canada bluejoint, cattail, bulrush, sedges, spike rush, sweet flag, arrowhead, bidens, great blue lobelia, blue flag iris, blue vervain, marsh milkweed, water willow, goldenrod, boneset, coreopsis, willow, dogwood, and white aster.

Table 13. Plants observed in the open water area of sensitive area 7.

| PRESENT (0-25% Cover) | Emergents | Submergents <i>Chara</i> (muskgrass) | Free-floating | Exotics <i>P. crispus</i> (curly-leaf pondweed) |
|-----------------------------|---|---|--|--|
| COMMON (26-50% Cover) | <i>Scirpus</i> (bulrush) <i>Eleocharis</i> (spike-rush) <i>Aster</i> (aster) <i>Acorus</i> (sweet flag) <i>Sagittaria</i> (arrowhead) <i>Typha</i> (cattail) | | | |
| ABUNDANT (51-75% Cover) | <i>Vallisneria</i> (wild celery) <i>Najas flexilis</i> (slender naiad) <i>P. zosteriformis</i> (flat-stemmed pondweed) | | <i>Nymphaea odorata</i> (white water lily) | |
| DOMINANT (76-100% Cover) | <i>Carex</i> (sedges) | | | |

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Table 14: Sensitive area 7 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

| Fish Species | Spawning | Nursery | Feeding | Protective Cover |
|--------------------------|-----------------|---|------------------------------------|------------------------------------|
| Northern Pike | <i>Chara</i> | <i>Chara</i> , water lily, wild celery, pondweeds | water lily, wild celery, pondweeds | water lily, wild celery, pondweeds |
| Largemouth Bass | hard substrate | water lily, <i>Chara</i> , wild celery, pondweeds | water lily, wild celery, pondweeds | water lily, wild celery, pondweeds |
| Rock Bass | | water lily, <i>Chara</i> , wild celery, pondweeds | pondweeds | pondweeds |
| Bluegill and Pumpkinseed | | water lily, <i>Chara</i> , wild celery, pondweeds | water lily, wild celery, pondweeds | water lily, wild celery, pondweeds |
| Black Crappie | <i>Chara</i> | water lily, <i>Chara</i> , wild celery, pondweeds | pondweeds | pondweeds, woody debris |
| Yellow Perch | pondweeds | water lily, <i>Chara</i> , wild celery, pondweeds | pondweeds | pondweeds |

Management Recommendations for Sensitive Area #7

1. No mechanical harvesting, mowing, or clear-cutting permitted.
2. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.
3. A DNR permit should not be issued for any of the following:

| | |
|-----------------------|--------------------------|
| Filling | Boardwalks |
| Aquatic plant screens | Dredging |
| Wetland alterations | Pea gravel/sand blankets |
4. No alteration of littoral zone unless the activity improves spawning habitat.
5. Maintain the “No-Wake” boating zone.
6. Efforts should be undertaken to create and enforce shoreland and wetland ordinances, as well as educate developers on preventing erosion during construction.

Conclusion

Seven sensitive areas have been designated. Sensitive area number 3 contains one of the highest quality shorelines in southeast Wisconsin. Development along the shoreline of each of the seven sensitive areas sensitive should be carefully studied to prevent the further loss of habitat in the Lauderdale Lakes chain. This sensitive area report identifies characteristics and management recommendations for each of the seven areas.

In Wisconsin, lakes attract many users and water quality in these lakes affects many more. The Lauderdale Lakes attract a diversity of user groups, inevitably creating conflict. An integrated approach that includes the public and all of the Lakes' governing units is essential. The objective is to create and maintain a balance between recreational use and preservation of habitat, which is essential to the Lakes' health. Improving or at least maintaining water quality in Wisconsin lakes is critical. By protecting and restoring habitat these resources will continue to provide ecosystem functions and responsible recreational opportunities for years to come.

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APPENDIX 1 - Aquatic plants within sensitive areas of the Lauderdale Lakes

| Emergent | Area 1 | Area 2 | Area 3 | Area 4 | Area 5 | Area 6 | Area 7 |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|
| Zizania (wild rice) | | | X | | | | |
| Typha (cattail) | X | | X | X | X | X | X |
| Scirpus (bulrush) | X | | X | X | | X | X |
| Eleocharis (spike-rush) | | | | | | | X |
| Carex (sedges) | X | | X | X | | X | X |
| Decodon (water-willow) | | X | X | X | | X | X |
| Alisma (water plantain) | | | | | | X | |
| Sagittaria (arrowhead) | | | | | | X | X |
| Acorus (sweet flag) | | | | | | X | X |
| Aster (aster) | | | | | | X | X |
| Thelypteris (marsh fern) | | | | | | X | X |
| Glyceria (mannagrass) | | | | | | X | X |
| Calamagrostis (Can. BG) | | | | | | X | X |
| Bidens (Beggar Tick) | | | | | | X | X |
| Lobelia (great blue) | | | | | | X | X |
| Iris (Blue Flag) | | | | | | X | X |
| Eupatorium (Boneset) | | | | | | X | X |
| Mentha (mint) | | | | | | X | |
| Asclepias (marsh milkweed) | | | | | | X | X |
| Verbena (blue vervain) | | | | | | X | X |
| Coreopsis | | | | | | X | X |
| Impatiens (jewelweed) | | | | | | X | |
| Rumex (marsh dock) | | | | | | X | |
| Cornus (dogwood) | | | | | | X | X |
| Solidago (goldenrod) | | | | | | | X |

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| Submergent | Area 1 | Area 2 | Area 3 | Area 4 | Area 5 | Area 6 | Area 7 |
|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <i>Myriophyllum sibiricum</i> (northern watermilfoil) | | | X | | | | |
| <i>Chara</i> (muskgrass) | | X | X | X | X | X | X |
| <i>Potamogeton amplifolius</i> (large-leaf pondweed) | | | | X | X | | |
| <i>Elodea</i> (waterweed) | | X | X | X | X | | |
| <i>Utricularia</i> (bladderwort) | X | | X | | | X | |
| <i>Ceratophyllum</i> (coontail) | X | | | | | X | |
| <i>Stuckenia pectinata</i> (sago pondweed) | X | | X | | | | |
| <i>Vallisneria</i> (wild celery) | | X | X | X | X | X | X |
| <i>P. zosteriformis</i> (flat-stemmed pondweed) | | X | X | X | X | | X |
| <i>P. illinoensis</i> (Illinois pondweed) | | | X | X | | | |
| <i>Najas flexilis</i> (slender naiad) | | | X | X | X | X | X |
| <i>P. praelongus</i> (white-stemmed pondweed) | X | X | | | | | |
| <i>P. richardsonii</i> (clasping-leaf pondweed) | | | | | | X | |
| Free-floating | | | | | | | |
| <i>Nuphar advena</i> (yellow water lily) | | X | X | X | X | X | |
| <i>Nymphaea odorata</i> (white water lily) | | X | X | X | | X | X |
| <i>P. natans</i> (floating-leaf pondweed) | | | X | | X | | |
| <i>Lemna</i> (duckweed) | | | | | | X | |
| <i>Spirodela</i> (large duckweed) | | | | | | X | |
| Exotic | | | | | | | |
| <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) | X | X | X | X | X | X | |
| <i>P. crispus</i> (curly-leaf pondweed) | | X | X | X | X | X | X |
| <i>Lythrum</i> (purple loosestrife) | | | | | | X | |
| Algae | | | | | | | |
| filamentous | | X | X | | X | X | |

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