# 2012-2017 Aquatic Plant Management Plan for the Red Cedar Lakes

# Appendices

Balsam, Mud, Red Cedar, & Hemlock Lakes
Barron and Washburn Counties, Wisconsin

***Red Cedar Lakes AIS Education, Prevention, and Planning Project***

DNR No. AEPP-265-11
SEH No. RECLA 115171

May 2012

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# Appendix A

Goals, Objectives, and Actions

## Red Cedar Lakes Aquatic Plant Management Goals, Objectives, and Actions

1. Goal One: Native Aquatic Plant Species Preservation, Protection, and Enhancement
    a. **Objective One**: Provide for native aquatic plant management that aides access to open water for recreational purposes
        i. Action: Identify areas of potential navigational issue
            1. Monitor aquatic plant beds throughout the summer season
                a. RCLA volunteers will be trained in bed density determination and basic plant identification.
            2. Riparian owners requests for aquatic plant management to provide access to open water
                a. Requests made to the RCLA
                    i. Prior to May 15th for CLP
                    ii. Prior to June 15th for mid-season native aquatic plants
                b. Trained RCLA volunteers and/or resource specialists will evaluate all riparian requests for plant management based on these criteria
                    i. Reason for the request
                    ii. Potential for physical removal or control by normal watercraft movement
                    iii. Density and level of interference with watercraft movement
                    iv. Type of vegetation present: submerged, floating leaf, free-floating, or emergent
                    v. Species identification and distribution in the lakes
                    vi. Location of requested treatment: sensitive area, proximity to larger management operations, proximity to other riparian requests
                    vii. Condition/use of the adjacent shoreline
                c. Permit applications, fees, and cost of treatment
                    i. Individual riparian owner plant management requests will be combined with larger RCLA aquatic plant management projects where possible
                    ii. Permit applications, fees, and actual treatment costs outside of pre-established RCLA management plans will be the responsibility of the requester
        ii. Action: Consider implementation native plant management
            1. Physical or manual removal of native plants
                a. Riparian owner removal in 1-5 ft of water
                b. Follow guidelines established by NR 109.
            2. Mechanical harvesting (small- or large-scale) of native plants
                a. Criteria that warrant mechanical harvesting consideration
                    i. RCLA and WDNR approval
                b. Harvesting Conditions
                    i. Proposed harvesting will be based on documented nuisance and navigation impairment

ii. Dump sites will be identified and approved by the appropriate stakeholders prior to beginning harvesting

3. Chemical treatment of native plants
    a. Criteria
        i. RCLA and WDNR approval
    b. Conditions
        i. Proposed current year treatments will be based on documented nuisance or navigation impairments
        ii. Plant species, location, and size of treatment area will determine type and concentration of herbicide used
        iii. Herbicide will be applied by a licensed commercial applicator

iii. Action: Maintain or increase native plant diversity and distribution in areas of the littoral zone where AIS are currently present

1. Add at least one new native plant species over the timeframe established in this plan
    a. Promote aquatic plant management that will increase the diversity and distribution of native aquatic plants
        i. Examples: CLP and purple loosestrife management aimed at improving native plant habitat

b. **Objective Two:** Protect and enhance wild rice populations in the Red Cedar Lakes

i. Action: Promote riparian owners and lake user knowledge and appreciation of wild rice

1. Partner with UW-Extension, GLIFWC, Tribal Resources and others to provide educational materials, workshops, or demonstrations related to wild rice

ii. Action: Monitor wild rice populations

1. Complete rice bed mapping and density monitoring annually in those areas identified as having wild rice present
    a. July - August
2. Monitoring all lakes for the presence of wild rice annually
    a. July -August
3. Track and evaluate CLP/wild rice interactions

iii. Action: Complete wild rice habitat evaluation on all lakes

1. Partner with GLIFWC and/or Tribal resources
2. Consider introducing wild rice into new areas

c. **Objective Three:** Promote, plan, and implement management actions that maintain or improve the current fishery

i. Action: Support fisheries habitat improvement projects

1. Examples: Fishsticks, fish cribs, less removal of woody debris

ii. Action: Support and implement aquatic plant management strategies that minimize impacts to the fishery

1. Minimize aquatic plant management in areas designated as sensitive or critical habitat, unless it is expected to improve that area
2. Limit aquatic plant management other than physical removal to areas greater than 3-ft of water

2. Goal Two: AIS Monitoring and Management
    a. **Objective One**: Monitor the expansion of CLP in the Red Cedar Lakes
        i. Action: Track the density and distribution of CLP annually
            1. Survey littoral zone for new areas of CLP
                a. Completed by trained RCLA volunteers in June
            2. Map CLP beds
                a. Completed by trained RCLA volunteers in June
                b. GPS mapping of definable beds
            3. Determine level of CLP growth (density)
                a. Completed by trained RCLA volunteers following accepted rakehead density sampling methods
        ii. Action : Determine the density of CLP turions in areas identified in the 2011 survey and in designated management areas
            1. Completed by resource professionals retained by the RCLA in the fall of the year
            2. Provides additional baseline data to help determine management locations and management results
        iii. Action: Identify annual CLP management areas
            1. Based on survey data and turion density data
            2. Completed prior to March 31st annually
    b. **Objective Two**: Implement CLP management actions
        i. Action: Complete physical or manual removal of CLP
            1. Riparian owner removal of CLP in 1-5 ft of water
            2. Coordinated, small-scale, lake-wide, manual removal
                a. Planned and executed by the Red Cedar Lakes Association
        ii. Action: Consider Mechanical harvesting (small- or large-scale) of CLP
            1. Criteria that warrant mechanical harvesting consideration
                a. Availability of contracted or owned harvesting operations
                b. Location and size of proposed management area
                c. Documented navigational impairments or nuisance growth conditions
                d. Presence of native plant species
                e. Time of year
            2. Harvesting Conditions
                a. Proposed harvesting will be based on CLP bed mapping and density rating
                b. Harvesting will be completed between June 1st and 15th
                    i. Subject to annual growing conditions
                c. Dump sites will be identified and approved by the appropriate stakeholders prior to beginning harvesting
        iii. Action: Consider chemical treatment of CLP
            1. Criteria that warrant chemical treatment consideration
                a. Location and size of proposed management area
                b. Documented navigational impairment or nuisance growth conditions
                c. CLP growth that negatively impacts native species richness

d. Time of year

2. Treatment Conditions
    a. Proposed current year treatments will be based on previous year CLP bed mapping and density rating, post treatment surveys, and turion density monitoring
    b. Pre treatment aquatic plant survey will be used to confirm the treatment
    c. Chemical treatment will occur between April 15th and May 15th
        i. Subject to annual growing conditions
    d. Granular or liquid endothall will be used at between 0.5-1.5 mg/l (parts per million)
        i. Location and size of treatment area will determine type and concentration of herbicide used
    e. Post treatment aquatic plant surveying will be completed
    f. Herbicide will be applied by a licensed commercial applicator

iv. Action: Pre and Post Chemical Treatment Aquatic Plant Surveying
    1. Completed with any recommended herbicide application
    2. Follow WDNR guidelines

c. **Objective Three**: Continue purple loosestrife management implementation
    i. Action: Monitor the expansion of purple loosestrife in the Red Cedar Lakes
        1. Survey the shoreline and adjacent wetlands annually for new infestations
            a. Completed by trained RCLA volunteers
    ii. Action: Implement physical or manual removal of purple loosestrife
        1. Remove flower heads, hand-pull, or dig out newly discovered individual and isolated plants and dispose of properly
            a. Completed by trained RCLA volunteers
    iii. Action: Consider chemical treatment of isolated, small patches of purple loosestrife
        1. Use glyphosate w/surfactant (Trade name Rodeo)
            a. Foliar application via spray
            b. Cut and dabbed stem application
            c. Requires a WDNR permit when completed in or over water
            d. Follow appropriate safety guidelines
    iv. Action: Continue management via biological control agents
        1. Collect and transfer established Gallerucella beetles to other areas of the lakes
            a. Completed by trained RCLA volunteers
            b. Collected in two time periods – May and July
        2. Set-up beetle rearing stations
            a. Completed by RCLA volunteers following WDNR rearing guidelines (Appendix I)

3. Goal Three: AIS Education, Planning, and Prevention
    a. **Objective One**: Work to prevent AIS from entering and leaving the Red Cedar Lakes
        i. Action: Maintain a watercraft inspection program at public and private lake accesses
            1. Follow UW-Extension Clean Boats Clean Waters (CBCW) Guidelines
            2. Encourage private access owners to post and monitor their landings
    b. **Objective Two**: Monitor the Red Cedar Lakes for other AIS
        i. Action: Maintain an in-lake and shoreline AIS monitoring program
            1. Completed by RCLA volunteers follow Citizen Lake Monitoring Network AIS Monitoring Guidelines
    c. **Objective Three**: Follow established EWM early detection and response plan if a suspect AIS is identified
            1. See EWM Rapid Response Plan (Appendix J)
    d. **Objective Four**: Retain the services of an AIS Coordinator to aide in AIS education activities annually

4. Goal Four: Educate and Inform the Lake Community about the Importance of Aquatic Plants
    a. **Objective One**: Set up and maintain a public participation and communication program and an AIS education and information program
        i. Action: Develop and distribute at least one annual newsletters updating AIS activities
        ii. Action: Host at least one annual public event to promote public involvement in lake activities
            1. Examples: Lake fair, aquatic plant identification workshop, shoreland restoration workshop, wild rice seminar, etc
            2. Can be combined with regularly scheduled events , or done in partnership with another entity
        iii. Action: Maintain a webpage
            1. Post aquatic plant and lake management documents for public viewing
5. Goal Five: 5. Instill an appreciation for aquatic ecosystems and habitat in the Red Cedar Lakes community
    a. **Objective One:** Promote appreciation of wildlife including, but not limited to, loons, bald eagles, fur-bearers, and amphibians
        i. Action: Provide education and informational materials related to wildlife and wildlife monitoring programs during public events, in newsletters, on the webpage, and during public meetings
            1. Examples: Loonwatch, Citizen-based monitoring programs
6. Goal Six: Develop a better understanding of the lakes and the factors affecting lake water quality
    a. **Objective One:** Promote shoreland restoration and habitat improvement projects
        i. Action: Provide riparian owners with general shoreland improvement educational and informational materials and training
        ii. Action: Provide riparian owners landowner access to professional site evaluation and planning services
            1. Set aside limited funding annually to pay for professional shoreland restoration planning services

2. Determine a system for identifying riparian owners that may wish to take advantage of professional shoreland services

iii. Action: Provide annual recognition to riparian property owners participating in shoreland restoration and habitat improvement projects.

iv. Action: Plan and implement small-scale aquatic emergent species re-introduction projects as a means to reduce shoreline erosion

b. **Objective Two:** Promote riparian owner participation in best management practices that may reduce shoreland runoff and nutrient loading into the lakes

i. Action: Provide good lake stewardship educational and informational materials and training

1. Examples: Buffer strips, runoff diversion, rain gardens, septic system maintenance, non-impervious surfaces, no mow areas

c. **Objective Three**: Continue to participate in the CLMN Water Quality Monitoring Program

i. Action: Complete Secchi, Temperature (Temp), Dissolved Oxygen (DO), Total Phosphorous (TP), and Chlorophyll a (CHL) sampling

1. One site in Balsam Lake
2. One site in Mud Lake
3. Two sites in Red Cedar Lake
4. One site in Hemlock Lake
    a. Completed by trained RCLA volunteers
    b. Follow CLMN Expanded water quality monitoring protocol

ii. Action: Complete supplementary water quality monitoring at all lake monitoring sites

1. Completed by trained RCLA volunteers
2. Secchi, Temp, DO, TP and CHL
3. October each year

iii. Action: Complete lake level monitoring in all four lakes

1. Completed by RCLA volunteers weekly ice-off to ice-on
2. Staff gages installed near volunteer

7. Goal Seven: Coordinate Water Level Management

a. **Objective One**: Maintain open lines of communication with dam operators from other impoundments on the Red Cedar River

i. Action: Communicate with dam operators on Big Chetac/Birch Lakes, Murphy Lake Flowage, Long Lake, and Rice Lake

1. Time fall and spring withdrawals so that the water being released upstream passes through the entire Upper Red Cedar River
2. Inform impoundments downstream when normal outflow is to be reduced

Aquatic Plant management Plan Maintenance

b. **Objective One**: Compile annual education, management, planning and prevention data for end of year reporting purposes

i. Action: Make recommendation for annual revisions and updates to the APM Plan

ii. Action: Prepare following year proposed management plans

iii. Action: Share annual report document

1. RCLA webpage, Barron and Washburn Counties, and WDNR
2. Two paper and digital copies to the RCLA
3. One paper and digital copy to the Counties and the WDNR

c. **Objective Two**: Complete Five-year End of Project Report
   i. Action: Review all project successes and failures
   ii. Action: Revise/rewrite APM Plan
   iii. Action: Repeat early- and mid-season whole-lake point intercept survey of all plants
   iv. Action: Share end of project report document
      1. RCLA webpage, Barron and Washburn Counties, and WDNR
      2. Two paper and digital copies to the RCLA
      3. One paper and digital copy to the Counties and the WDNR

# Appendix B

Five-year Timeline of Events

**1-yr Interim, and 5-year Timeline of Recommended Activities in the Red Cedar Lakes Aquatic Plant Management Plan**

| Goal | Objective | Action | AIS Grant Eligible | Facilitator | Year | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2012 Interim | 2013 | 2014 | 2015 | 2016 | 2017 |
| Native Species Preservation, Protection, and Enhancement | Native plant management | Identification of problem areas | no | RCLA, Consultant, WDNR | x | x | x | x | x | x |
| | | Riparian request for management | | | x | x | x | x | x | x |
| | | Implementation of native plant management | | | ? | ? | ? | ? | ? | ? |
| | | Maintain or increase native plant diversity | | | x | x | x | x | x | x |
| | Wild rice education | Promote knowledge and appreciation of wild rice | yes | RCLA, Consultant, GLIFWC, Tribal Resources | x | x | x | x | x | x |
| | | Monitor wild rice populations | yes | | x | x | x | x | x | x |
| | | Habitat evaluation | yes | | | | x | | | x |
| | Maintain current fishery | Habitat improvement | yes | RCLA, Consultant, WDNR | x | x | x | x | x | x |
| | | Plant management considerations | yes | | | x | x | x | x | x |
| AIS Monitoring and Management | Monitor CLP distribution | Bed mapping and density surveying | yes | RCLA, Consultant, Contractor | x | x | x | x | x | x |
| | | Fall turion density monitoring | yes | | x | x | x | x | x | x |
| | | Identification of management areas | yes | | | x | x | x | x | x |
| | CLP management | Land owner manual removal | yes | RCLA, Consultant,Contractor | x | x | x | x | x | x |
| | | Early season endothall application | yes | | | ? | ? | ? | ? | ? |
| | | Pre and Post Herbicide Treatment Aquatic Plant Surveying | yes | | | ? | ? | ? | ? | ? |
| | | Mechanical harvesting | yes | | | ? | ? | ? | ? | ? |
| | Purple loosestrife management | System wide monitoring | yes | RCLA, Consultant, WDNR, UW-Extension Lakes | x | x | x | x | x | x |
| | | Physical or manual removal | yes | | x | x | x | x | x | x |
| | | Chemical treatment | yes | | ? | ? | ? | ? | ? | ? |
| | | Biological control | yes | | x | x | x | x | x | x |
| AIS Education and Prevention | Prevent AIS transport in/out | Watercraft inspection program | yes | RCLA, UW-Extension Lakes | x | x | x | x | x | x |
| | Monitor for other AIS | In-lake and shoreline monitoring (CLMN) | yes | RCLA, Consultant, CLMN | x | x | x | x | x | x |
| | | Follow EWM Rapid Response Plan | no | | ? | ? | ? | ? | ? | ? |
| | Hire and AIS Coordinator | Full-time, summer hire | yes | RCLA | x | x | x | x | x | x |
| Importance of native aquatic plants | Public particpartion and communication program | Annual newsletters | yes | RCLA, Consultant | x | x | x | x | x | x |
| | | Annual public event planning and implementation | yes | | x | x | x | x | x | x |
| | | Maintain a RCLA webpage | yes | | x | x | x | x | x | x |
| Community Appreciation of Aquatic Ecosystem | Promote wildlife monitoring programs | Provide information and education materials | yes | UTLA/Consultant | x | x | x | x | x | x |
| Understanding factors the affect water quality | Promote shoreland restoration and habitat improvement projects | provide education and information material | yes | RCLA, Consultant, Contractor | x | x | x | x | x | x |
| | | Provide for professional site palnninng services | yes | | ? | x | x | x | x | x |
| | | Riparian owner recognition | yes | | ? | x | x | x | x | x |
| | | Small-scale emergent species re-introduction | yes | | ? | ? | ? | ? | ? | ? |
| | Promote riparian owner participation in nutrient runoff best management practices | provide education and information material | yes | RCLA, Consultant, Contractor | x | x | x | x | x | x |
| | CLMN expanded monitoring at 4 lake sites | Secchi, Temp, DO, TP, CHL | no | RCLA, Consultant, CLMN | | x | x | x | x | x |
| | | October sampling TP and CHL | yes | | | x | x | x | x | x |
| | | Lake level monitoring all four lakes | yes | | | x | x | x | x | x |
| Coordinated Water Level Management | Maintain open lines of communication between dam operators | Big Chetac and Birch Lakes, Long Lake, Murphy Flowage, Rice Lake | no | RCLA, Barron County | x | x | x | x | x | x |
| Assessment and Evaluation | Annual Project Activity and Assessment Reports | Plan revisions | yes | Consultant, RCLA | x | x | x | x | x | x |
| | | Annual management plans | yes | | | x | x | x | x | x |
| | | Document sharing | yes | | x | x | x | x | x | x |
| | End-of-project Summary Report | Overall review of project successes and failures | yes | Consultant, RCLA | x | | | | | x |
| | | Revise/rewrite APM Plan | yes | | | | | | | x |
| | | Whole-lake point intercept plant survey | yes | | | | | | | x |
| | | Document sharing | yes | | x | | | | | x |

# Appendix C

Aquatic Plant Community of the Red Cedar Lakes

FRESHWATER
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# Aquatic Plant Community of the Red Cedar Lakes

## July/August 2011

- **Red Cedar Lake** – *Barron County, WI (#2109600)*
- **Hemlock Lake** – *Barron County, WI (#2109800)*
- **Balsam Lake** – *Washburn County, WI (#2112800)*
- **Mud Lake** – *Washburn County, WI (#2112800)*



Prepared for SEH Inc. and the Red Cedar Lakes Association (Washburn Co., WI) – December 2011

## Surveyed by:

James A. Johnson – *Aquatic Ecologist, Freshwater Scientific Services, LLC*

## Data Analysis and Reporting by:

James A. Johnson – *Aquatic Ecologist, Freshwater Scientific Services, LLC*

Report available for download at http://www.freshwatersci.com/fw_projects.html

## Cite this report as:

Johnson JA. 2011. Aquatic plant community of the Red Cedar Lakes: July/August 2011. *Report to* Short Elliott Hendrickson Inc. (Spooner, WI) and the Red Cedar Lakes Association (Washburn County, WI). Freshwater Scientific Services LLC (Maple Grove, MN). 69 pp.

## *Table of Contents*

# *Executive Summary*

## Curlyleaf Pondweed Delineation

Although curlyleaf pondweed was widespread in the Red Cedar Lakes (Red Cedar, Hemlock, Balsam, and Mud) in June 2011, most areas had no curlyleaf or only supported very sparse curlyleaf growth. This suggests either (1) that curlyleaf has only recently spread throughout the lake (in the last few years) or, more likely, (2) that curlyleaf has had ample time to spread, but that most areas of the lakes are not able to support curlyleaf due to local conditions such as sediment texture and fertility. In general, sandy and rocky substrates, such as those found in most areas of Red Cedar and Balsam Lake and along the northern shore of Hemlock Lake, do not support nuisance curlyleaf pondweed growth.

Much of the upper Midwest experienced a long, cool spring in 2011. This appeared to affect the timing, rate, and density of curlyleaf pondweed growth in many lakes. Consequently, the curlyleaf growth observed in 2011 may represent lower density and less extensive beds than typically seen in previous years.

## Aquatic Plant Surveys

Point-intercept vegetation surveys found that all of the Red Cedar Lakes supported diverse native aquatic plant communities. In Red Cedar and Balsam Lake, most plant growth was found in shallow areas with mucky sediments. Open areas of these lakes generally had sandy and rocky sediments that supported only sparse native aquatic plants. By contrast, Hemlock and Mud Lake had more prevalent areas of soft, mucky sediments, and thus supported more widespread aquatic plant growth.

## Management Considerations

1) Any plans to control invasive curlyleaf pondweed in the lakes must consider the possible impacts on native plants in the managed areas. Unintended removal of native plants may allow curlyleaf to spread and grow more densely. Any control measures should seek to target curlyleaf through the use of selective herbicides, early-spring treatment, and judicious confinement of treatments to only those areas that support nuisance curlyleaf.

2) Any use of herbicides to control curlyleaf will need to consider the potential effects of water movement on treatment efficacy. In particular, the beds of curlyleaf found in northeast Balsam Lake and in the channel between Balsam and Red Cedar Lake experience substantial water movement due to river inflow. In addition, the curlyleaf beds in the southern portion of Red Cedar Lake are likely subjected to substantial wave action and mass water movement due to the effect of wind across the large open lake area to the north. Any herbicide treatments should occur during times of calm winds and low inflows, and treatment areas should be relatively large to reduce the potential for dilution.

3) Curlyleaf growth in most areas of Red Cedar Lake and Balsam Lake was too sparse to warrant the use of herbicides. Hand pulling of isolated patches should be considered.

4) Hemlock Lake supported abundant fern-leaf pondweed (*Potamogeton robbinsii*) in many areas out to roughly 8 ft. This dense growth of fern-leaf pondweed appeared to compete well with curlyleaf pondweed, as there was little curlyleaf found in areas with dense fern-leaf pondweed. Furthermore, most of the denser stands of curlyleaf in Hemlock were found in deeper areas where fern-leaf pondweed was not found. Any treatments to control curlyleaf in Hemlock Lake should strive to protect fern-leaf pondweed.

# *Introduction*

## Value of Aquatic Plants

Aquatic plants play an important role in freshwater lakes. They anchor sediments, buffer wave action, oxygenate water, and provide valuable habitat for aquatic animals. Consequently, the amount and type of plants in a lake can greatly affect nutrient cycling, water clarity, and food-web interactions (Jeppeson et al. 1998). Furthermore, plants are very important for fish reproduction, survival, and growth, and can greatly impact the type and size of fish in a lake. Unfortunately, healthy aquatic plant communities are often degraded by poor water clarity, excessive plant control activities, and the invasion on non-native nuisance plants. These disruptive forces alter the diversity and abundance of aquatic plants in lakes and can lead to undesirable changes in many other aspects of a lake's ecology. Consequently, it is very important that lake managers find a balance between controlling nuisance plant growth and maintaining a healthy, diverse plant community.

## Purpose of Aquatic Plant Surveys

These surveys were designed to map the extent of curlyleaf pondweed beds and provide detailed, statistical assessments of the aquatic plant communities in Red Cedar Lake, Hemlock Lake, Balsam Lake, and Mud Lake (collectively referred to as the "Red Cedar Lakes" hereafter). The information gained from these assessments provides a baseline for evaluating any changes in the plant community over the coming years, and will help to guide responsible vegetation management planning.

## Objectives of Aquatic Plant Surveys

5) Delineate curlyleaf pondweed beds throughout the lakes
6) Estimate the percent of each lake that supports vegetation
7) Estimate the maximum depth of plant growth in each lake
8) Develop a list of the aquatic plant species found in each lake
9) Characterize the distribution and abundance of plant species in each lake
10) Calculate plant community statistics

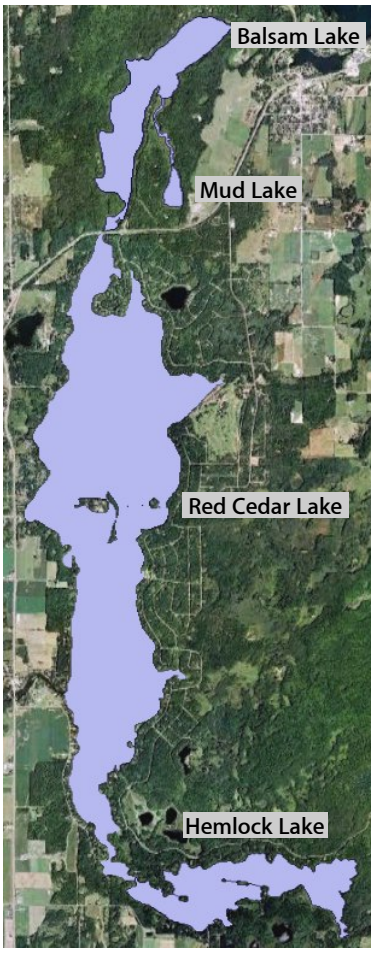
## Description of Lakes

The four Red Cedar Lakes straddle the border between Barron and Washburn Counties in northwestern Wisconsin (Figs. 1 and 2, Table 1). These lakes are all interconnected and can be accessed from multiple public and private boat launches, and are highly valued in the region for fishing and boating.

Hemlock and Mud Lakes are fertile waterbodies (eutrophic) that typically experience low to moderate summer water clarity (average Secchi ~5 ft, Table 1). By contrast, Balsam and Red Cedar Lake are less fertile (mesotrophic) and typically experience greater summer water clarity (average Secchi ~8 to 11 ft, Table 1).

All four of the surveyed lakes are known to be infested with curlyleaf pondweed (*Potamogeton crispus*), an invasive, non-native, aquatic plant. The Red Cedar Lakes Association has plans to actively management curlyleaf in the lakes over the coming years.

**Figure 1.** Map showing Balsam, Red Cedar, Hemlock and Mud Lakes.




## Mud Lake


**Table 1.** Lake identifiers and characteristics (WDNR 2011)

| | Red Cedar | Hemlock | Balsam | Mud |
|---|---|---|---|---|
| County | Barron | Barron | Washburn | Washburn |
| ID# (WBIC) | 21-096-00 | 21-098-00 | 21-128-00 | – |
| Surface Area *(acres)* | 1841 | 357 | 295 | 28 |
| Maximum Depth *(ft)* | 53 | 21 | 49 | 26 |
| Mean Depth *(ft)* | 27 | 8 | 25 | 4 |
| Summer Water Clarity *(ft)* | 8 | 5 | 11 | ~5 |
| Trophic State (fertility) | mesotrophic | eutrophic | mesotrophic | eutrophic |

## Bathymetric Maps

**Figure 3.** *Red Cedar Lake* bathymetry map. (WDNR map superimposed over aerial image). Areas deeper than ~20 ft are shaded dark blue.

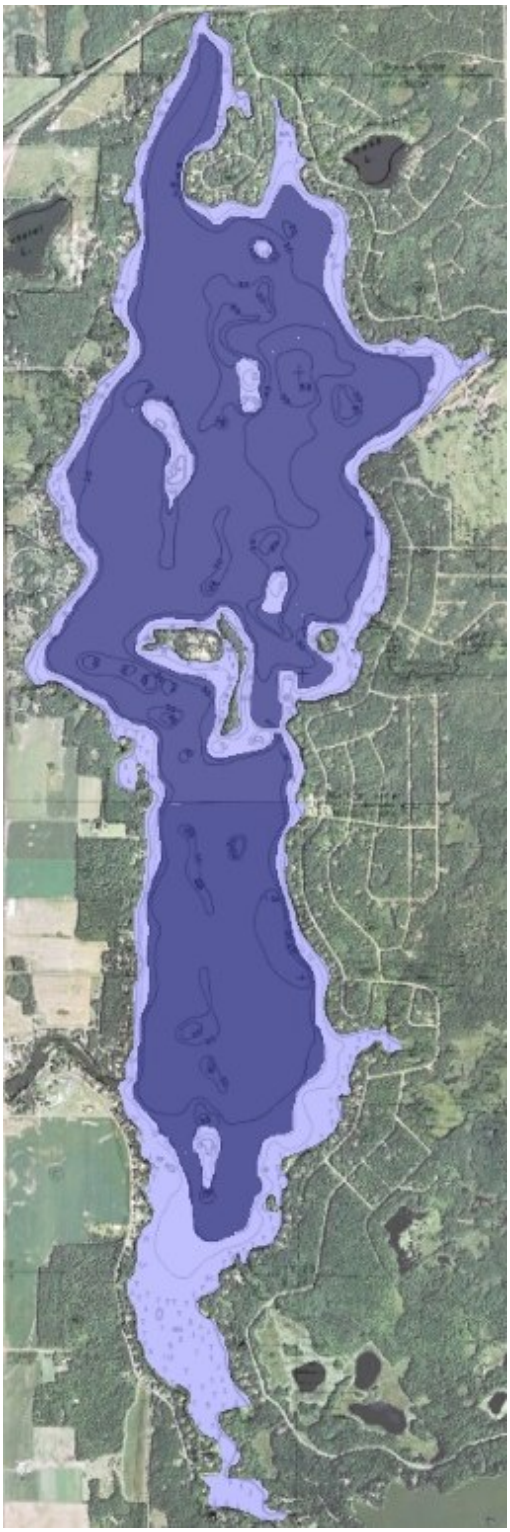
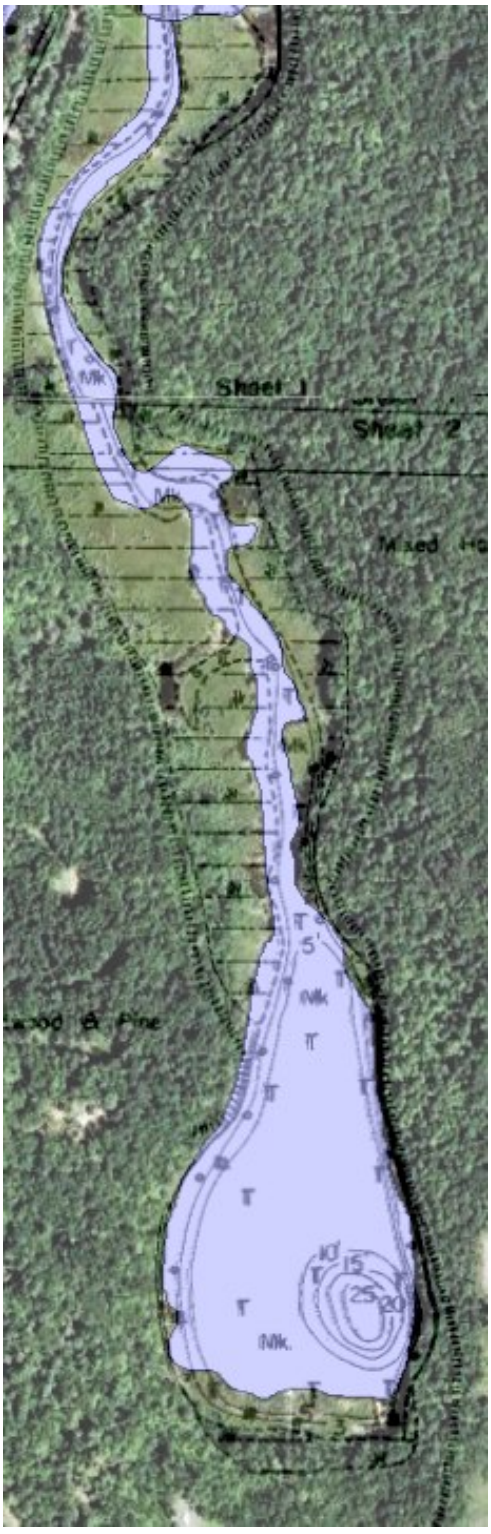


**Figure 4.** *Mud Lake* bathymetry map. (WDNR map superimposed over aerial image).



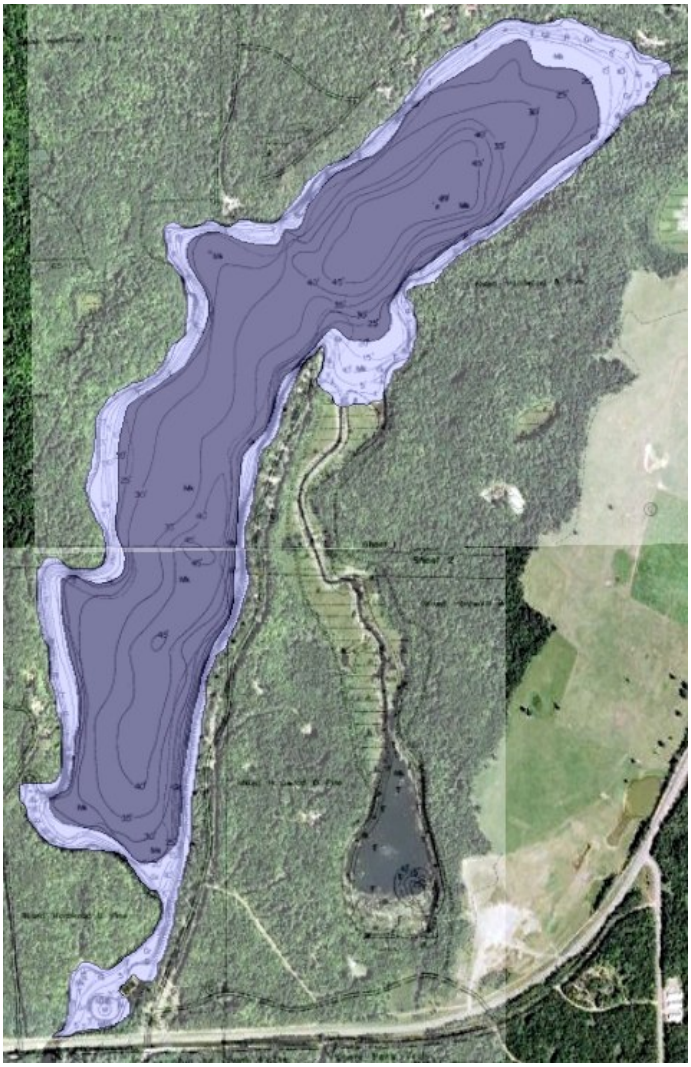
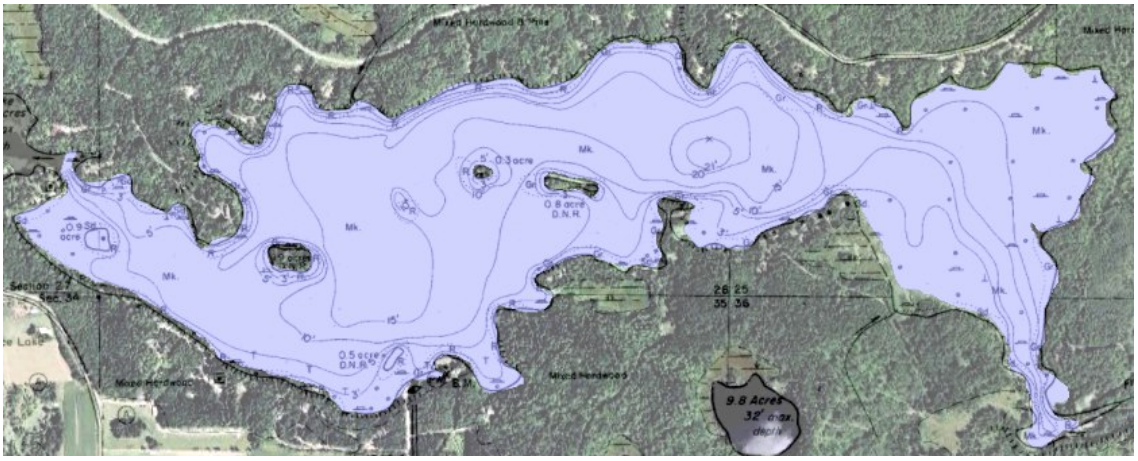


**Figure 5.** *Balsam Lake* bathymetry map. (WDNR map superimposed over aerial image). Areas deeper than ~20 ft are shaded dark blue.

**Figure 6.** *Hemlock Lake* bathymetry map. (WDNR map superimposed over aerial image).



# *Sampling & Analysis Methods*

## 2011 Spring Curlyleaf Pondweed Bed Delineations

Freshwater Scientific Services, LLC completed lake-wide searches for curlyleaf pondweed growth in each of the four lakes between June 22 and June 24, 2011. Due to the long, cool spring, these curlyleaf delineation surveys were delayed by several weeks to capture peak curlyleaf density in 2011. We found extensive areas of curlyleaf growth, however, this growth generally did not reach the surface in 2011 (likely due to weather). This made delineation difficult, as curlyleaf beds were generally not visible on the surface of the lakes. Consequently, we used a combination of sonar, rake tosses, and visual transects with an underwater video camera to enhance our ability to detect and map curlyleaf beds. In areas where we found curlyleaf pondweed, we conducted intensive sampling with rake tosses and video searches in the immediate area. During this intensive bed sampling, we noted beds on paper maps and recorded the GPS location of each sample and the density of curlyleaf growth. We then imported these GPS locations and sample notes into desktop GIS software (ArcView), delineated the edge of observed curlyleaf growth, and calculated the area of each bed.

## 2011 Summer Aquatic Plant Surveys

Freshwater Scientific Services, LLC completed lake-wide vegetation surveys for each of the four lakes between July 29 and August 1, 2011 using the point-intercept method described by Madsen (1999). These surveys incorporated assessments at roughly 100 to 400 points in each lake (Figs. 7–10). These points were arranged in a grid across each lake (points provided by WDNR). We then loaded the sample point locations onto a handheld GPS unit (Garmin GPSMAP-78) to enable navigation to each point while in the field.

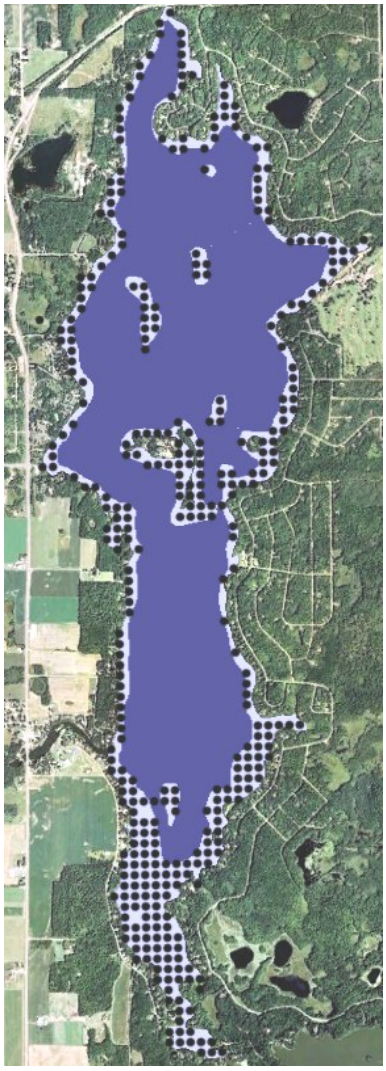
At each designated location, we sampled plants using a rake. For sites shallower than 10 ft, we used a double-headed, 14-tine rake on a pole; for sites deeper than 10 ft, we used an identical rake head attached to a 50-ft rope. To ensure that each sample collected plants from a consistent area of lake sediment, we dragged the rake (13 inches wide) approximately 1 foot along the bottom before retrieving (WDNR 2010). For each rake sample, all of the retrieved plants were piled on top of the rake head and assigned density ratings from 1 to 3 based upon rake coverage as described in Table 2. Shoreland plant species were noted as present when observed growing in the water near the sampled points, however we did not conduct intensive shoreland plant surveys.

We assigned density ratings for all plants collectively (whole rake density) as well as for each individual plant species retrieved on the rake. Additional species that were observed growing within 10 ft of a sample point but not retrieved on the rake were given a rating of zero for that site. These "zero" species were included in the final species lists and distribution maps, but were not included in the calculation of plant community metrics and statistics.

**Table 2.** Description of rake density ratings (WDNR 2010)

| Density Rating | Rake Coverage | Description |
|---|---|---|
| 1 |  | Only a few plants retrieved |
| 2 |  | Plants cover full length of rake head, but do not cover the tines completely |
| 3 |  | Plants completely cover rake head and tines |

**Figure 7.** *Red Cedar Lake* – Map of sample points used for the 2011 point-intercept plant survey (areas deeper than ~20 ft are shaded in dark blue), and plot of sampling effort (number of points) by depth zone



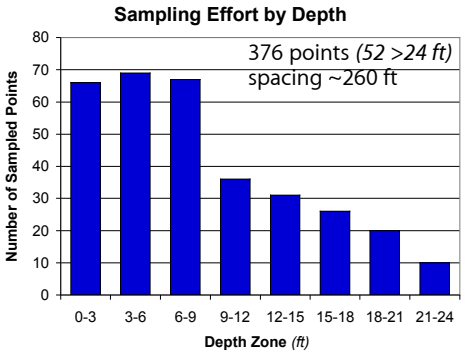
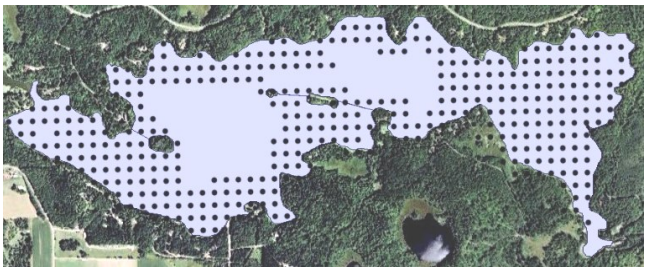



**Figure 8.** *Hemlock Lake* – Map of sample points used for the 2011 point-intercept plant survey, and plot of sampling effort (number of points) by depth zone.



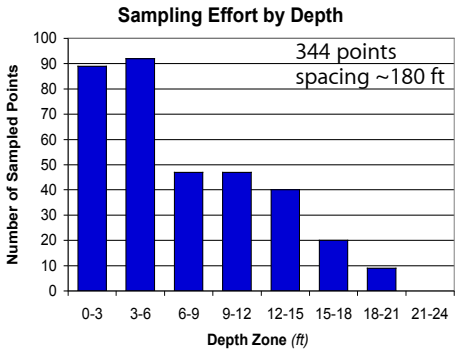
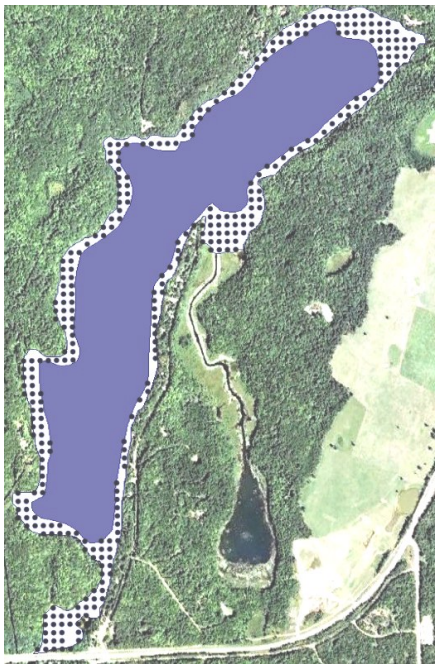


**Figure 9.** *Balsam Lake* – Map of sample points used for the 2011 point-intercept plant survey (areas deeper than ~20 ft are shaded in dark blue), and plot of sampling effort (number of points) by depth zone



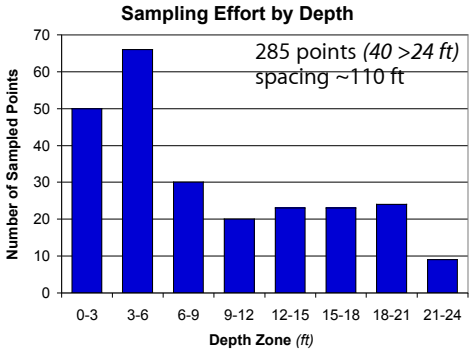
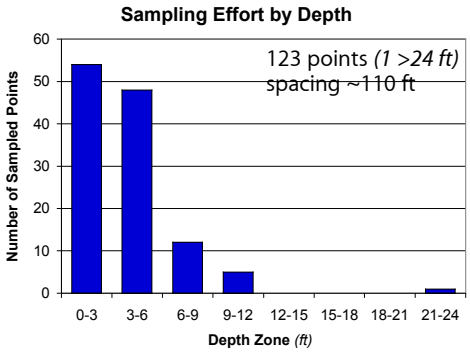



**Figure 10.** *Mud Lake* – Map of sample points used for the 2011 point-intercept plant survey, and plot of sampling effort (number of points) by depth zone. Areas deeper than ~20 ft are shaded in dark blue.



## Aquatic Plant Survey Data Analysis

### *Frequency of Aquatic Plant Species (% Occurrence)*

Plant frequency is the percent of sampled points where a given taxon of plant (most taxa identified to species, hereafter referred to as "species") of plant was found. This indicates how common each species was, but does not reflect the density of the plant growth. We calculated plant frequency for (1) the entire portion of the lake shallower than the observed maximum depth of plant growth (*littoral frequency*, WDNR 2010), (2) areas shallower than a fixed depth of 15 ft to allow for easier comparisons between lakes, and (3) within specific depth zones to show plant distribution by depth.

### *Density of Aquatic Plant Growth*

Plant density provides an estimate of the abundance or biomass of plants. For each lake, we calculated average plant densities for (1) the entire area shallower than the maximum depth of plant growth (*littoral density*), (2) within specific depth zones, and (3) within plant beds (*bed density*).

*Littoral density* is a measure of how densely each plant species grew throughout the littoral area (<maximum depth of growth) of the lake. This assessment provides an indication of whether plants formed widespread, dense growth in the littoral area of the lake. In general, density ratings greater than 2 are often associated with nuisance growth, particularly for plant species that can grow to the surface. Conversely, density ratings below 2 represent light to moderate plant density that would not be expected to interfere much with lake recreation.

*Bed density* is a measure of how densely a plant species grew in the beds where it was found – disregarding sites where it was not found. For example, if a given plant species was only found in a 1-acre patch in a large lake, but was growing very densely in that area, it would have a very low littoral density, but a high bed density. Bed density is useful for identifying plant species that may form localized areas of nuisance growth.

### *Aquatic Plant Community Statistics*

In addition to reporting the frequency and density of individual plant species in the lakes, we have included plant community statistics and indices that evaluate all of the plants collectively (*Simpson's Diversity*, *Floristic Quality Index* (FQI), *Aquatic Macrophyte Community Index* (AMCI), etc.). These plant community assessments provide a simple way to evaluate the diversity and ecological quality of the plant community in the lakes, compare between lakes, and detecting changes in the lakes over time.

# Description of Calculated Statistics and Metrics

## % Occurrence

*Description:* The percent of sampled locations shallower than a reference depth where a given plant species was found; in this report, we have calculated the % occurrence (1) using all points shallower than 15 ft ("littoral"), and (2) using all points shallower than the maximum depth of plant growth ("max") in each lake (WDNR 2010).

*Formula:* = Number of points with a given species ÷ Total # points *(only from sites < reference depth)*

## % Littoral Area Vegetated

*Description:* The percent of the littoral area (<15 ft deep) that supported plants of any kind

*Formula:* $= VA_{lit} \div TA_{lit}$

- $VA_{lit}$ = Vegetated Littoral Area = $\sum$ Thiessen polygon areas for vegetated littoral points
- $TA_{lit}$ = Total Littoral Area = (Total Basin Area) – (Area >15 ft)

## % Lake Area Vegetated

*Description:* The percent of the entire lake area that supported plants of any kind

*Formula:* = Vegetated Area ÷ Total Lake Area

- Vegetated Area = $\sum$ Thiessen polygon areas for points with vegetation
- Total Lake Area = Area calculated using delineated shoreline in ArcView GIS

## % Lake with Surface Vegetation

*Description:* The percent of the entire lake area with plants that reach the water's surface. This is a good indicator of recreational impairment.

*Formula:* = Area with surface growth ÷ Total Lake Area

- Area with surface growth = $\sum$ Thiessen polygon areas for points with surface vegetation
- Total Lake Area = Area calculated using delineated shoreline in ArcView GIS

## Species Richness

*Description:* The number of different plant species found in the lake. Greater richness often translates into greater habitat diversity for fish.

*Formula:* = Total number of plant species encountered during the survey

## Simpson's Diversity

*Description:* How "mixed" or diverse is the plant community? Lakes with many plant species that are evenly mixed throughout the lake have high diversity; those dominated by only one or two species have low diversity. A higher value (up to 1.0) indicates greater diversity.

*Formula:* $= 1 - \sum (\text{Relative Frequency of encountered taxa})^2$

- Relative Frequency = (% occurrence of a species) ÷ ($\sum$ % occurrence for all species found) (see Nichols et al. 2000)

## Average Number of Native Species/Point

*Description:* Another measure of the diversity of native plants in the lake.

*Formula:* = $\sum$(#Native species per littoral point) ÷ # of littoral points sampled

# Results & Discussion

## Curlyleaf Pondweed Bed Delineation

Although curlyleaf pondweed was widespread in the Red Cedar Lakes in June 2011, most areas only supported very sparse curlyleaf growth – typically consisting of individual plants that were spaced widely apart (up to 100's of feet). This suggests either (1) that curlyleaf has only recently spread throughout the lake (in the last few years) or (2) that curlyleaf has had ample time to spread, but that most areas of the lakes are not able to support curlyleaf due to local conditions such as sediment texture and fertility. In general, sandy and rocky substrates, such as those found in most areas of Red Cedar and Balsam Lake and along the northern shore of Hemlock Lake, do not support nuisance curlyleaf pondweed growth.

In 2011, we found only one area of continuous, dense curlyleaf in the four lakes. This small, dense bed (0.5 acre, density=3) was found at the far northeast end of Balsam Lake, immediately south of the point where Birch Creek enters the lake (Figs. 11–13). This was the only area that presented true nuisance-level, surface-matted curlyleaf growth in any of the lakes. Overall, the other curlyleaf beds that we identified (Fig. 13) did not represent continuous areas of dense curlyleaf growth. Instead, these areas typically supported either uniform but light curlyleaf growth, or widely-spaced patches of moderate growth. Although we occasionally found isolated small patches (~5-10 ft across) of moderate to dense curlyleaf in other areas, curlyleaf growth in most of the delineated beds was not dense enough to substantially impair lake use.

Much of the upper Midwest experienced a long, cool spring in 2011. This appeared to affect the timing, rate, and density of curlyleaf pondweed growth in many lakes. Lake managers in northern Wisconsin and Minnesota reported unusual curlyleaf growth in many infested lakes, with most reports suggesting that early-spring curlyleaf growth in the region was delayed and that the overall peak density was dramatically lower (pers. comm.; (1) David Blumer, Lake Scientist, SEH Inc.; Spooner, WI; (2) Chip Welling, Aquatic Invasive Species Management Coordinator, MNDNR; St. Paul, MN). Consequently, the curlyleaf growth presented in Fig. 13 may represent lower density and less extensive beds than typically seen in previous years.

Given the prevalence of sparse curlyleaf growth in 2011, areas of growth generally did not have clear edges. Consequently the delineated beds should be considered to be subjective approximations of areas that warrant continued monitoring and possible management action in the future. Fig. 13 and Table 3 provide details on the location, density, and size of curlyleaf beds found during the spring 2011 curlyleaf delineation surveys.

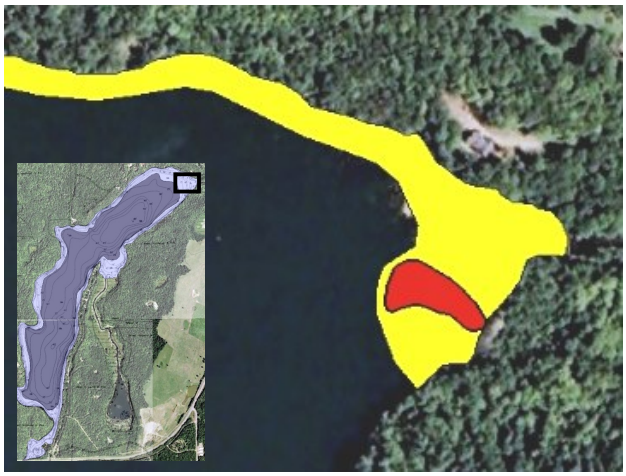


**Figure 11.** *Dense Curlyleaf Pondweed Bed* (0.5 acres, shown in red) on the north end of Balsam Lake (see inset map). The yellow area represents light and patchy curlyleaf growth in the area surrounding the dense patch (Bed #1, Fig. 13)

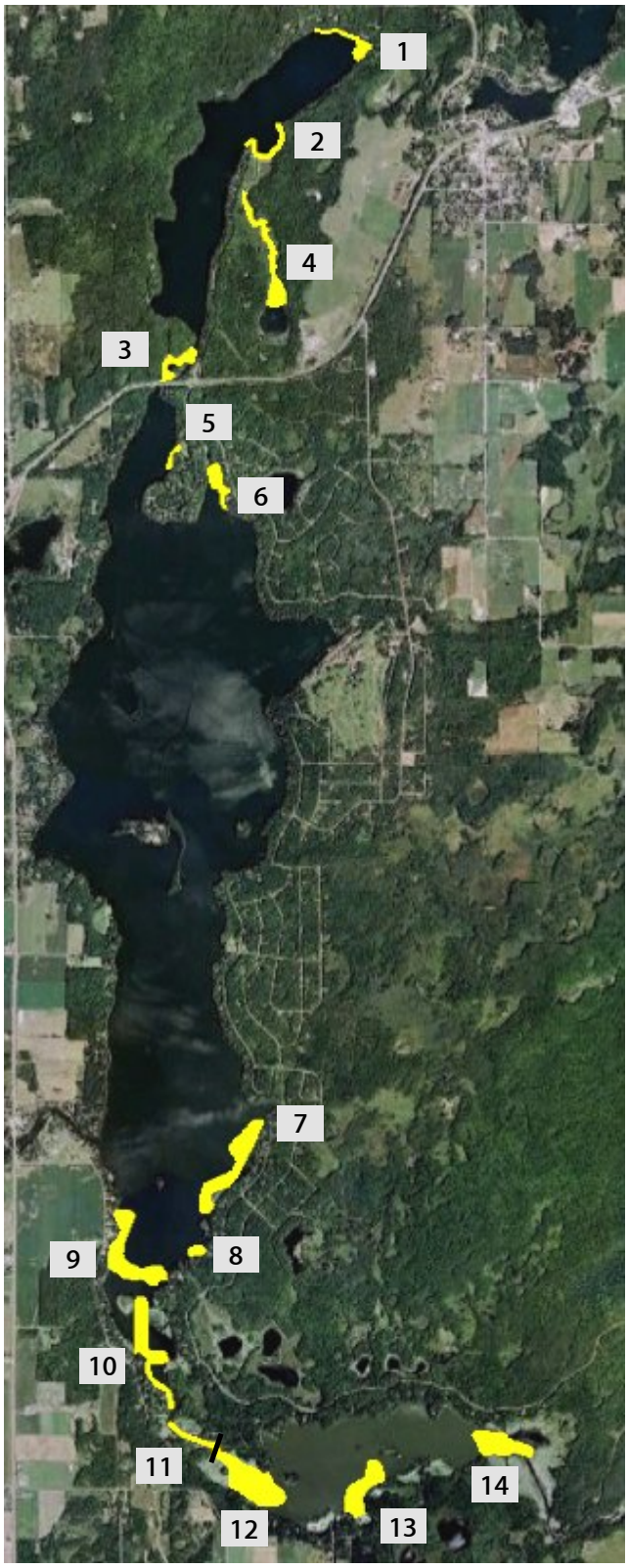



**Figure 12.** *Curlyleaf Pondweed Beds* in the Red Cedar Lakes; June 2011. Each curlyleaf bed is identified by number. See Table 3 for area of each delineated bed; Figure 13 for curlyleaf density ratings associated with each bed.

**Table 3.** *Curlyleaf Pondweed Bed* identifiers and delineated areas (acres) in the Red Cedar Lakes; June 2011

| Lake | Bed # | Area *(acres)* |
|---|---|---|
| Balsam | 1 | 5.1 |
| | 2 | 4.5 |
| | 3 | 5.7 |
| Mud | 4 | 12.0 |
| Red Cedar | 5 | 1.5 |
| | 6 | 6.0 |
| | 7 | 20.7 |
| | 8 | 2.0 |
| | 9 | 20.7 |
| | 10 | 17.1 |
| | 11 | 3.5 |
| Hemlock | 12 | 25.3 |
| | 13 | 13.9 |
| | 14 | 14.6 |
| **Total Area** | | **152.6** |

**Figure 13a.** *Curlyleaf Pondweed Density* in Red Cedar Lake; June 2011. Density based upon rake coverage as described in Table 2. See Fig. 12 and Table 3 for curlyleaf bed delineations based upon these rake densities and visual inspections.

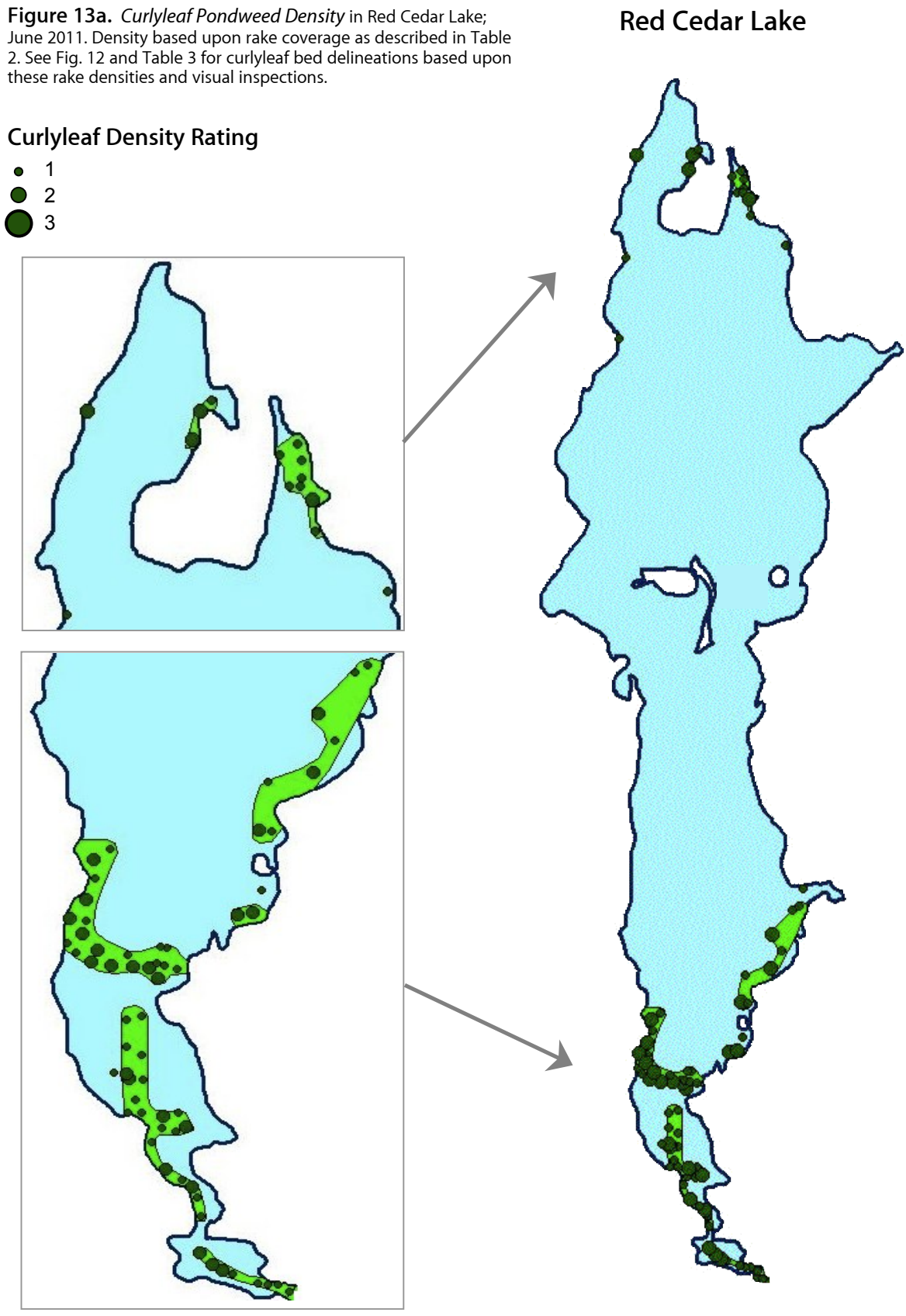
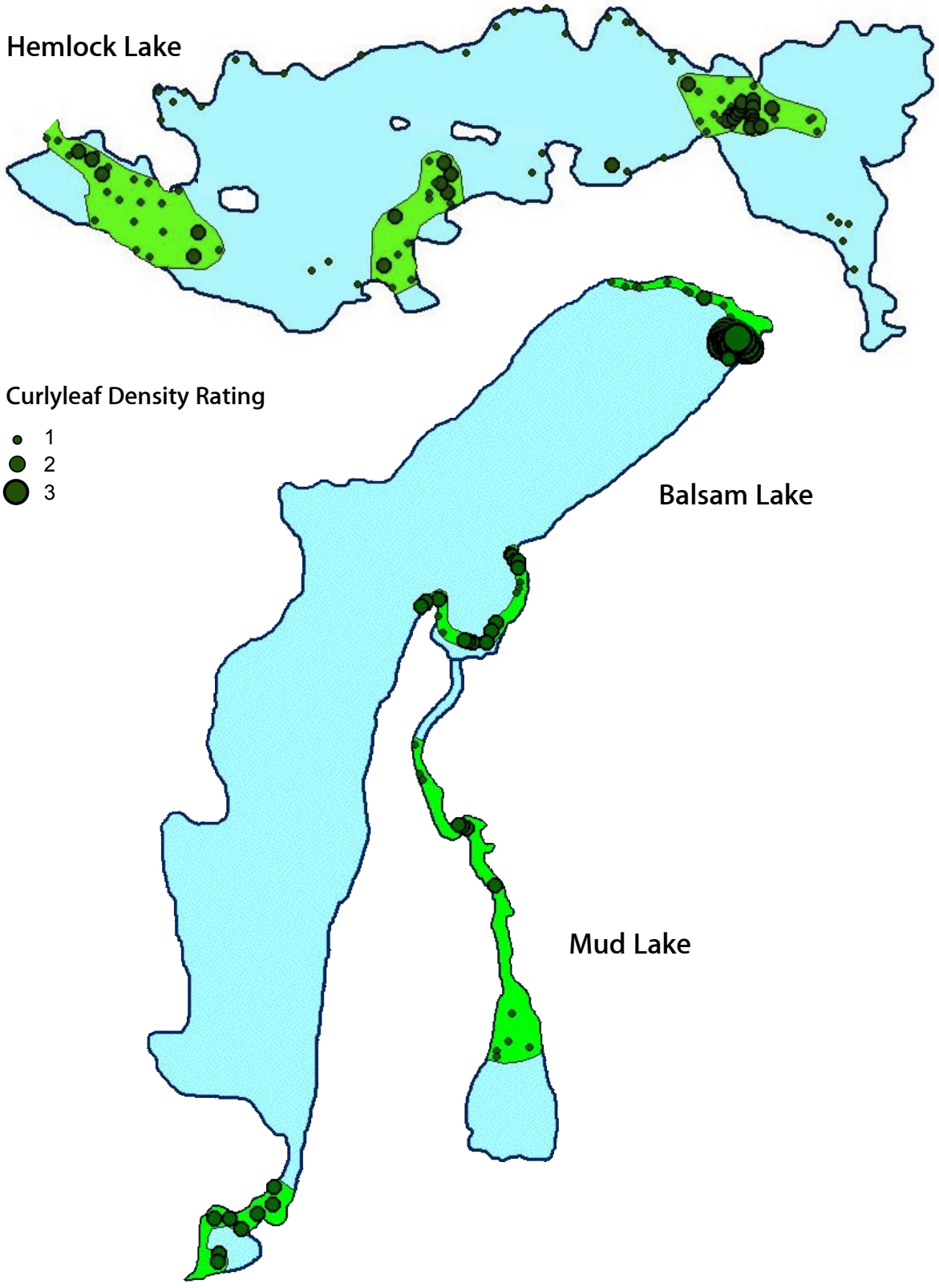


**Figure 13b.** *Curlyleaf Pondweed Density* in Hemlock, Balsam, and Mud Lake; June 2011.



## Point-Intercept Aquatic Plant Surveys

### *Red Cedar Lake: Plant Frequency and Density*

**Table 4.** *Plant Frequency and Density* statistics for species found in Red Cedar Lake in 2011. *Max* = % occurrence based upon max depth of plant growth, *<15ft* = % occurrence for depths <15 ft, *LITTORAL DENSITY* = average density rating for points < max depth of growth, *BED* DENSITY = average density rating at points where species was found.

| COMMON NAME | SCIENTIFIC NAME | %OCCURRENCE Max | %OCCURRENCE <15ft | LITTORAL DENSITY | BED DENSITY |
|---|---|---|---|---|---|
| **SUBMERSED PLANTS** | | | | | |
| Coontail | *Ceratophyllum demersum* | 41 | 35 | 0.6 | 1.4 |
| Wild Celery | *Vallisneria americana* | 28 | 25 | 0.3 | 1.0 |
| Fern-leaf Pondweed | *Potamogeton robbinsii* | 26 | 22 | 0.3 | 1.3 |
| Flat-stem Pondweed | *Potamogeton zosteriformis* | 23 | 20 | 0.3 | 1.2 |
| Small Pondweed | *Potamogeton pusillus* | 18 | 15 | 0.2 | 1.2 |
| Northern Watermilfoil | *Myriophyllum sibiricum* | 13 | 11 | 0.2 | 1.1 |
| Canadian Waterweed | *Elodea canadensis* | 12 | 11 | 0.1 | 1.1 |
| Star Duckweed | *Lemna trisulca* | 12 | 10 | 0.1 | 1.0 |
| Clasping-leaf Pondweed | *Potamogeton richardsonii* | 10 | 8 | 0.1 | 1.1 |
| Water Marigold | *Bidens beckii* | 7 | 6 | 0.1 | 1.0 |
| Large-leaf Pondweed | *Potamogeton amplifolius* | 5 | 5 | 0.1 | 1.3 |
| Stonewort | *Nitella* sp. | 4 | 3 | <0.1 | 1.0 |
| Slender Naiad | *Najas flexilis* | 3 | 3 | <0.1 | 1.0 |
| Fries' Pondweed | *Potamogeton friesii* | 3 | 3 | <0.1 | 1.1 |
| White-stem Pondweed | *Potamogeton praelongus* | 3 | 3 | <0.1 | 1.0 |
| Stiff Water-crowfoot | *Ranunculus aquatilis* | 2 | 2 | <0.1 | 1.0 |
| Muskgrass | *Chara* sp. | 1 | 1 | <0.1 | 1.0 |
| Variable-leaf Pondweed | *Potamogeton gramineus* | 1 | 1 | <0.1 | 1.0 |
| Aquatic Moss | *Fontinalis antipyretica* | 1 | 1 | <0.1 | 1.0 |
| Common Bladderwort | *Utricularia vulgaris* | 1 | 1 | <0.1 | 1.0 |
| Water Stargrass | *Zosterella dubia* | 1 | 1 | <0.1 | 1.0 |
| Curlyleaf Pondweed | *Potamogeton crispus* | 1 | <1 | <0.1 | 1.0 |
| Quillwort | *Isoetes sp.* | P | P | – | – |
| Sago Pondweed | *Stuckenia pectinata* | P | P | – | – |
| **FLOATING PLANTS** | | | | | |
| White Waterlily | *Nymphaea odorata* | 8 | 7 | 0.1 | 1.0 |
| Yellow Waterlily | *Nuphar variegata* | 4 | 4 | 0.1 | 1.1 |
| Giant Duckweed | *Spirodella polyrhiza* | 3 | 2 | <0.1 | 1.0 |
| Watermeal | *Wolffia columbiana* | 1 | 1 | <0.1 | 1.0 |
| Small Duckweed | *Lemna minor* | <1 | <1 | <0.1 | 1.0 |
| Floating-leaf Pondweed | *Potamogeton natans* | P | P | – | – |
| **EMERGENT PLANTS** | | | | | |
| Burr-reed | *Sparganium* sp. | 3 | 2 | <0.1 | 1.0 |
| Cattail | *Typha* sp. | P | P | – | – |
| Purple Loosestrife | *Lythrum salicaria* | P | P | – | – |
| Arrowhead | *Sagittaria* sp. | P | P | – | – |
| Hard-stem Bulrush | *Schoenoplectus acutus* | P | P | – | – |
| Creeping Spikerush | *Eleocharis palustris* | P | P | – | – |

**Figure 14.** Frequency (% occurrence) of common plant taxa by depth zone in Red Cedar Lake; Aug 2011

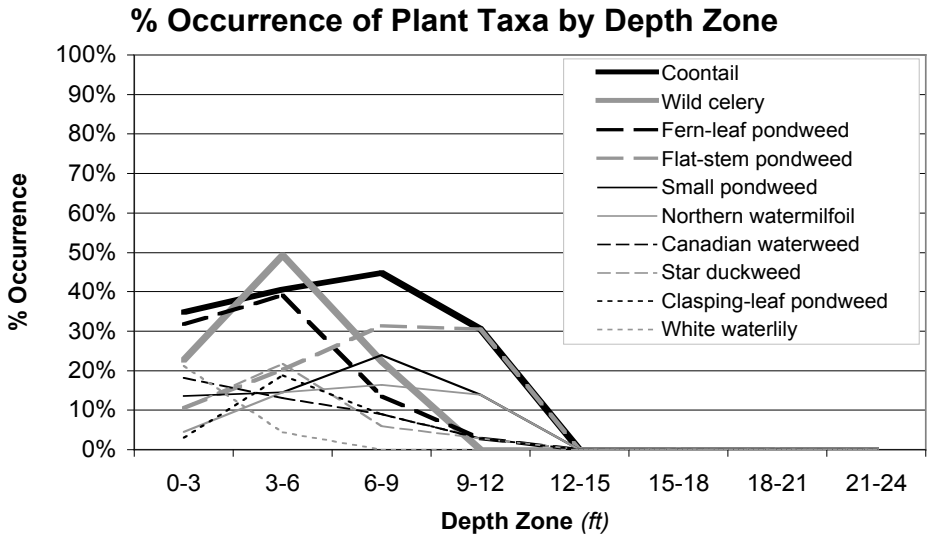
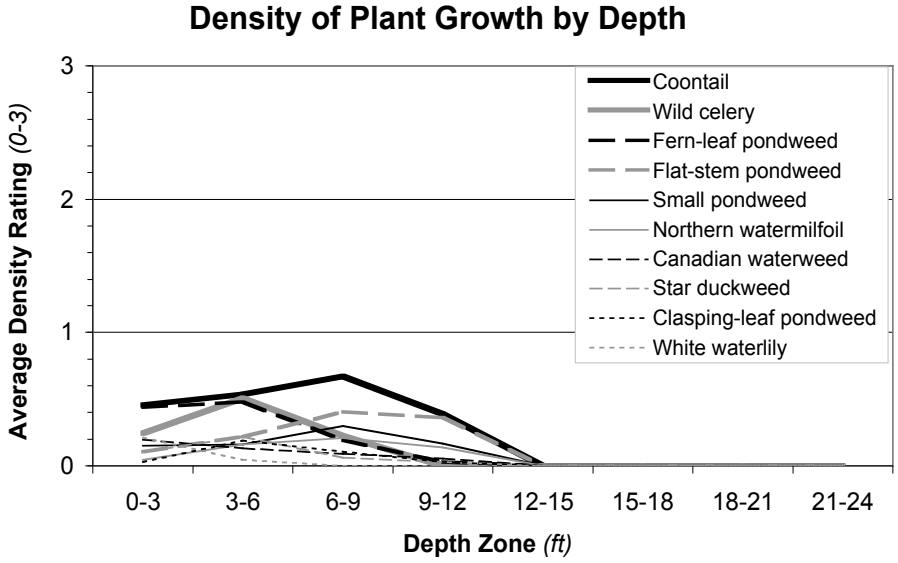



**Figure 15.** Average density rating by depth zone for common plant taxa in Red Cedar Lake; Aug 2011



## *Red Cedar Lake: Aquatic Plant Community Statistics & Metrics*

*% Lake Area Vegetated*
In 2011, about 260 acres of Red Cedar Lake supported plants (14% of the lake). Most of this plant growth was found in areas with mucky sediment, particularly in the far southern portion of the lake and in protected bays. Most of the nearshore areas in the central and northern portions of the lake had sandy or rocky bottoms and generally supported only sparse plant growth. Figure 16 provides additional detail about the % area vegetated within specific depth zones.

*% Lake with Surface Vegetation*
The amount of surface-matted plant growth is a good indicator of recreational impairment by plants. In 2011, only a small portion of the lake (<1%) supported plant growth to the surface. Any surface growth was generally confined to areas immediately adjacent to shore or shallow, mucky bays. This means that the vast majority of the lake had open water and there was very little recreational impairment due to dense surface growth of plants

*Maximum Depth of Growth*
This aspect of the plant community is highly dependent upon water clarity. In Red Cedar Lake, the maximum depth of growth in 2011 was 11.8 ft (Table 5, Figs. 14–17). This maximum depth is consistent with the average summer water clarity in the lake, which was reported to be roughly 8 ft (Secchi depth, WDNR 2011). Plant growth is generally expected out to depths that are roughly 1.5 to 2 times the Secchi depth.

*% Littoral Area Vegetated*
The littoral area is the portion of a lake where the bottom receives enough light to support plants. In Red Cedar Lake, we found plants growing in 58% of this littoral zone. (Table 5, Figs. 14-17). As noted above, most of this area supported only sparse plant growth.

*Average Plant Height*
This is an evaluation of plant height (regardless of species) throughout the littoral portion of the lake. In Red Cedar Lake, the average plant height in the littoral zone was 6.2 ±0.4 ft (average ±1SE). In general, this assessment represents the average height of the tallest plant species from each littoral site.

**Table 5.** Plant community statistics and metrics for Red Cedar Lake; August 2011 survey.

| STATISTIC / METRIC | Aug 2011 |
|---|---|
| **WHOLE LAKE BASIN** | |
| % Lake Area Vegetated | 14 |
| % Lake Surface Vegetation | <1 |
| Max Depth of Growth *(ft)* | 12 |
| **LITTORAL *(< max depth of growth)*** | |
| % Littoral Area Vegetated | 58 |
| Average Plant Height *(ft, ±1SE)* | 6.2 ±0.4 |
| Average Plant Density *(±1SE)* | 1.3 ±0.1 |
| Species Richness | 36 |
| Simpson's Diversity | 0.91 |
| Native Taxa per Sample *(±1SE)* | 2.3 ±0.1 |

**Figure 16.** Percent of sample points with plants for each depth zone of Red Cedar Lake in August 2011

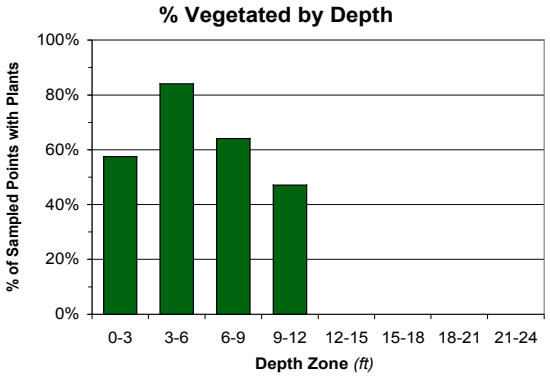
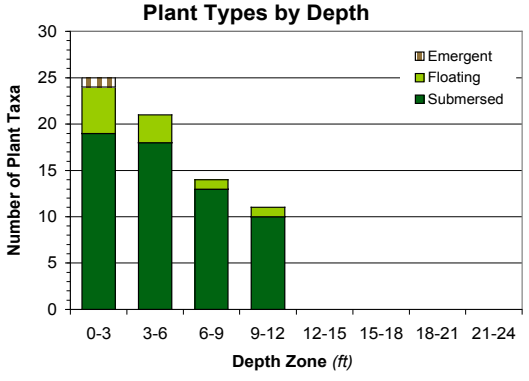



**Figure 17.** Number and type of plant species found in each depth zone of Red Cedar Lake in 2011

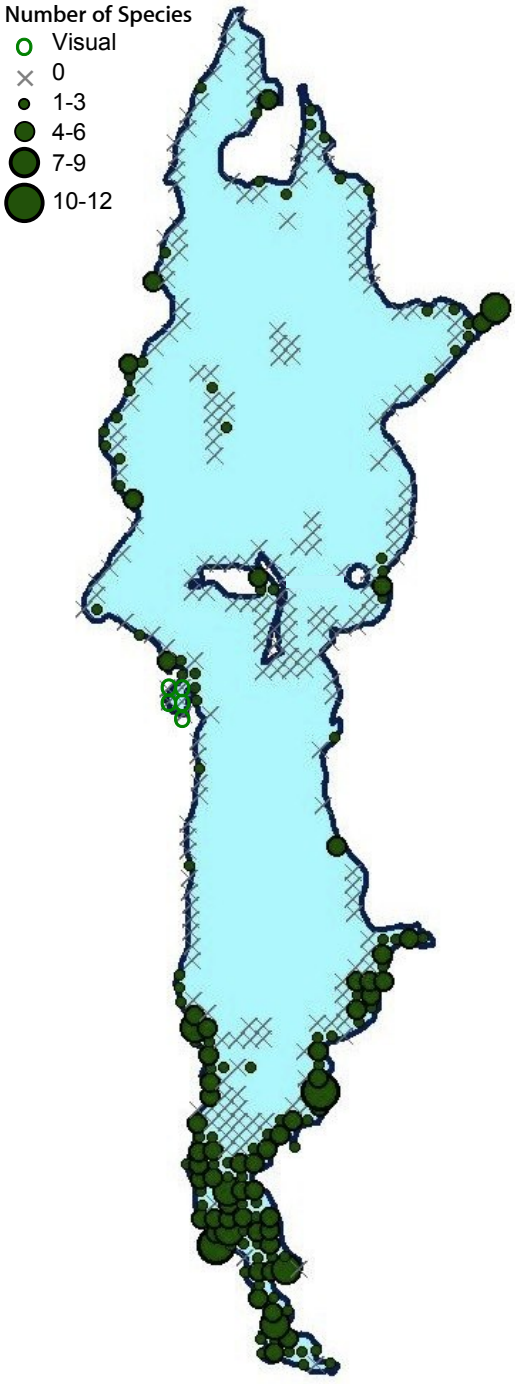


*Species Richness*
This is simply the total number of aquatic plant species found in the lake during the survey. In 2011, Red Cedar Lake supported 36 different plant taxa - most identified to species (Table 4); 24 submersed (underwater), 6 floating (like lilies), and 6 emergent (extending out of the water).

*Simpson's Diversity Index*
This index is a measure of both the number of species and the degree to which those species are equally mixed. Values close to 1.0 reflect a very diverse plant community with many species that are equally common (no strong dominance by any one species). Lower values reflect lower diversity (fewer species, clearly dominated by one or two species). In general, greater diversity means that there is better habitat for fish. In Red Cedar Lake, the *Simpson's Diversity Index* for 2011 was 0.91, indicating a diverse plant community. This index is most useful for tracking any major changes in the diversity of the plant community over time.

*Number of Native Species per Sample*
This is another measure of aquatic plant diversity in the littoral portion of the lake. In 2011, the average number of native species per sample in Red Cedar Lake was 3.1 ±0.1 (average ±1SE, Fig. 18). This further indicates that Red Cedar Lake supported a healthy, diverse aquatic plant community in 2011.

**Figure 18.** *Number of Native Plant Species* at each location sampled in Red Cedar Lake, August 2011. A few sites were inaccessible due to extremely dense plants or shallow water. These sites were assessed visually from a distance ("Visual", number of species not known).



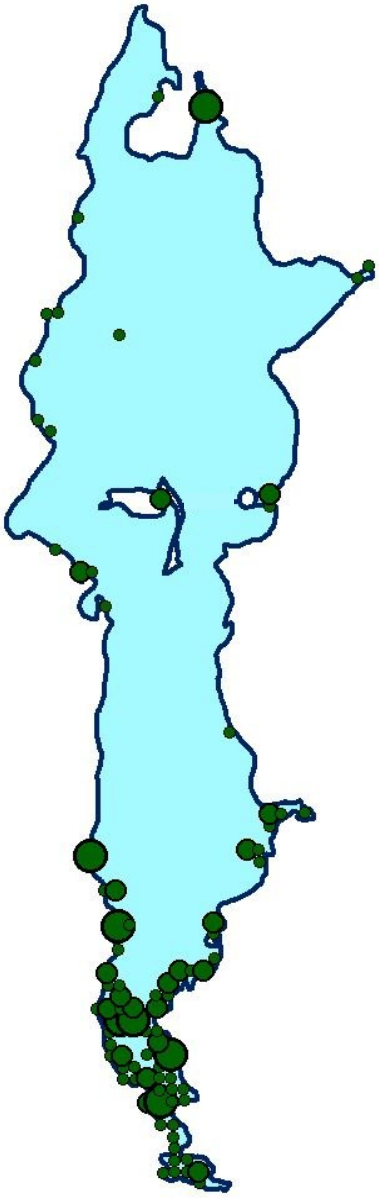
## *Red Cedar Lake: Distribution and Density Maps*

(Common species – presented in decreasing order of frequency)

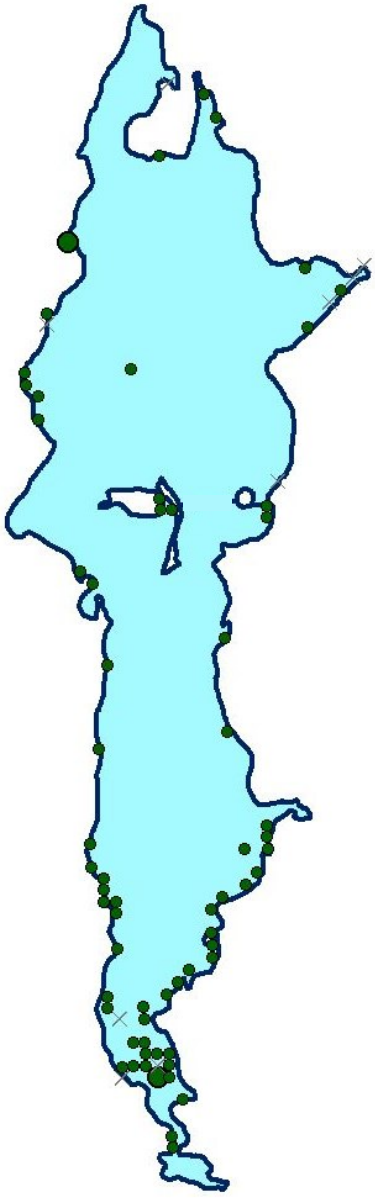
**Plant Density Ratings**

× 0 *(observed nearby)*
• 1
● 2
● 3

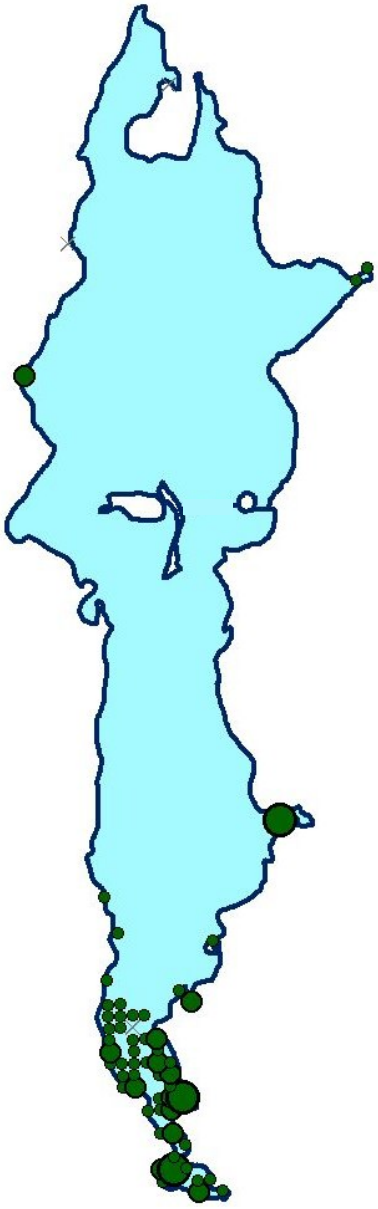
**Coontail**
*(C. demersum)*



**Wild Celery**
*(V. americana)*



**Fern-leaf Pondweed**
*(P. robbinsii)*

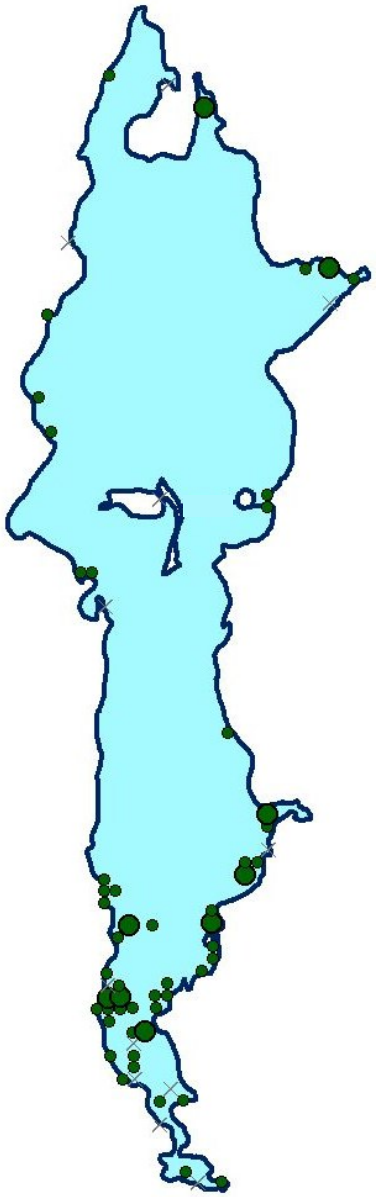


*Red Cedar Lake*

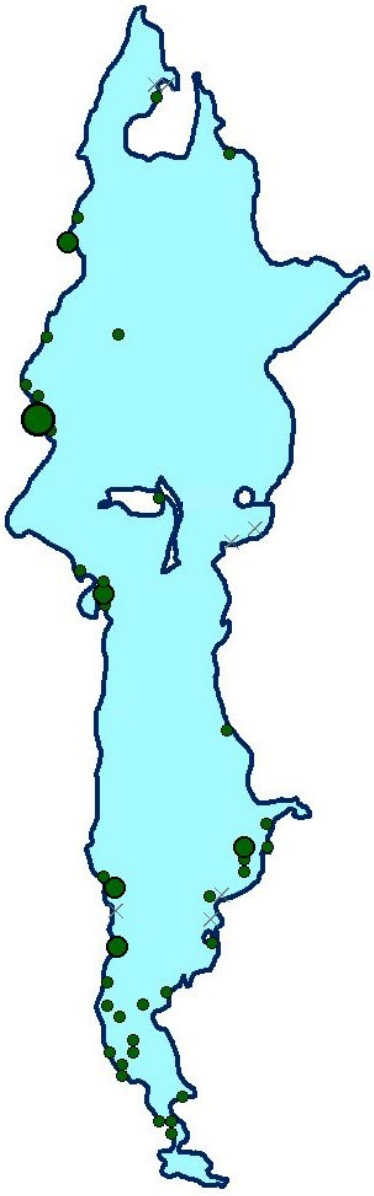
**Plant Density Ratings**

× 0 *(observed nearby)*
• 1
2
3

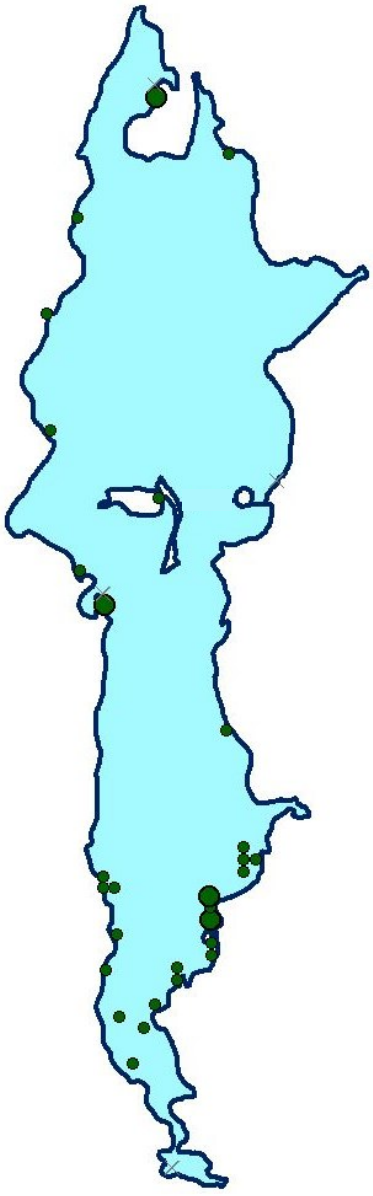
**Flat-stem Pondweed**
*(P. zosteriformis)*



**Small Pondweed**
*(P. pusillus)*



**Northern Watermilfoil**
*(M. sibiricum)*

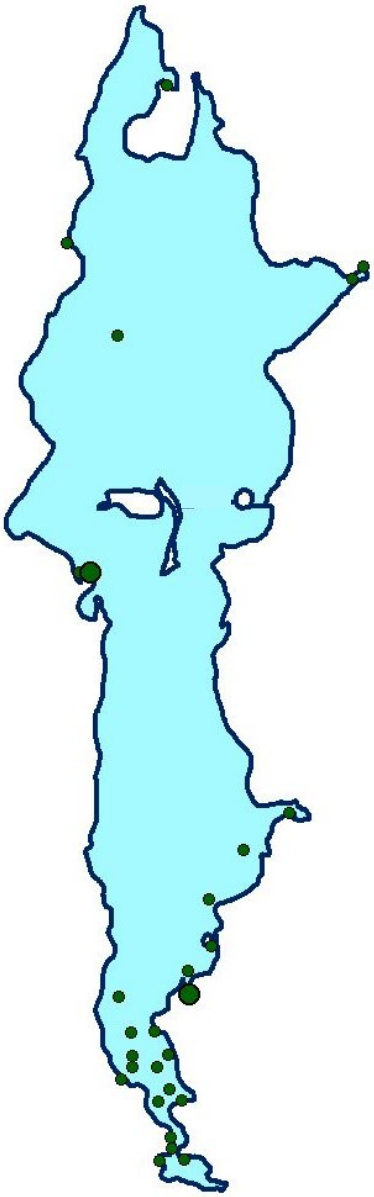


## *Red Cedar Lake*

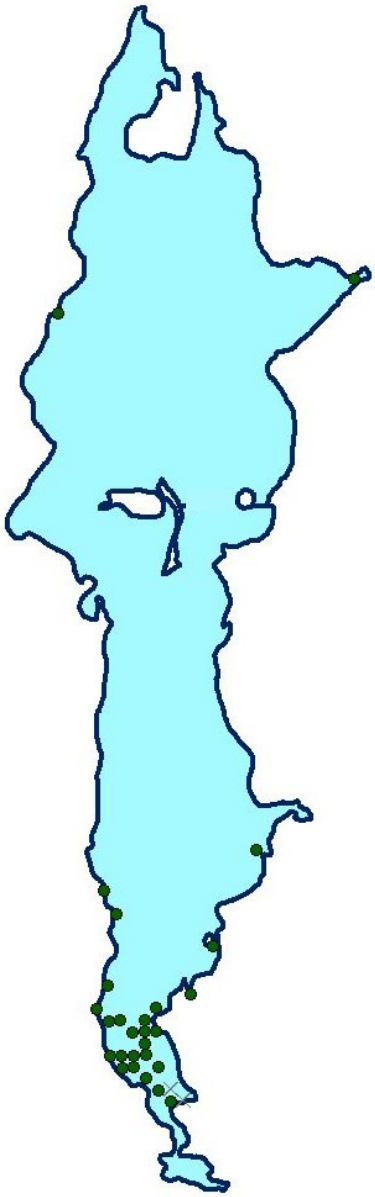
### Plant Density Ratings

× 0 *(observed nearby)*
• 1
2
3

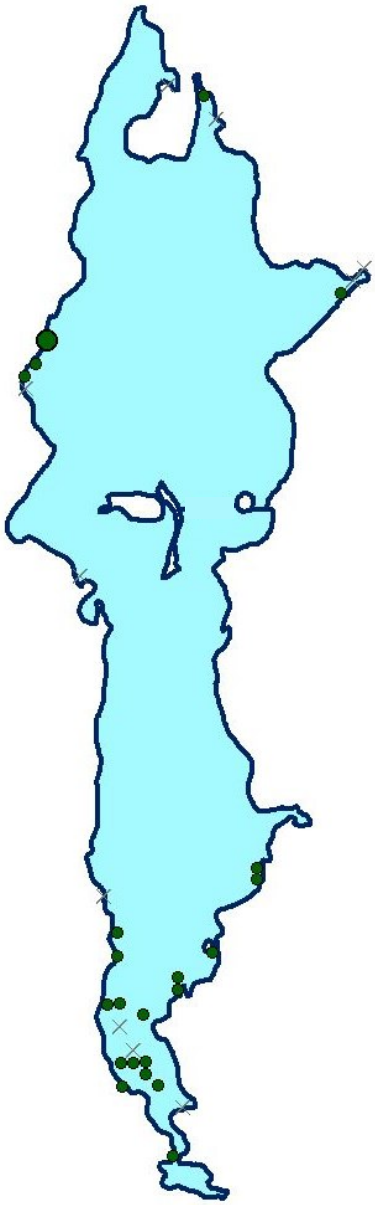
**Canadian Waterweed**
*(E. canadensis)*



**Star Duckweed**
*(L. trisulca)*



**Clasping-leaf Pondweed**
*(P. richardsonii)*

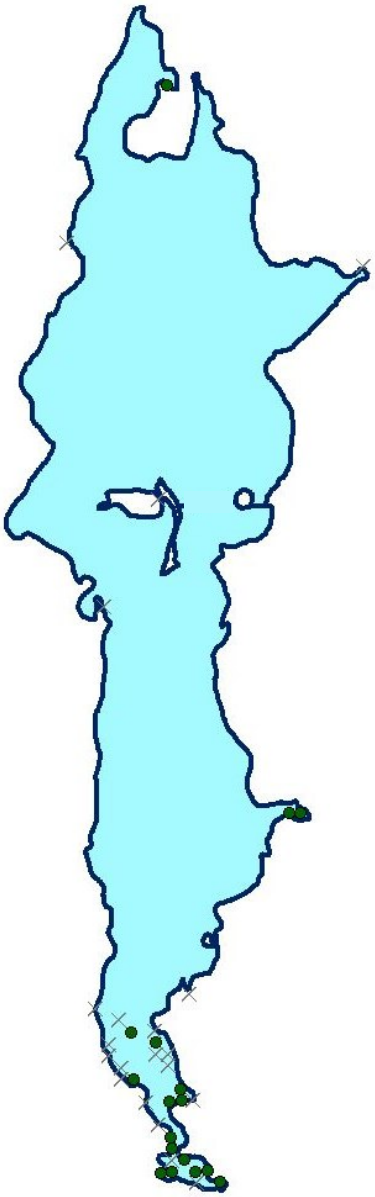


## *Red Cedar Lake*

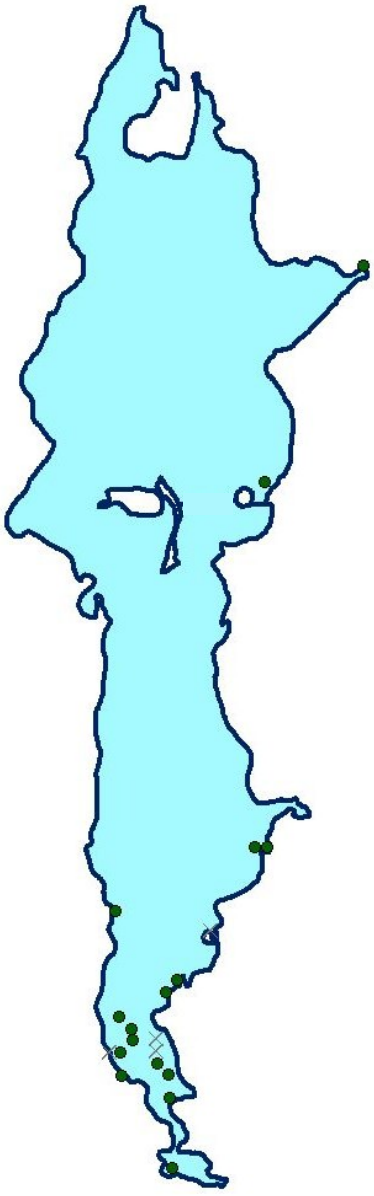
### Plant Density Ratings

× 0 *(observed nearby)*
• 1
2
3

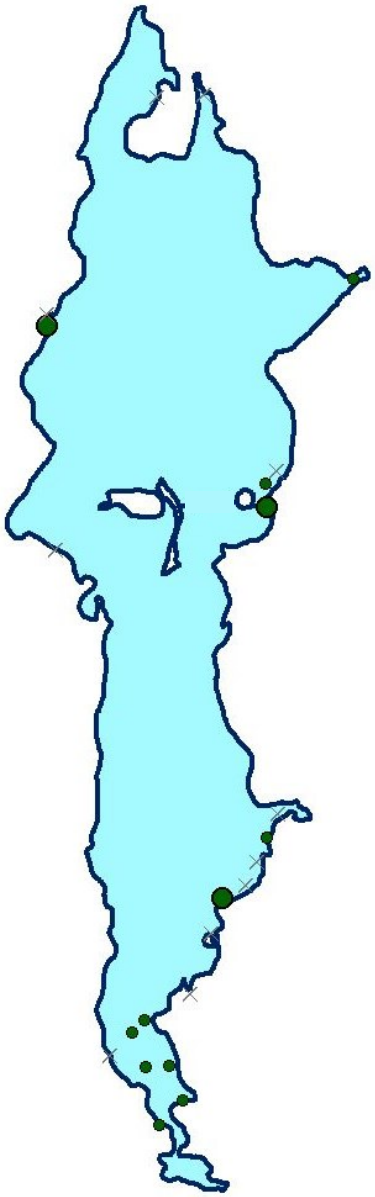
**White Waterlily**
*(N. odorata)*



**Water Marigold**
*(B. beckii)*



**Large-leaf Pondweed**
*(P. amplifolius)*

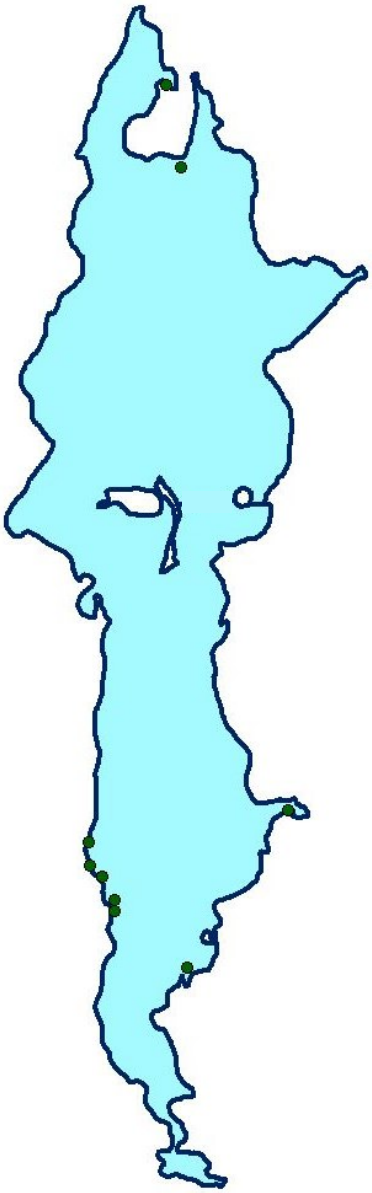


## *Red Cedar Lake*

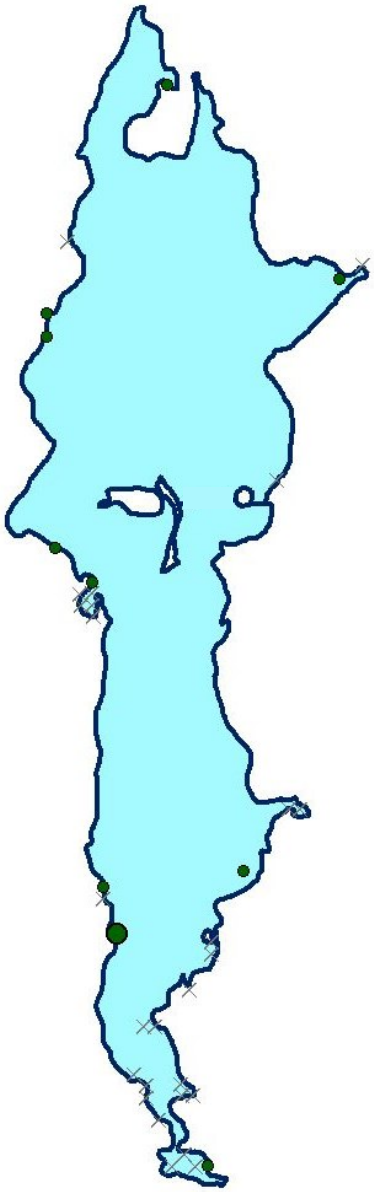
### Plant Density Ratings

× 0 *(observed nearby)*
• 1
2
3

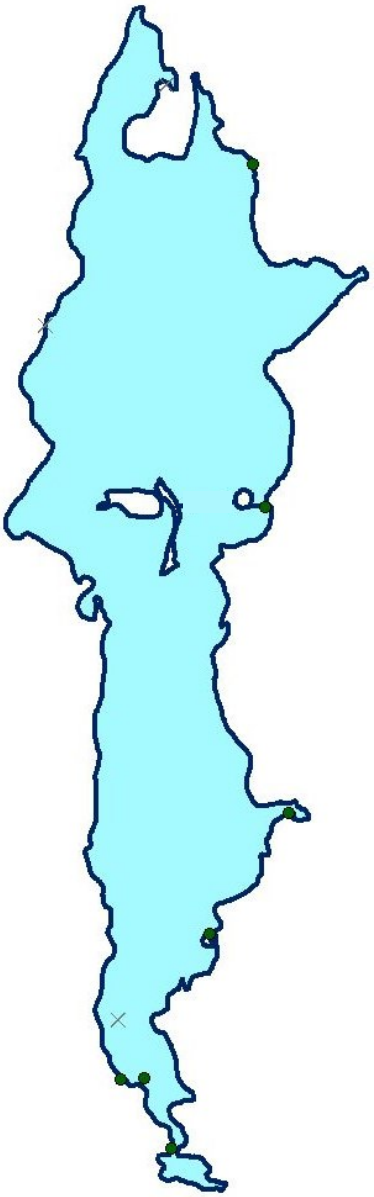
**Stonewort**
*(Nitella* sp.*)*



**Yellow Waterlily**
*(N. variegata)*



**Slender Naiad**
*(N. flexilis)*



## *Hemlock Lake: Plant Frequency and Density*

**Table 6.** *Plant Frequency and Density* statistics for species found in Hemlock Lake in 2011. *Max* = % occurrence based upon max depth of plant growth, *<15ft* = % occurrence for depths <15 ft, *LITTORAL DENSITY* = average density rating for points < max depth of growth, *BED* DENSITY = average density rating at points where species was found.

| COMMON NAME | SCIENTIFIC NAME | %OCCURRENCE Max | %OCCURRENCE <15ft | LITTORAL DENSITY | BED DENSITY |
|---|---|---|---|---|---|
| **SUBMERSED PLANTS** | | | | | |
| Fern-leaf Pondweed | *Potamogeton robbinsii* | 81 | 60 | 1.4 | 1.7 |
| Coontail | *Ceratophyllum demersum* | 60 | 44 | 0.9 | 1.5 |
| Flat-stem Pondweed | *Potamogeton zosteriformis* | 25 | 18 | 0.3 | 1.0 |
| Canadian Waterweed | *Elodea canadensis* | 18 | 14 | 0.2 | 1.0 |
| Star Duckweed | *Lemna trisulca* | 14 | 10 | 0.1 | 1.0 |
| Common Bladderwort | *Utricularia vulgaris* | 9 | 6 | 0.1 | 1.0 |
| Small Pondweed | *Potamogeton pusillus* | 8 | 6 | 0.1 | 1.1 |
| Large-leaf Pondweed | *Potamogeton amplifolius* | 6 | 5 | 0.1 | 1.0 |
| Wild Celery | *Vallisneria americana* | 5 | 4 | 0.1 | 1.0 |
| Aquatic Moss | *Fontinalis antipyretica* | 4 | 3 | <0.1 | 1.0 |
| Northern Watermilfoil | *Myriophyllum sibiricum* | 4 | 3 | <0.1 | 1.0 |
| Water Marigold | *Bidens beckii* | 3 | 2 | <0.1 | 1.0 |
| Clasping-leaf Pondweed | *Potamogeton richardsonii* | <1 | <1 | <0.1 | 1.0 |
| Curlyleaf Pondweed | *Potamogeton crispus* | <1 | <1 | <0.1 | 1.0 |
| Stiff Water-crowfoot | *Ranunculus aquatilis* | 1 | 1 | <0.1 | 1.0 |
| Water Stargrass | *Zosterella dubia* | 1 | 1 | <0.1 | 1.0 |
| White-stem Pondweed | *Potamogeton praelongus* | 1 | 1 | <0.1 | 1.0 |
| Sago Pondweed | *Stuckenia pectinata* | P | P | – | – |
| Slender Naiad | *Najas flexilis* | P | P | – | – |
| Spiral-fruited Pondweed | *Potamogeton spirillus* | P | P | – | – |
| Variable-leaf Pondweed | *Potamogeton gramineus* | P | P | – | – |
| **FLOATING PLANTS** | | | | | |
| Giant Duckweed | *Spirodella polyrhiza* | 32 | 24 | 0.3 | 1.0 |
| White Waterlily | *Nymphaea odorata* | 24 | 18 | 0.3 | 1.1 |
| Yellow Waterlily | *Nuphar variegata* | 15 | 11 | 0.2 | 1.0 |
| Floating-leaf Pondweed | *Potamogeton natans* | 6 | 5 | 0.1 | 1.0 |
| Watermeal | *Wolffia columbiana* | 2 | 1 | <0.1 | 1.0 |
| Slender Riccia | *Riccia fluitans* | 1 | 1 | <0.1 | 1.0 |
| **EMERGENT PLANTS** | | | | | |
| Arrowhead | *Sagittaria* sp. | 1 | 1 | <0.1 | 1.0 |
| Burr-reed | *Sparganium* sp. | P | P | – | – |
| Cattail | *Typha* sp. | P | P | – | – |
| Creeping Spikerush | *Eleocharis palustris* | P | P | – | – |

**Figure 19.** Frequency (% occurrence) of common plant taxa by depth zone in Hemlock Lake; July 2011

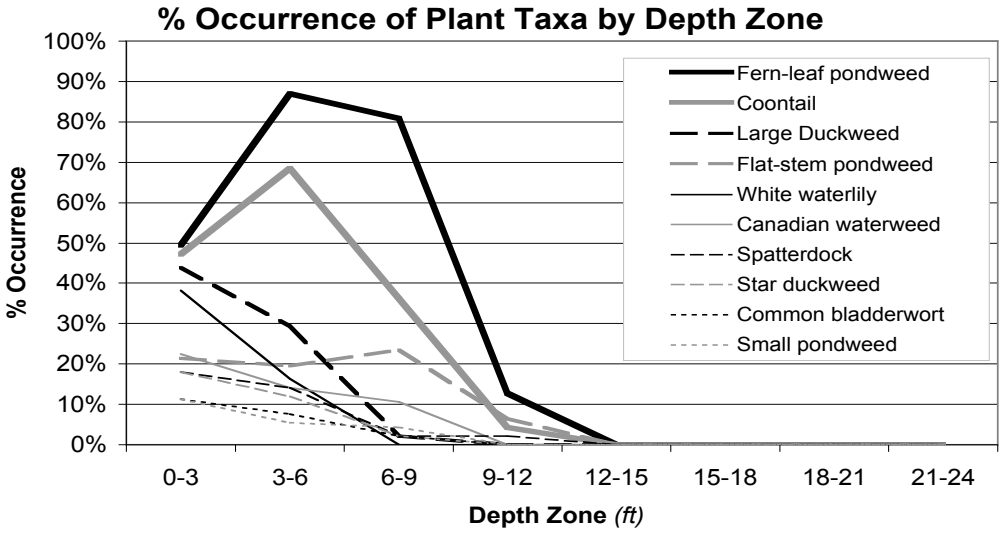
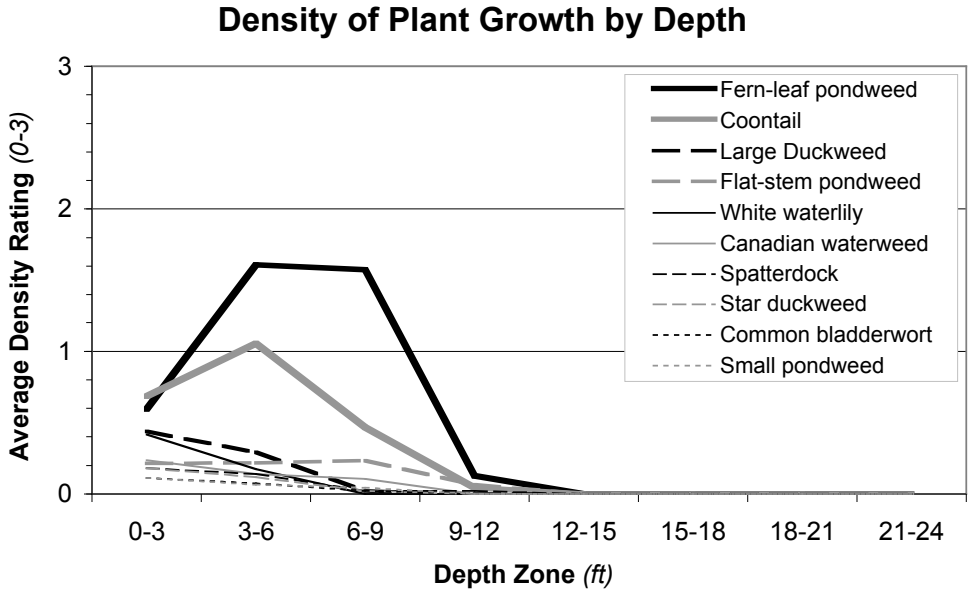



**Figure 20.** Average density rating by depth zone for common plant taxa in Hemlock Lake; July 2011



## *Hemlock Lake: Aquatic Plant Community Statistics & Metrics*

*% Lake Area Vegetated*
In 2011, about 160 acres of Hemlock Lake supported plants (45% of the lake). Most of this plant growth was found in areas with mucky sediment, particularly in the eastern and southern portions of the lake. Most of the nearshore areas along the northern shore of the lake had sandy or rocky bottom and generally supported only sparse plant growth. Figure 21 provides additional detail about the % area vegetated within specific depth zones.

*% Lake with Surface Vegetation*
The amount of surface-matted plant growth is a good indicator of recreational impairment by plants. In 2011, 91 acres (26% of the lake) supported plant growth to the surface. Much of this surface growth was found in the eastern third of the lake and in shallow bays along the southern shoreline, and consisted mostly of water lilies (*N. odorata* and *N. variegata*) and fern-leaf pondweed (*P. robbinsii*). Although this surface growth impaired recreational use in these areas, most of the lake had open water with no plants at the surface.

*Maximum Depth of Growth*
This aspect of the plant community is highly dependent upon water clarity. In Hemlock Lake, the maximum depth of growth in 2011 was 10 ft (Table 7, Figs. 19–22). This maximum depth is consistent with the average summer water clarity in the lake, which was reported to be roughly 8 ft (Secchi depth, WDNR 2011). Plant growth is generally expected out to depths that are roughly 1.5 to 2 times the Secchi depth.

*% Littoral Area Vegetated*
The littoral area is the portion of a lake where the bottom receives enough light to support plants. In Hemlock Lake, we found plants growing in 58% of this littoral zone. (Table 7, Figs. 19-22). As noted above, most of this area supported only sparse plant growth.

*Average Plant Height*
This is an evaluation of plant height (regardless of species) throughout the littoral portion of the lake. In Hemlock Lake, the average plant height in the littoral zone was 10.9 ±0.4 ft (average ±1SE). In general, this assessment represents the average height of the tallest plant species from each littoral site.

**Table 7.** Plant community statistics and metrics for Hemlock Lake; July 2011 survey.

| STATISTIC / METRIC | Jul 2011 |
|---|---|
| **WHOLE LAKE BASIN** | |
| % Lake Area Vegetated | 45 |
| % Lake Surface Vegetation | 26 |
| Max Depth of Growth *(ft)* | 10 |
| **LITTORAL *(< max depth of growth)*** | |
| % Littoral Area Vegetated | 61 |
| Average Plant Height *(ft, ±1SE)* | 10.9 ±0.4 |
| Average Plant Density *(±1SE)* | 2.1 ±0.1 |
| Species Richness | 31 |
| Simpson's Diversity | 0.87 |
| Native Taxa per Sample *(±1SE)* | 3.2 ±0.1 |
| Floristic Quality Index *(FQI)* | 28.8 |
| AMCI *(Community Index)* | 48 |

**Figure 21.** Percent of sample points with plants for each depth zone of Hemlock Lake in 2011

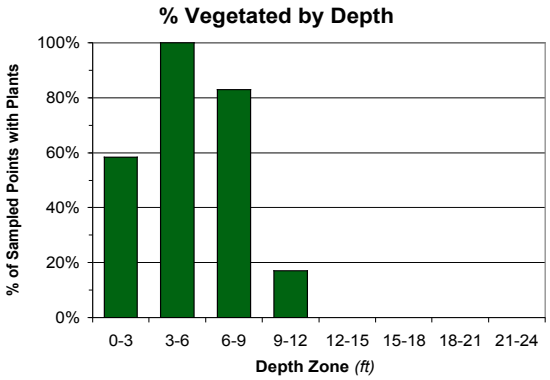
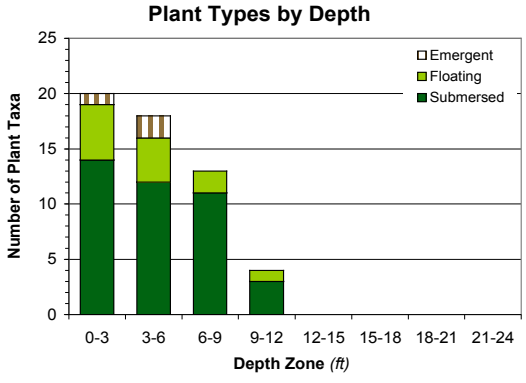



**Figure 22.** Number and type of plant species found in each depth zone of Hemlock Lake in 2011

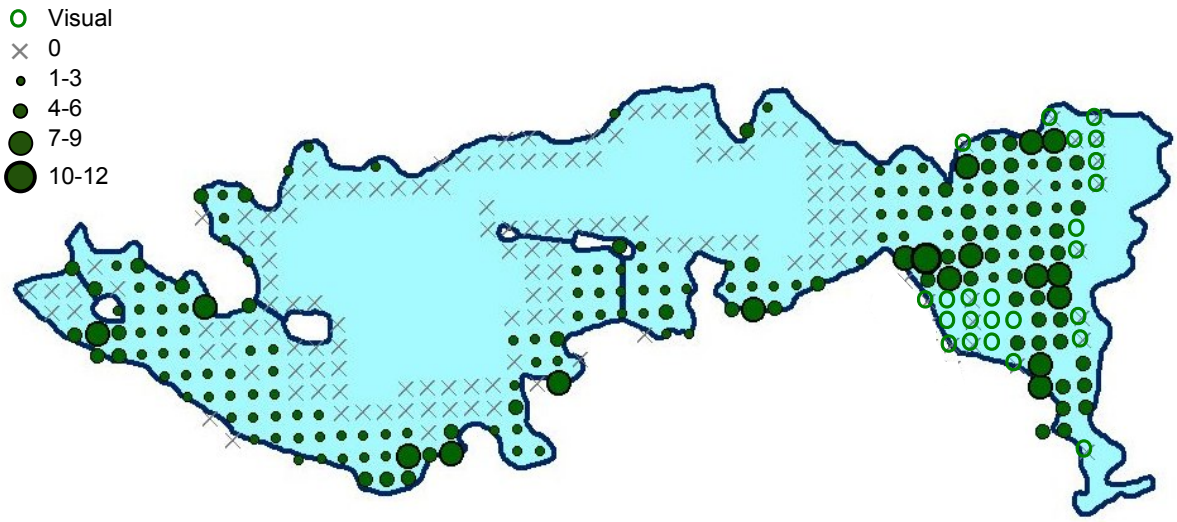


*Species Richness*
This is simply the total number of aquatic plant species found in the lake during the survey. In 2011, Hemlock Lake supported 31 different plant taxa - most identified to species (Table 6); 21 submersed (underwater), 6 floating (like lilies), and 4 emergent (extending out of the water).

*Simpson's Diversity Index*
This index is a measure of both the number of species and the degree to which those species are equally mixed. Values close to 1.0 reflect a very diverse plant community with many species that are equally common (no strong dominance by any one species). Lower values reflect lower diversity (fewer species, clearly dominated by one or two species). In general, greater diversity means that there is better habitat for fish. In Hemlock Lake, the *Simpson's Diversity Index* for 2011 was 0.87, indicating a diverse plant community. This index is most useful for tracking any major changes in the diversity of the plant community over time.

*Number of Native Species per Sample*
This is another measure of aquatic plant diversity in the littoral portion of the lake. In 2011, the average number of native species per sample in Hemlock Lake was 3.2 ±0.1 (average ±1SE, Fig. 23). This was similar to the diversity found in Red Cedar Lake and further indicates that Hemlock Lake supported a healthy, diverse aquatic plant community in 2011.

**Figure 23.** *Number of Native Plant Species* at each location sampled in Hemlock Lake; July 2011. A few sites were inaccessible due to extremely dense plants or shallow water. These sites were assessed visually from a distance ("Visual", number of species not known).

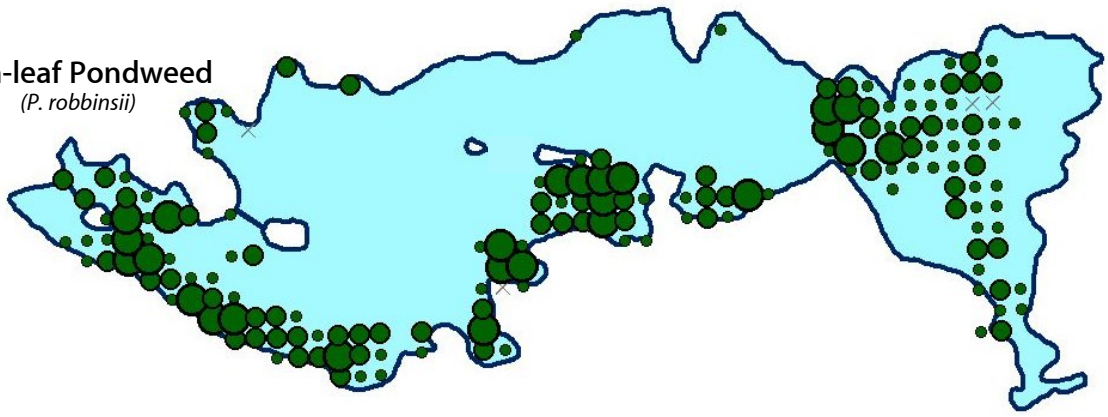


## *Hemlock Lake: Distribution and Density Maps*

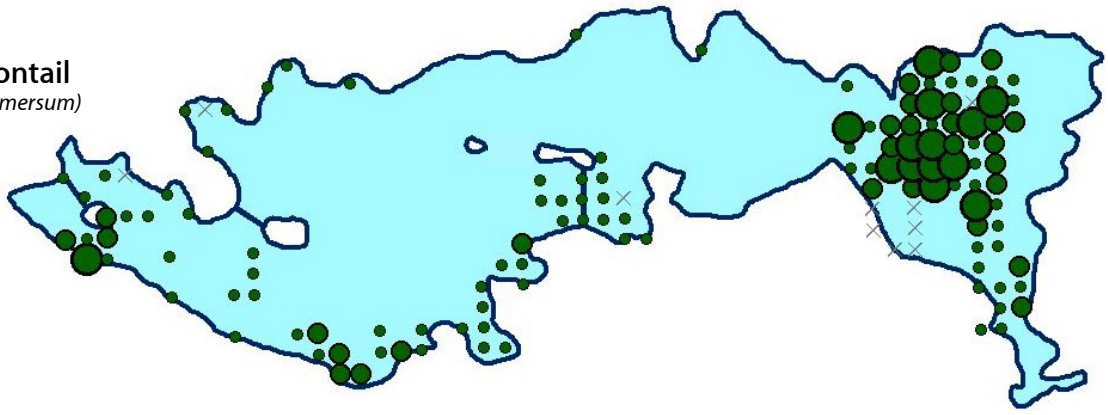
**Plant Density Ratings**

× 0 *(observed nearby)*
• 1
2
3

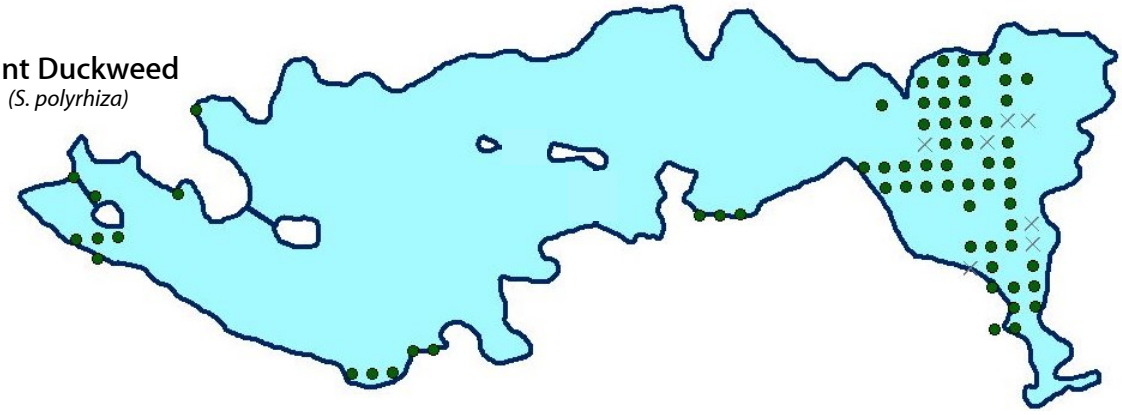
**Fern-leaf Pondweed**
*(P. robbinsii)*



**Coontail**
*(C. demersum)*



**Giant Duckweed**
*(S. polyrhiza)*

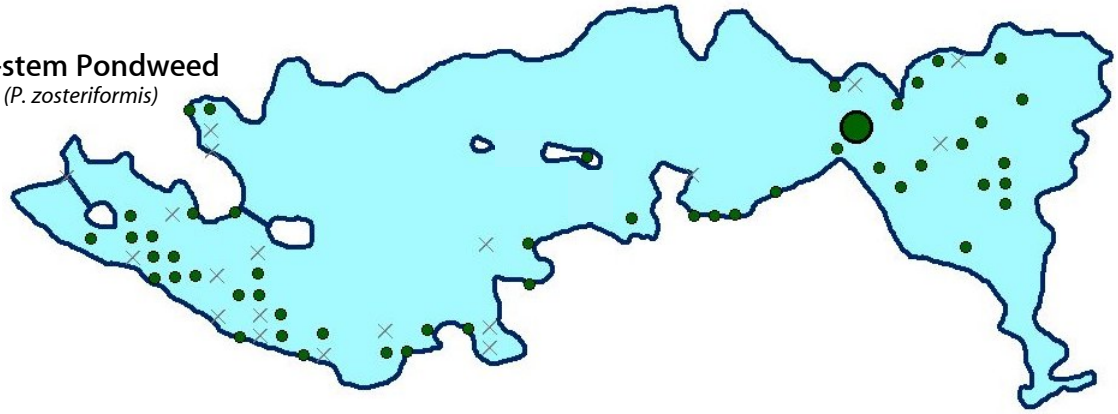


*Hemlock Lake*

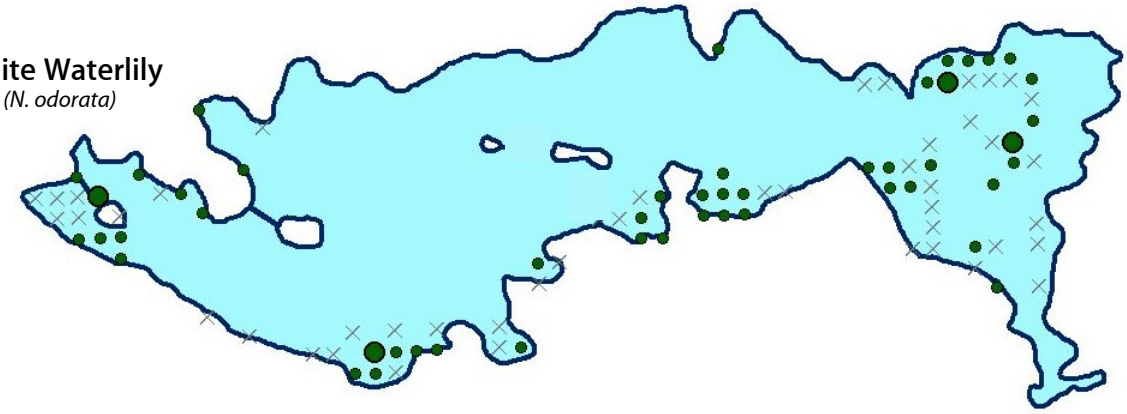
**Plant Density Ratings**

× 0 *(observed nearby)*
• 1
2
3

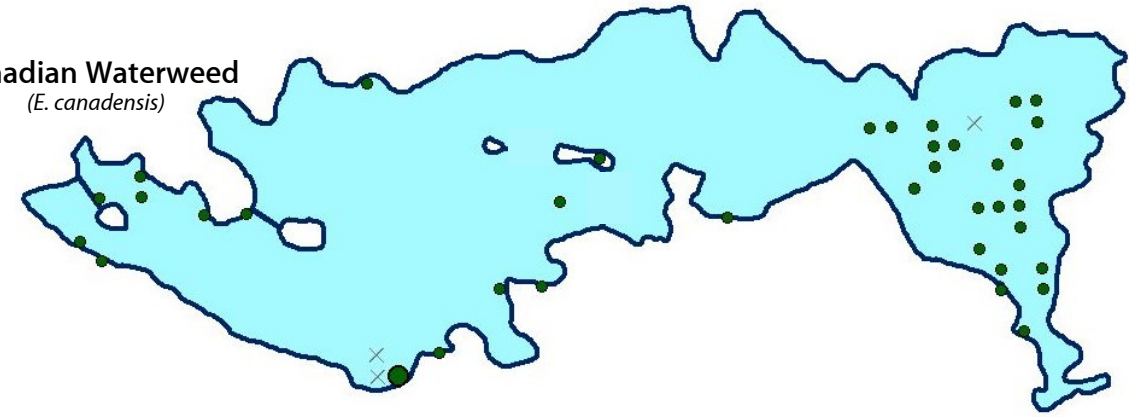
**Flat-stem Pondweed**
*(P. zosteriformis)*



**White Waterlily**
*(N. odorata)*



**Canadian Waterweed**
*(E. canadensis)*

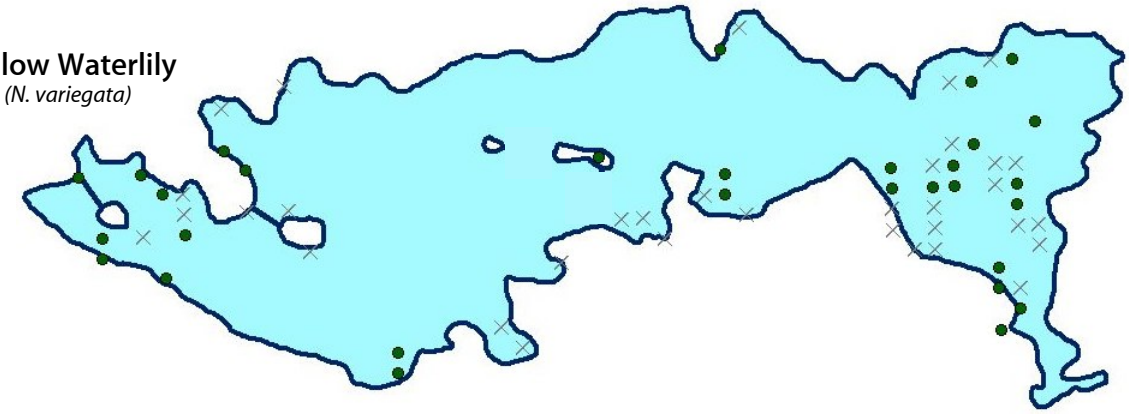


## *Hemlock Lake*

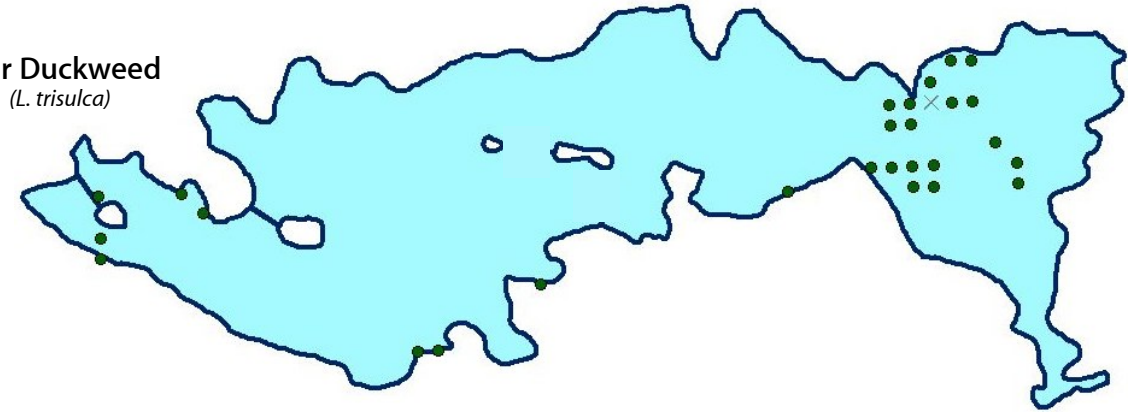
### Plant Density Ratings

× 0 *(observed nearby)*
• 1
2
3

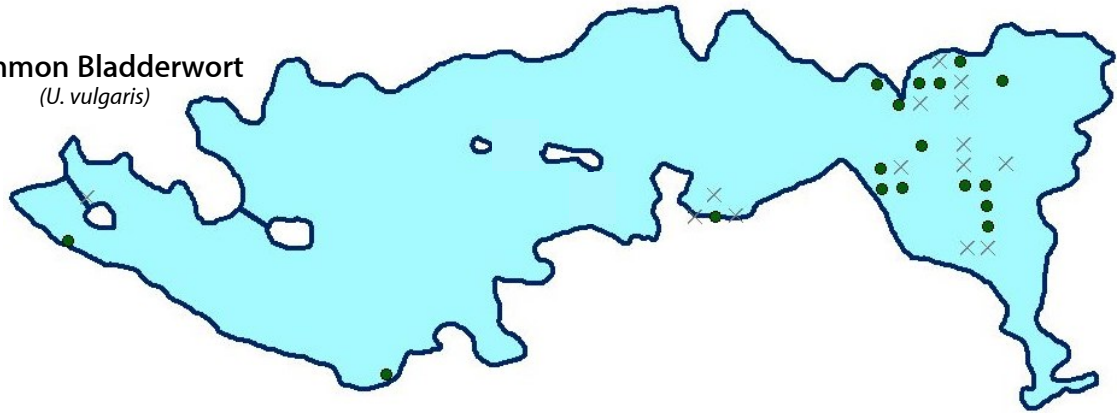
### Yellow Waterlily
*(N. variegata)*



### Star Duckweed
*(L. trisulca)*



### Common Bladderwort
*(U. vulgaris)*

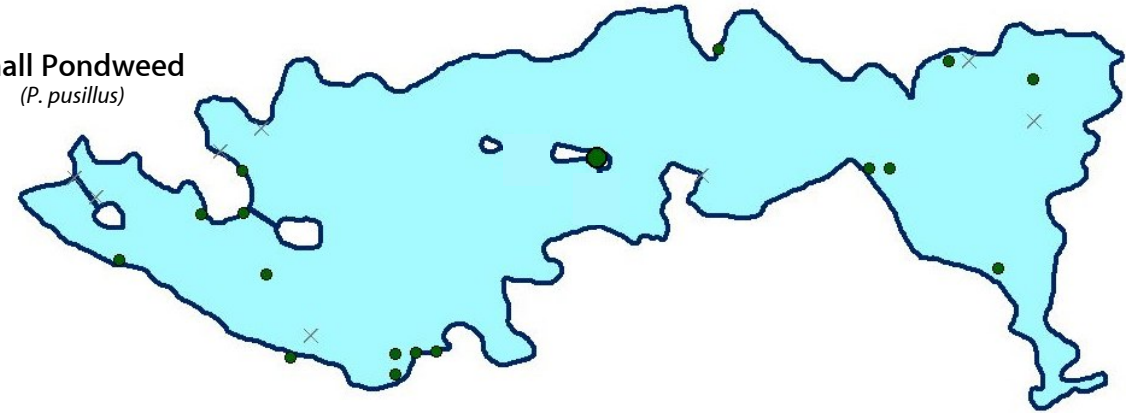


*Hemlock Lake*

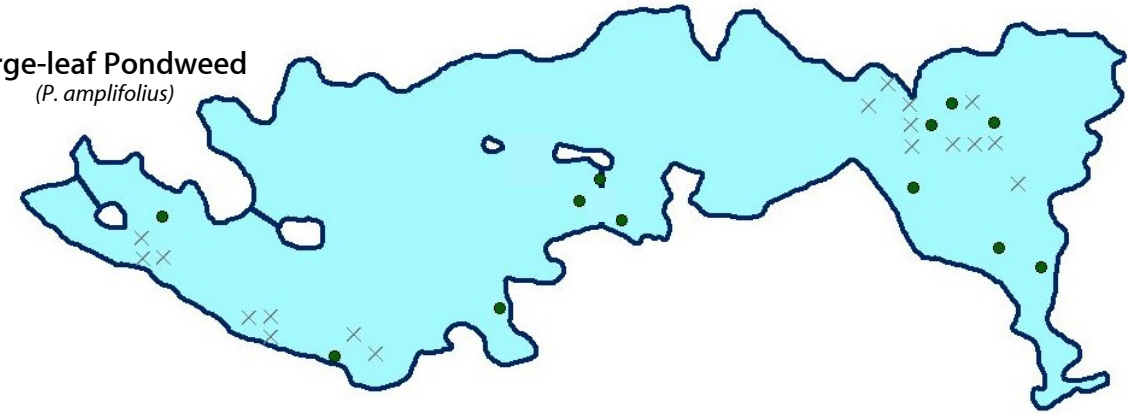
**Plant Density Ratings**

× 0 *(observed nearby)*
• 1
2
3

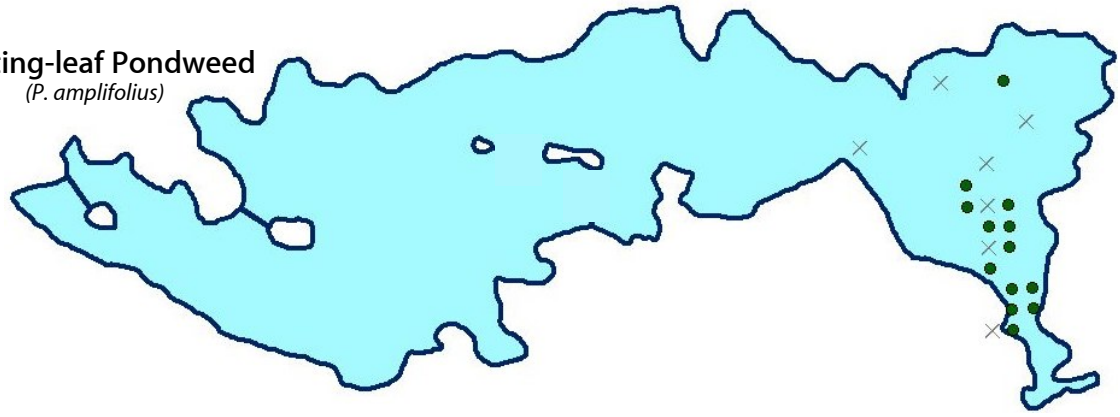
**Small Pondweed**
*(P. pusillus)*



**Large-leaf Pondweed**
*(P. amplifolius)*



**Floating-leaf Pondweed**
*(P. amplifolius)*

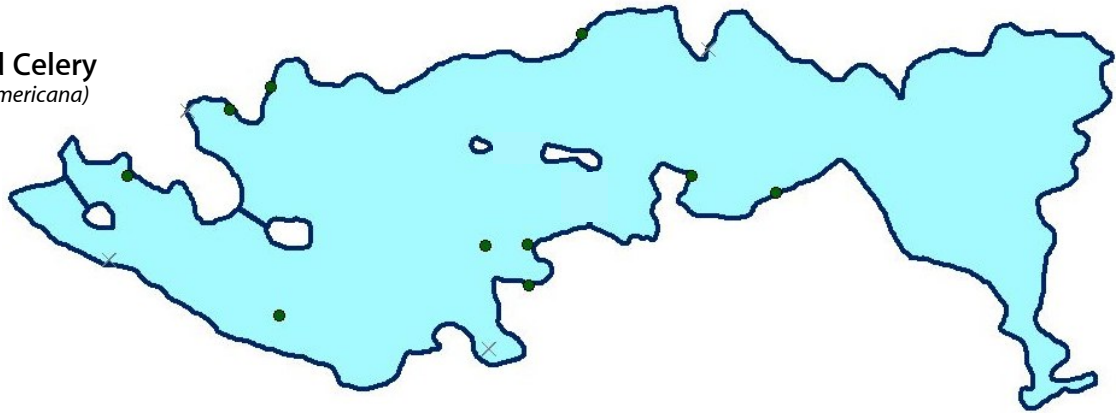


## *Hemlock Lake*

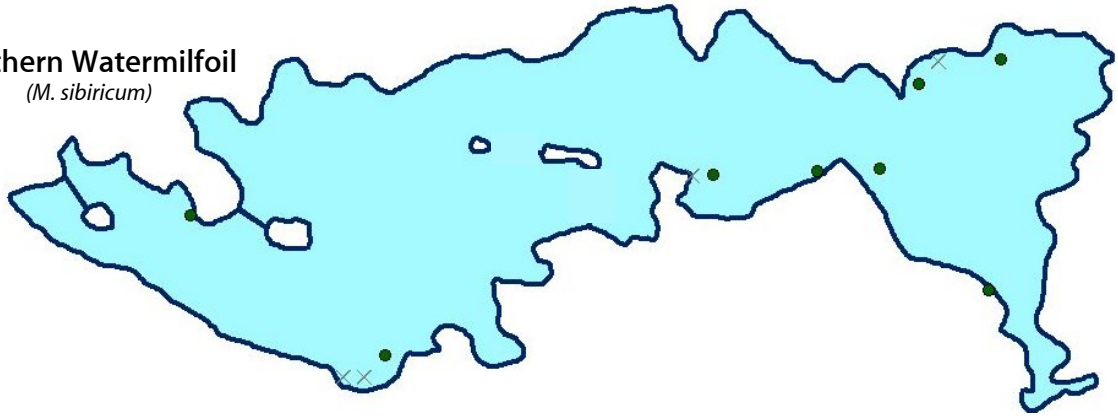
### Plant Density Ratings

× 0 *(observed nearby)*
• 1
● 2
● 3

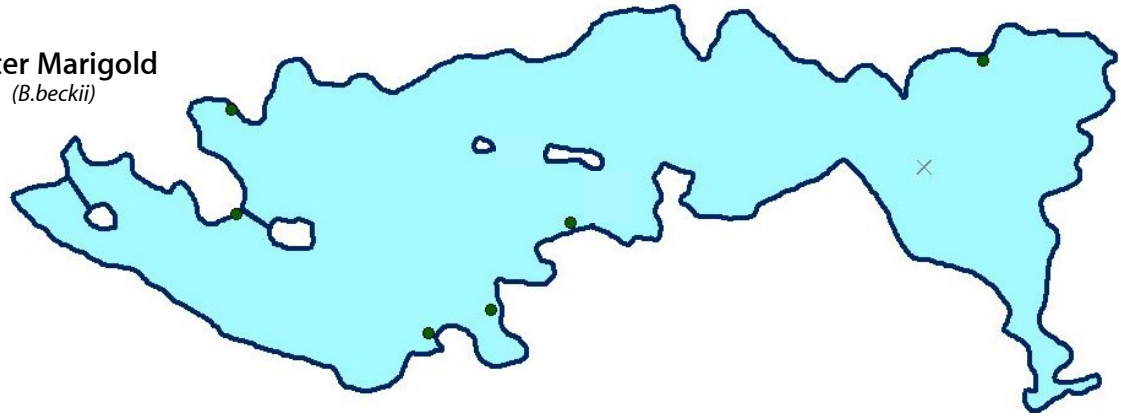
**Wild Celery**
*(V. americana)*



**Northern Watermilfoil**
*(M. sibiricum)*



**Water Marigold**
*(B.beckii)*



## *Balsam Lake: Plant Frequency and Density*

**Table 8.** *Plant Frequency and Density* statistics for species found in Balsam Lake in 2011. *Max* = % occurrence based upon max depth of plant growth, *<15ft* = % occurrence for depths <15 ft, *LITTORAL DENSITY* = average density rating for points < max depth of growth, *BED* DENSITY = average density rating at points where species was found.

| COMMON NAME | SCIENTIFIC NAME | %OCCURRENCE Max | %OCCURRENCE <15ft | LITTORAL DENSITY | BED DENSITY |
|---|---|---|---|---|---|
| **SUBMERSED PLANTS** | | | | | |
| Coontail | *Ceratophyllum demersum* | 41 | 45 | 0.8 | 1.9 |
| Canadian Waterweed | *Elodea canadensis* | 16 | 17 | 0.2 | 1.1 |
| Flat-stem Pondweed | *Potamogeton zosteriformis* | 16 | 17 | 0.2 | 1.0 |
| Star Duckweed | *Lemna trisulca* | 15 | 16 | 0.2 | 1.0 |
| Wild Celery | *Vallisneria americana* | 9 | 10 | 0.1 | 1.0 |
| Clasping-leaf Pondweed | *Potamogeton richardsonii* | 7 | 7 | 0.1 | 1.0 |
| Northern Watermilfoil | *Myriophyllum sibiricum* | 6 | 7 | 0.1 | 1.1 |
| Muskgrass | *Chara* sp. | 5 | 5 | 0.1 | 1.3 |
| Small Pondweed | *Potamogeton pusillus* | 5 | 6 | 0.1 | 1.0 |
| Stiff Water-crowfoot | *Ranunculus aquatilis* | 5 | 6 | 0.1 | 1.0 |
| Fries' Pondweed | *Potamogeton friesii* | 4 | 4 | <0.1 | 1.0 |
| Curlyleaf Pondweed | *Potamogeton crispus* | 3 | 3 | <0.1 | 1.0 |
| Large-leaf Pondweed | *Potamogeton amplifolius* | 2 | 2 | <0.1 | 1.0 |
| Sago Pondweed | *Stuckenia pectinata* | 2 | 2 | <0.1 | 1.0 |
| Water Marigold | *Bidens beckii* | 2 | 2 | <0.1 | 1.0 |
| Water Stargrass | *Zosterella dubia* | 2 | 2 | <0.1 | 1.0 |
| Fern-leaf Pondweed | *Potamogeton robbinsii* | 1 | 1 | <0.1 | 1.0 |
| Slender Naiad | *Najas flexilis* | 1 | 1 | <0.1 | 2.0 |
| Stonewort | *Nitella* sp. | 1 | 1 | <0.1 | 1.0 |
| Variable-leaf Pondweed | *Potamogeton gramineus* | 1 | 1 | <0.1 | 1.0 |
| **FLOATING PLANTS** | | | | | |
| White Waterlily | *Nymphaea odorata* | 6 | 7 | 0.1 | 1.0 |
| Giant Duckweed | *Spirodella polyrhiza* | 3 | 3 | <0.1 | 1.0 |
| Small Duckweed | *Lemna minor* | 3 | 3 | <0.1 | 1.0 |
| Watermeal | *Wolffia columbiana* | 3 | 3 | <0.1 | 1.0 |
| Yellow Waterlily | *Nuphar variegata* | 2 | 2 | <0.1 | 1.0 |
| Water Smartweed | *Polygonum amphibium* | 1 | 1 | <0.1 | 1.0 |
| **EMERGENT PLANTS** | | | | | |
| Arrowhead | *Sagittaria* sp. | 1 | 1 | <0.1 | 1.0 |
| Cattail | *Typha* sp. | 1 | 1 | <0.1 | 1.0 |
| Northern Wild Rice | *Zizania palustris* | 1 | 1 | <0.1 | 1.0 |
| Hard-stem Bulrush | *Schoenoplectus acutus* | P | P | – | – |
| Northern Blue Flag Iris | *Iris versicolor* | P | P | – | – |

**Figure 24.** Frequency (% occurrence) of common plant taxa by depth zone in Balsam Lake; July 2011

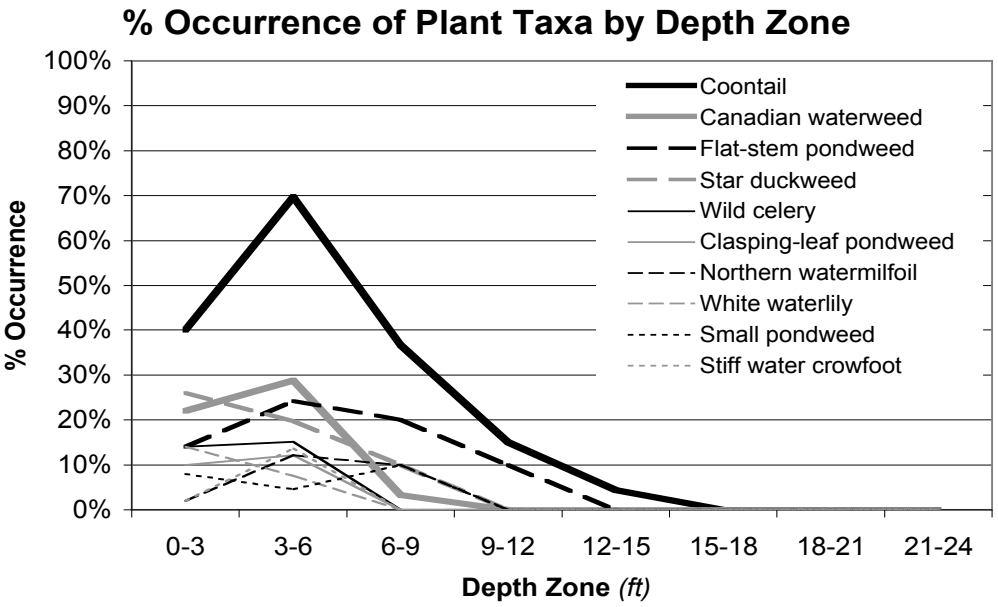
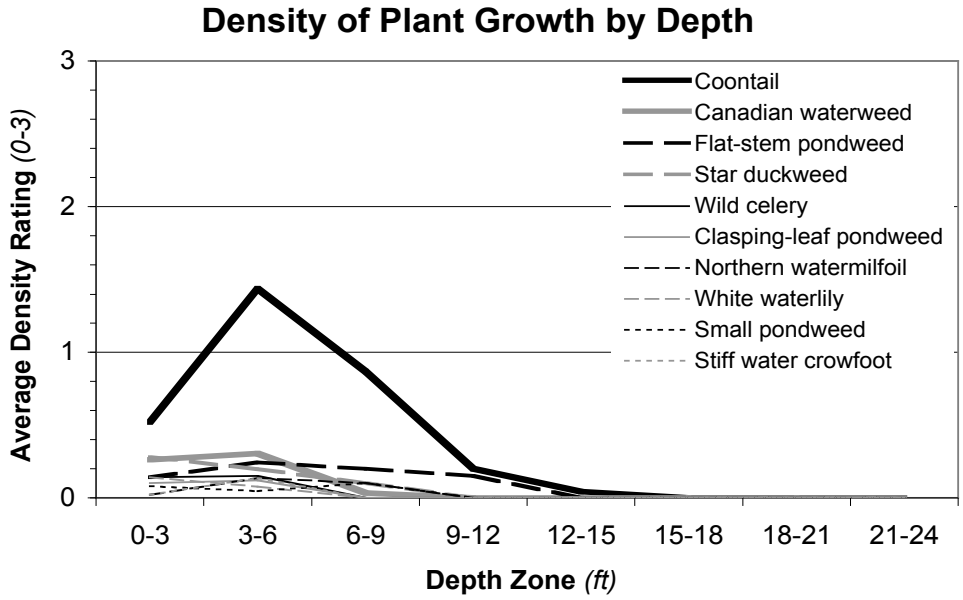



**Figure 25.** Average density rating by depth zone for common plant taxa in Balsam Lake; July 2011



## *Balsam Lake: Aquatic Plant Community Statistics & Metrics*

*% Lake Area Vegetated*
In 2011, about 29 acres of Balsam Lake supported plants (10% of the lake). Most of this plant growth was found in areas with mucky sediment, particularly in the far northeast end of the lake and in small bays. Most of the nearshore areas in the lake had a sandy or rocky bottom, very steep drop-offs, and generally supported only sparse plant growth in a narrow ring adjacent to shore.

*% Lake with Surface Vegetation*
The amount of surface-matted plant growth is a good indicator of recreational impairment by plants. In 2011, 14 acres (5% of the lake) supported plant growth to the surface. Most of this surface growth was found at the far northeast end of the lake and in several small, shallow bays. Surface growth consisted mostly of water lilies (*N. odorata* and *N. variegata*), coontail (*C. demersum*), and flat-stem pondweed (*P. zosteriformis*). However, the vast majority (95%) of the lake area had open water with no plants at the surface.

*Maximum Depth of Growth*
This aspect of the plant community is highly dependent upon water clarity. In Balsam Lake, the maximum depth of growth in 2011 was 17 ft (Table 9, Fig. 24–27). This maximum depth is consistent with the average summer water clarity in the lake, which was reported to be greater than 10 ft (Secchi depth, WDNR 2011). Plant growth is generally expected out to depths that are roughly 1.5 to 2 times the Secchi depth. This suggests that plant growth in Balsam Lake is not limited by light availability.

*% Littoral Area Vegetated*
The littoral area is the portion of a lake where the bottom receives enough light to support plants. In Balsam Lake, we found plants growing in 48% of this littoral zone. (Table 9, Fig. 24–27). Most of this area had only sparse plant growth.

*Average Plant Height*
This is an evaluation of plant height (regardless of species) throughout the littoral portion of the lake. In Balsam Lake, the average plant height in the littoral zone was 10.9 ±0.4 ft (average ±1SE). In general, this assessment represents the average height of the tallest plant species from each littoral site.

**Table 9.** Plant community statistics and metrics for Balsam Lake; July 2011 survey.

| STATISTIC / METRIC | Jul 2011 |
|---|---|
| **WHOLE LAKE BASIN** | |
| % Lake Area Vegetated | 10 |
| % Lake Surface Vegetation | 5 |
| Max Depth of Growth *(ft)* | 17 |
| **LITTORAL *(< max depth of growth)*** | |
| % Littoral Area Vegetated | 48 |
| Average Plant Height *(ft, ±1SE)* | 4.6 ±0.4 |
| Average Plant Density *(±1SE)* | 1.0 ±0.1 |
| Species Richness | 31 |
| Simpson's Diversity | 0.89 |
| Native Taxa per Sample *(±1SE)* | 1.6 ±0.1 |
| Floristic Quality Index *(FQI)* | 26.1 |
| AMCI *(Community Index)* | 52 |

**Figure 26.** Percent of sample points with plants for each depth zone of Balsam Lake in 2011

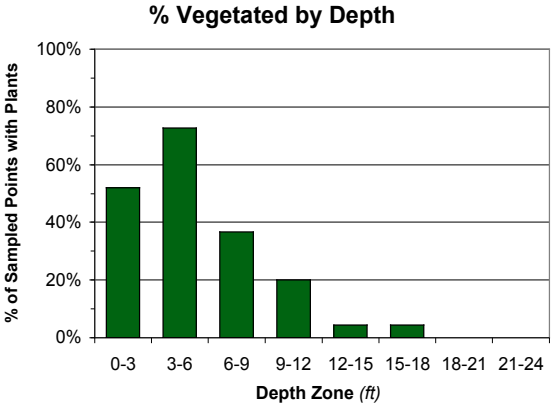
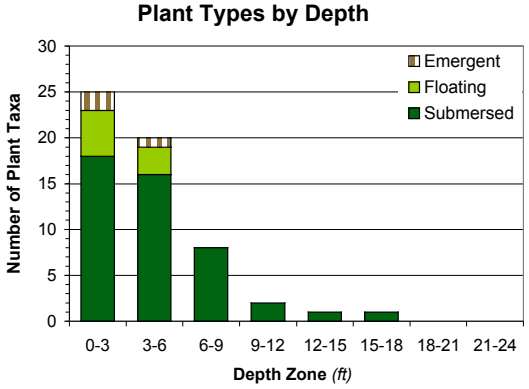



**Figure 27.** Number and type of plant species found in each depth zone of Balsam Lake in 2011

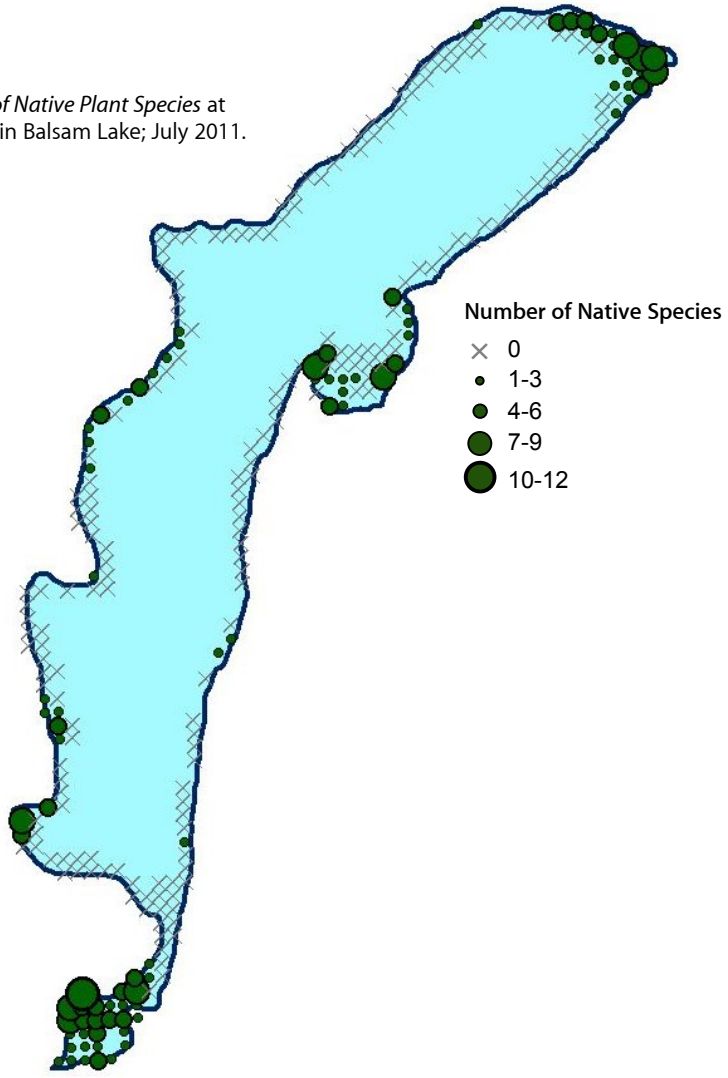


*Species Richness*
This is simply the total number of aquatic plant species found in the lake during the survey. In 2011, Balsam Lake supported 31 different plant taxa - most identified to species (Table 8); 20 submersed (underwater), 6 floating (like lilies), and 5 emergent (extending out of the water).

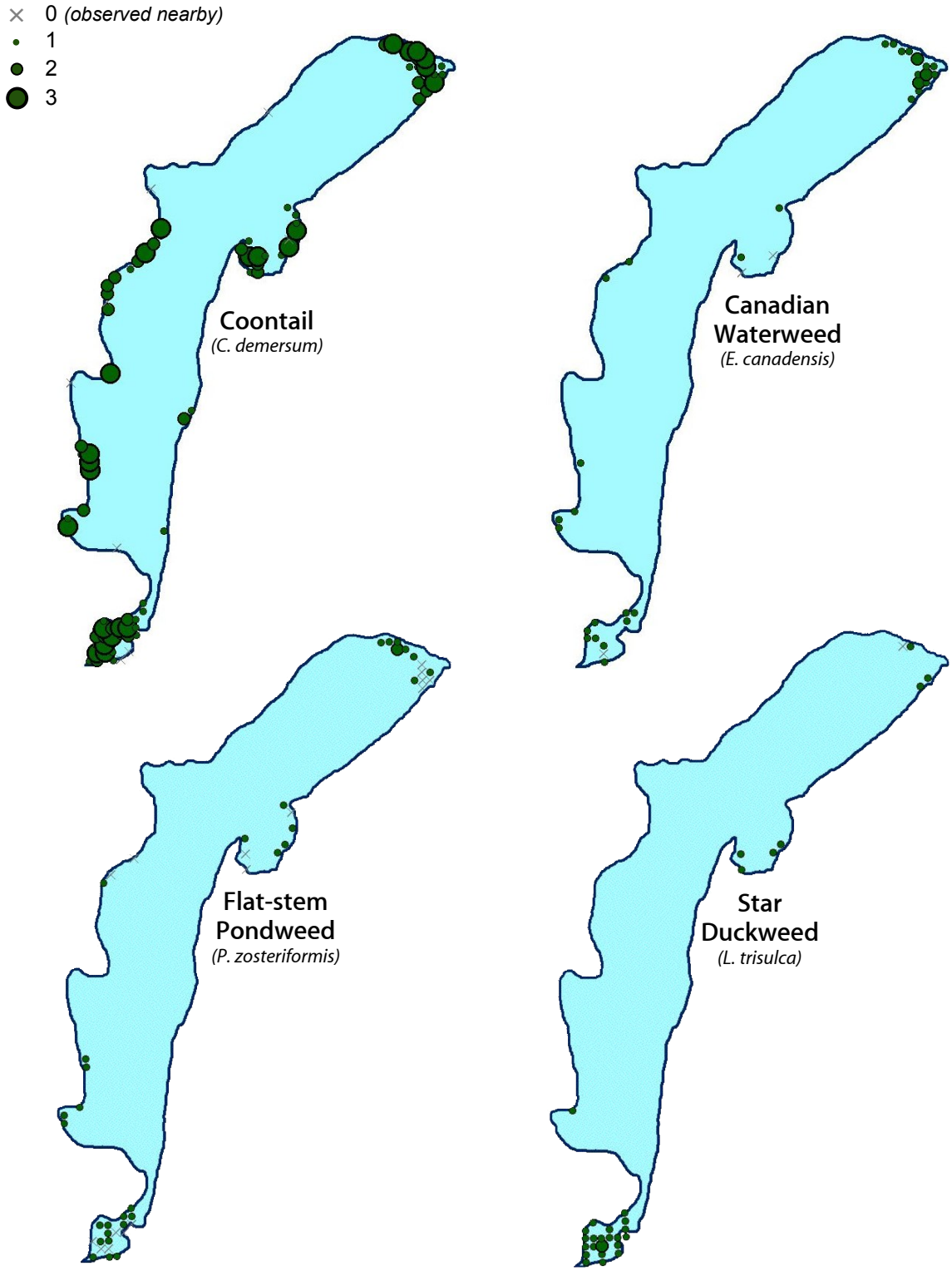
*Simpson's Diversity Index*
This index is a measure of both the number of species and the degree to which those species are equally mixed. Values close to 1.0 reflect a very diverse plant community with many species that are equally common (no strong dominance by any one species). Lower values reflect lower diversity (fewer species, clearly dominated by one or two species). In general, greater diversity means that there is better habitat for fish. In Balsam Lake, the *Simpson's Diversity Index* for 2011 was 0.89, indicating a diverse plant community. This index is most useful for tracking any major changes in the diversity of the plant community over time.

*Number of Native Species per Sample*
This is another measure of aquatic plant diversity in the littoral portion of the lake. In 2011, the average number of native species per sample in Balsam Lake was 1.6 ±0.1 (average ±1SE, Fig. 28). This is less than seen in the other surveyed lakes. This difference is attributable to the general sparse plant growth in most areas of Balsam Lake and the generally deeper water at more of the sampled locations.

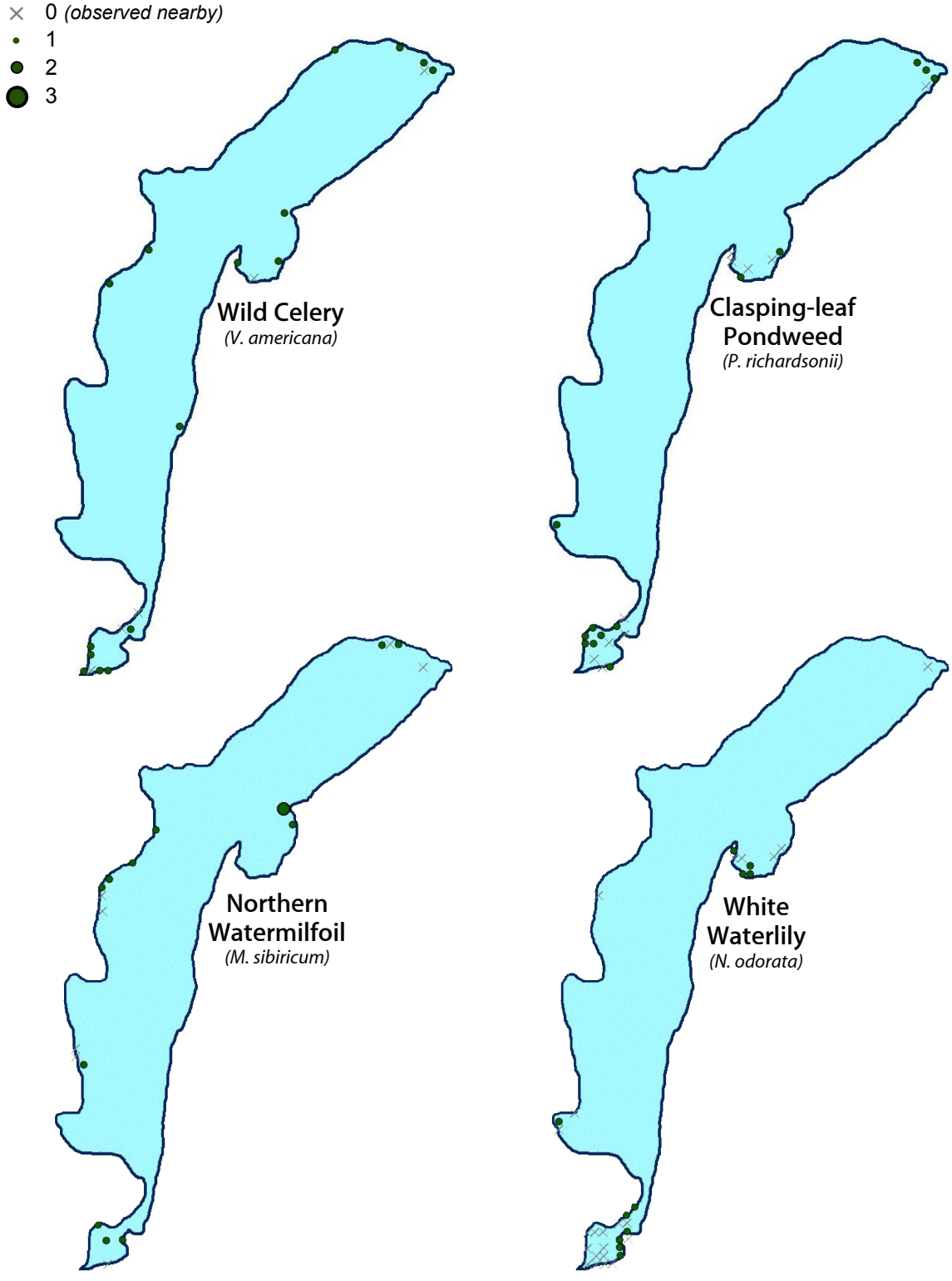
**Figure 28.** *Number of Native Plant Species* at each location sampled in Balsam Lake; July 2011.



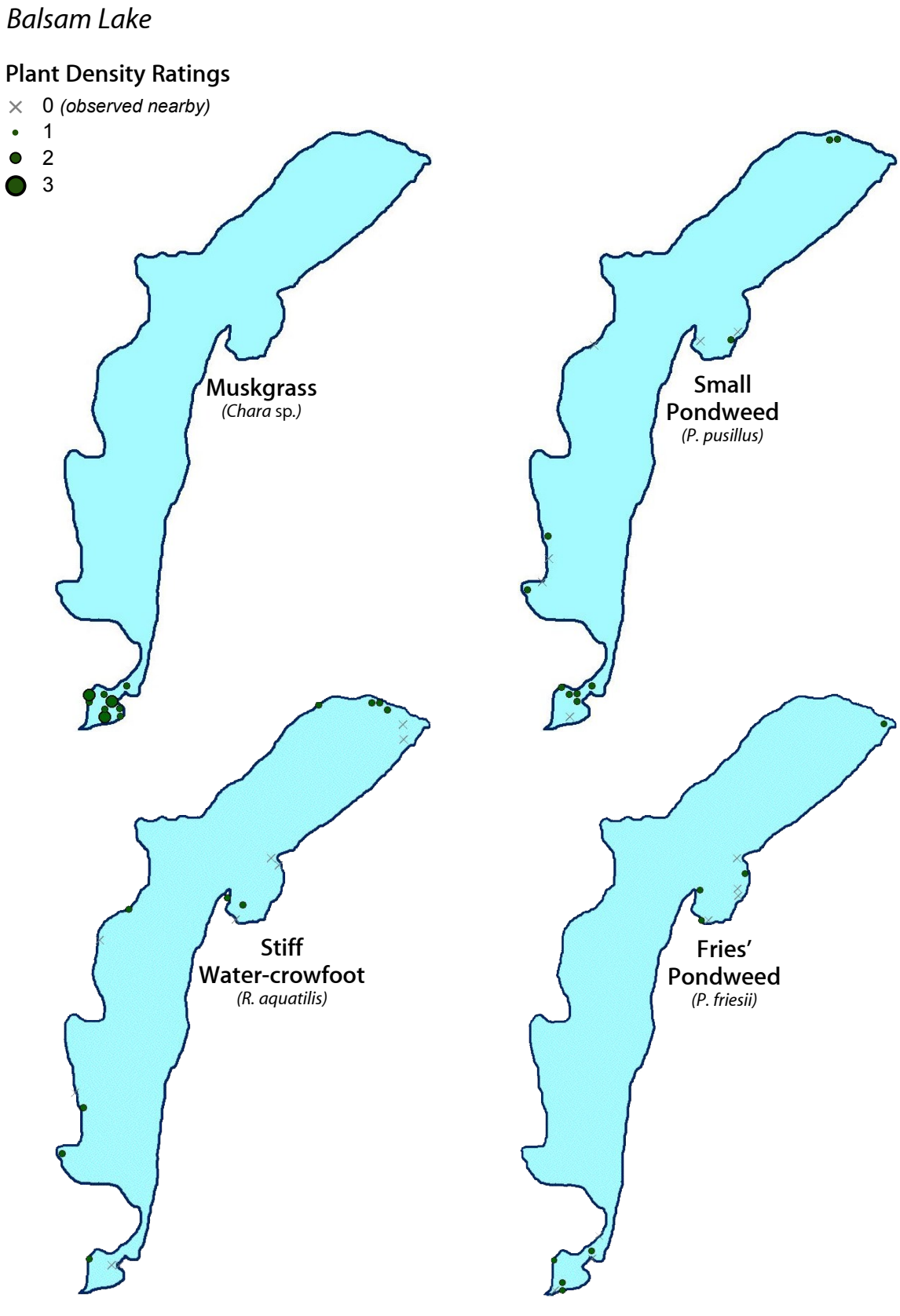
## *Balsam Lake: Distribution and Density Maps*



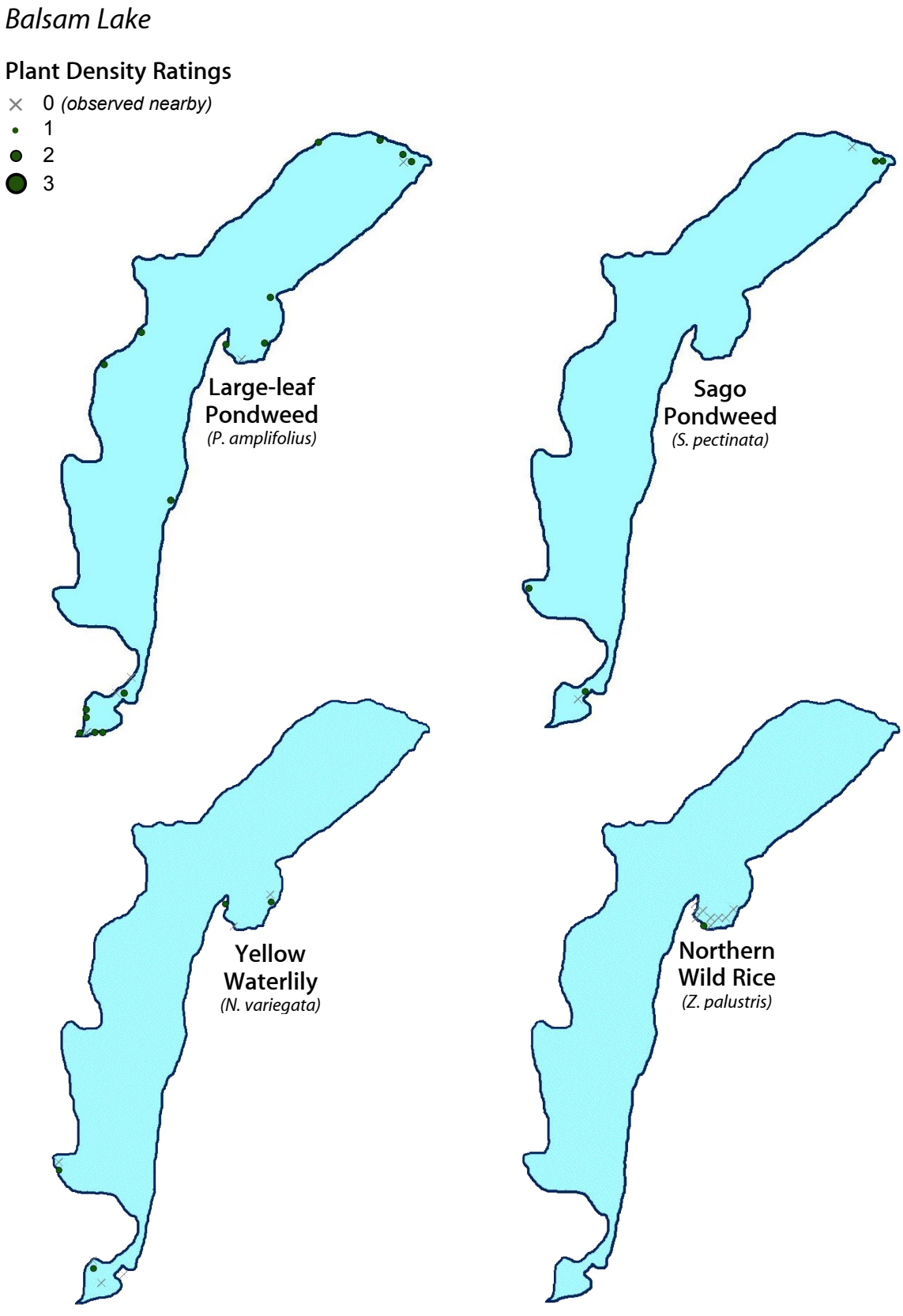
*Balsam Lake*



*Balsam Lake*



*Balsam Lake*



## *Mud Lake: Plant Frequency and Density*

**Table 10.** *Plant Frequency and Density* statistics for species found in Mud Lake in 2011. *Max* = % occurrence based upon max depth of plant growth, *<15ft* = % occurrence for depths <15 ft, *LITTORAL DENSITY* = average density rating for points < max depth of growth, *BED* DENSITY = average density rating at points where species was found.

| COMMON NAME | SCIENTIFIC NAME | %OCCURRENCE Max | %OCCURRENCE <15ft | LITTORAL DENSITY | BED DENSITY |
|---|---|---|---|---|---|
| **SUBMERSED PLANTS** | | | | | |
| Coontail | *Ceratophyllum demersum* | 74 | 73 | 0.9 | 1.2 |
| Sago Pondweed | *Stuckenia pectinata* | 26 | 26 | 0.3 | 1.0 |
| Slender Naiad | *Najas flexilis* | 25 | 25 | 0.3 | 1.2 |
| Canadian Waterweed | *Elodea canadensis* | 20 | 20 | 0.2 | 1.1 |
| Star Duckweed | *Lemna trisulca* | 20 | 20 | 0.2 | 1.0 |
| Flat-stem Pondweed | *Potamogeton zosteriformis* | 15 | 14 | 0.1 | 1.0 |
| Clasping-leaf Pondweed | *Potamogeton richardsonii* | 9 | 9 | 0.1 | 1.1 |
| Fries' Pondweed | *Potamogeton friesii* | 7 | 7 | 0.1 | 1.0 |
| Muskgrass | *Chara* sp. | 6 | 6 | 0.1 | 1.0 |
| Water Stargrass | *Zosterella dubia* | 5 | 5 | 0.1 | 1.0 |
| Wild Celery | *Vallisneria americana* | 5 | 5 | 0.1 | 1.2 |
| Small Pondweed | *Potamogeton pusillus* | 4 | 4 | <0.1 | 1.0 |
| Curlyleaf Pondweed | *Potamogeton crispus* | 3 | 3 | <0.1 | 1.0 |
| Stonewort | *Nitella* sp. | 3 | 3 | <0.1 | 1.0 |
| Large-leaf Pondweed | *Potamogeton amplifolius* | 1 | 1 | <0.1 | 1.0 |
| Northern Watermilfoil | *Myriophyllum sibiricum* | 1 | 1 | <0.1 | 1.0 |
| Stiff Water-crowfoot | *Ranunculus aquatilis* | 1 | 1 | <0.1 | 1.0 |
| Common Bladderwort | *Utricularia vulgaris* | P | P | – | – |
| Fern-leaf Pondweed | *Potamogeton robbinsii* | P | P | – | – |
| White-stem Pondweed | *Potamogeton praelongus* | P | P | – | – |
| **FLOATING PLANTS** | | | | | |
| White Waterlily | *Nymphaea odorata* | 22 | 22 | 0.2 | 1.1 |
| Floating-leaf Pondweed | *Potamogeton natans* | 15 | 15 | 0.2 | 1.1 |
| Yellow Waterlily | *Nuphar variegata* | 2 | 2 | <0.1 | 1.0 |
| Giant Duckweed | *Spirodella polyrhiza* | P | P | – | – |
| **EMERGENT PLANTS** | | | | | |
| Arrowhead | *Sagittaria* sp. | 5 | 5 | 0.1 | 1.0 |
| Burr-reed | *Sparganium* sp. | 2 | 2 | <0.1 | 1.0 |
| Cattail | *Typha* sp. | P | P | – | – |
| Hard-stem Bulrush | *Schoenoplectus acutus* | P | P | – | – |
| Northern Wild Rice | *Zizania palustris* | P | P | – | – |

**Figure 29.** Frequency (% occurrence) of common plant taxa by depth zone in Mud Lake; July 2011

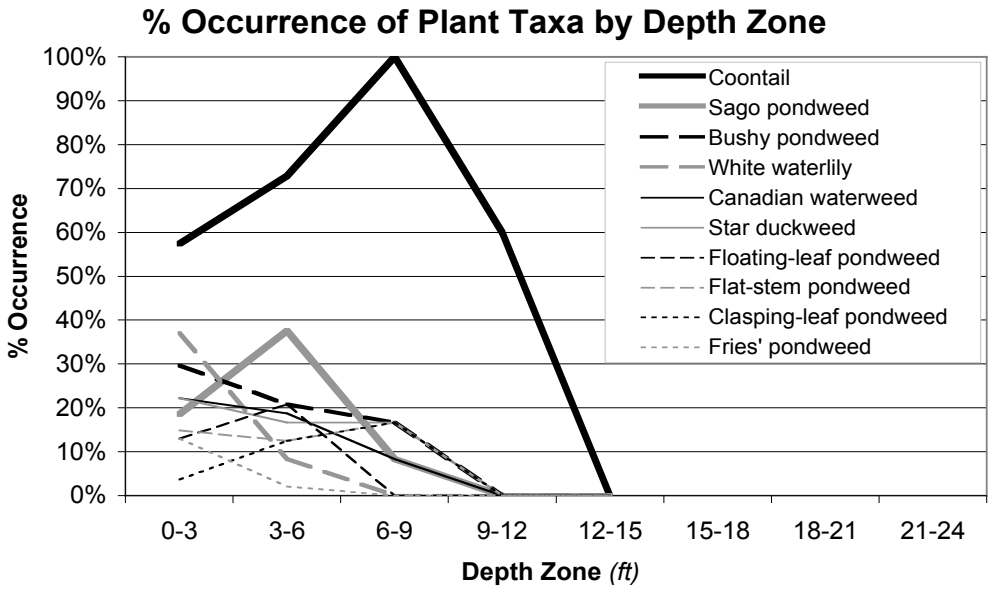
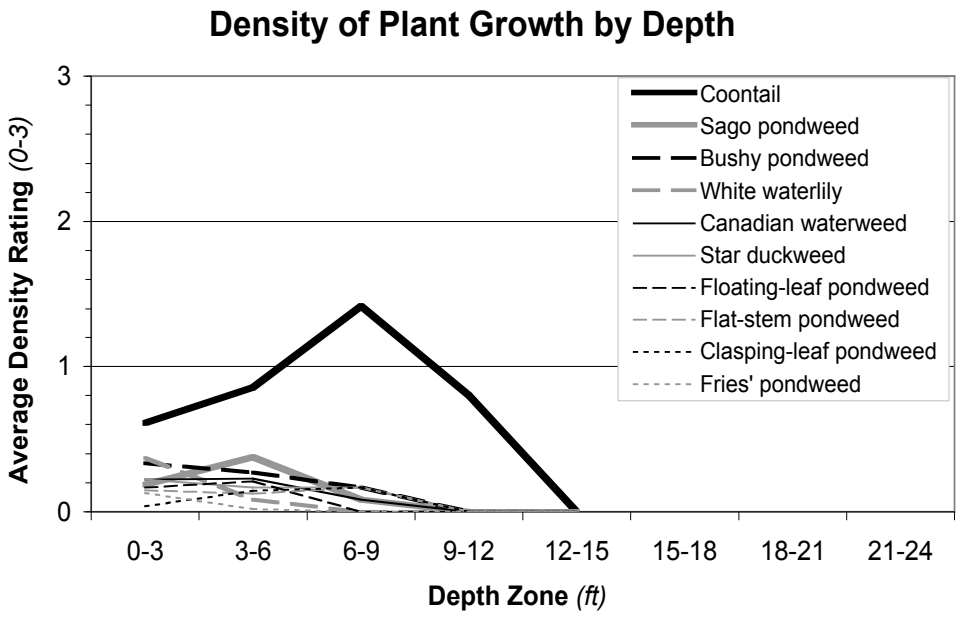



**Figure 30.** Average density rating by depth zone for common plant taxa in Mud Lake; July 2011



## *Mud Lake: Aquatic Plant Community Statistics & Metrics*

*% Lake Area Vegetated*
In 2011, about 26 acres of Mud Lake supported plants (93% of the lake). The entire lake and channel to Balsam Lake had mucky sediments that generally supported widespread and abundant plant growth.

*% Lake with Surface Vegetation*
The amount of surface-matted plant growth is a good indicator of recreational impairment by plants. In 2011, 12 acres (44% of the lake) supported plant growth to the surface. Some of this surface growth was found in the channel between Mud Lake and Balsam Lake, but there was an open-water path through this area. The actual basin of Mud Lake also had substantial areas of surface plant growth, but most of this was low in density and posed only a slight to moderate level of recreational impairment.

*Maximum Depth of Growth*
This aspect of the plant community is highly dependent upon water clarity. In Mud Lake, the maximum depth of growth in 2011 was 10 ft (Table 11, Figs. 29–32). Plant growth is generally expected out to depths that are roughly 1.5 to 2 times the Secchi depth. This suggests that the average summer water clarity in Mud Lake is close to 5 ft. Most of the lake is shallower than 10 ft (very small deep area), so it is likely that Mud Lake will continue to support widespread plant growth.

*% Littoral Area Vegetated*
The littoral area is the portion of a lake where the bottom receives enough light to support plants. In Mud Lake, we found plants growing in 95% of this littoral zone. (Table 11, Figs. 29–32).

*Average Plant Height*
This is an evaluation of plant height (regardless of species) throughout the littoral portion of the lake. In Mud Lake, the average plant height in the littoral zone was 2.6 ±0.2 ft (average ±1SE). In general, this assessment represents the average height of the tallest plant species from each littoral site.

**Table 11.** Plant community statistics and metrics for Mud Lake; July 2011 survey.

| STATISTIC / METRIC | Jul 2011 |
|---|---|
| **WHOLE LAKE BASIN** | |
| % Lake Area Vegetated | 93 |
| % Lake Surface Vegetation | 44 |
| Max Depth of Growth *(ft)* | 10 |
| **LITTORAL *(< max depth of growth)*** | |
| % Littoral Area Vegetated | 95 |
| Average Plant Height *(ft, ±1SE)* | 2.6 ±0.2 |
| Average Plant Density *(±1SE)* | 1.5 ±0.1 |
| Species Richness | 29 |
| Simpson's Diversity | 0.88 |
| Native Taxa per Sample *(±1SE)* | 2.7 ±0.2 |
| Floristic Quality Index *(FQI)* | 24.6 |
| AMCI *(Community Index)* | 45 |

**Figure 31.** Percent of sample points with plants for each depth zone of Mud Lake in 2011

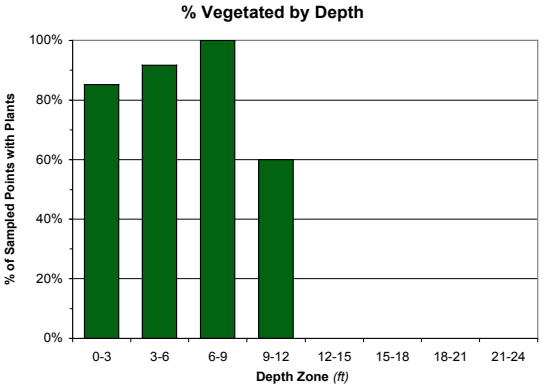
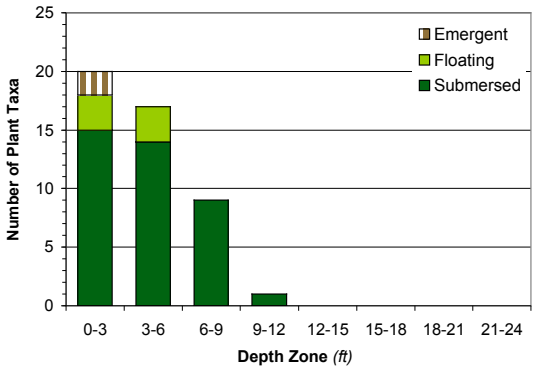



**Figure 32.** Number and type of plant species found in each depth zone of Mud Lake in 2011

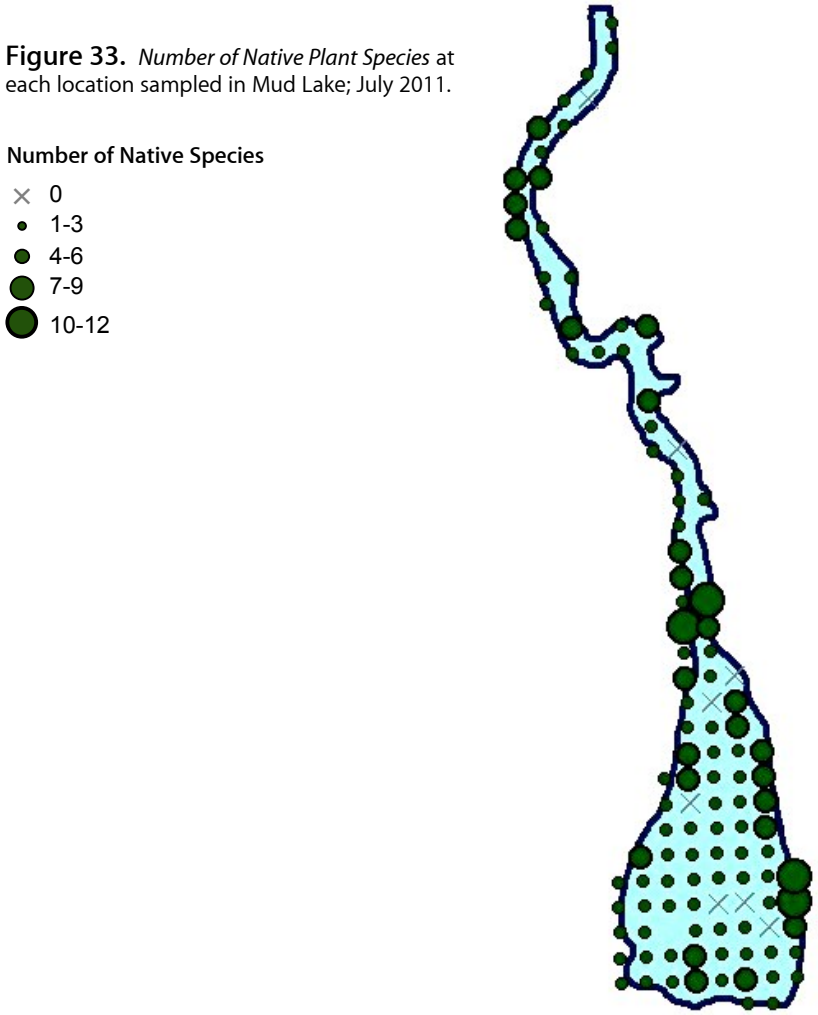


*Species Richness*
This is simply the total number of aquatic plant species found in the lake during the survey. In 2011, Mud Lake supported 29 different plant taxa - most identified to species (Table 10); 20 submersed (underwater), 4 floating (like lilies), and 5 emergent (extending out of the water).

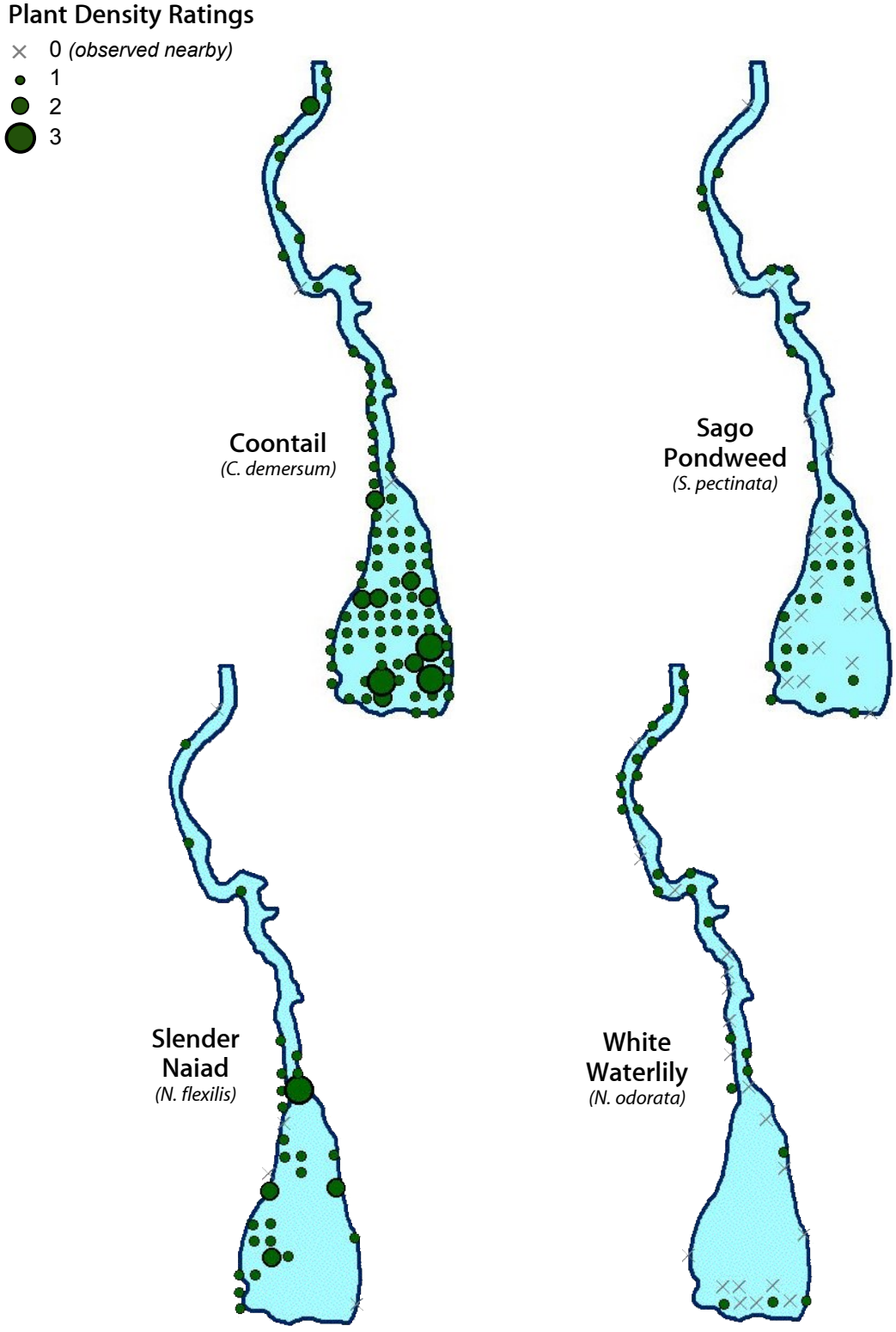
*Simpson's Diversity Index*
This index is a measure of both the number of species and the degree to which those species are equally mixed. Values close to 1.0 reflect a very diverse plant community with many species that are equally common (no strong dominance by any one species). Lower values reflect lower diversity (fewer species, clearly dominated by one or two species). In general, greater diversity means that there is better habitat for fish. In Mud Lake, the *Simpson's Diversity Index* for 2011 was 0.88, indicating a diverse plant community. This index is most useful for tracking any major changes in the diversity of the plant community over time.

*Number of Native Species per Sample*
This is another measure of aquatic plant diversity in the littoral portion of the lake. In 2011, the average number of native species per sample in Mud Lake was 2.7 ±0.2 (average ±1SE, Fig. 33). This further indicates a diverse plant community.

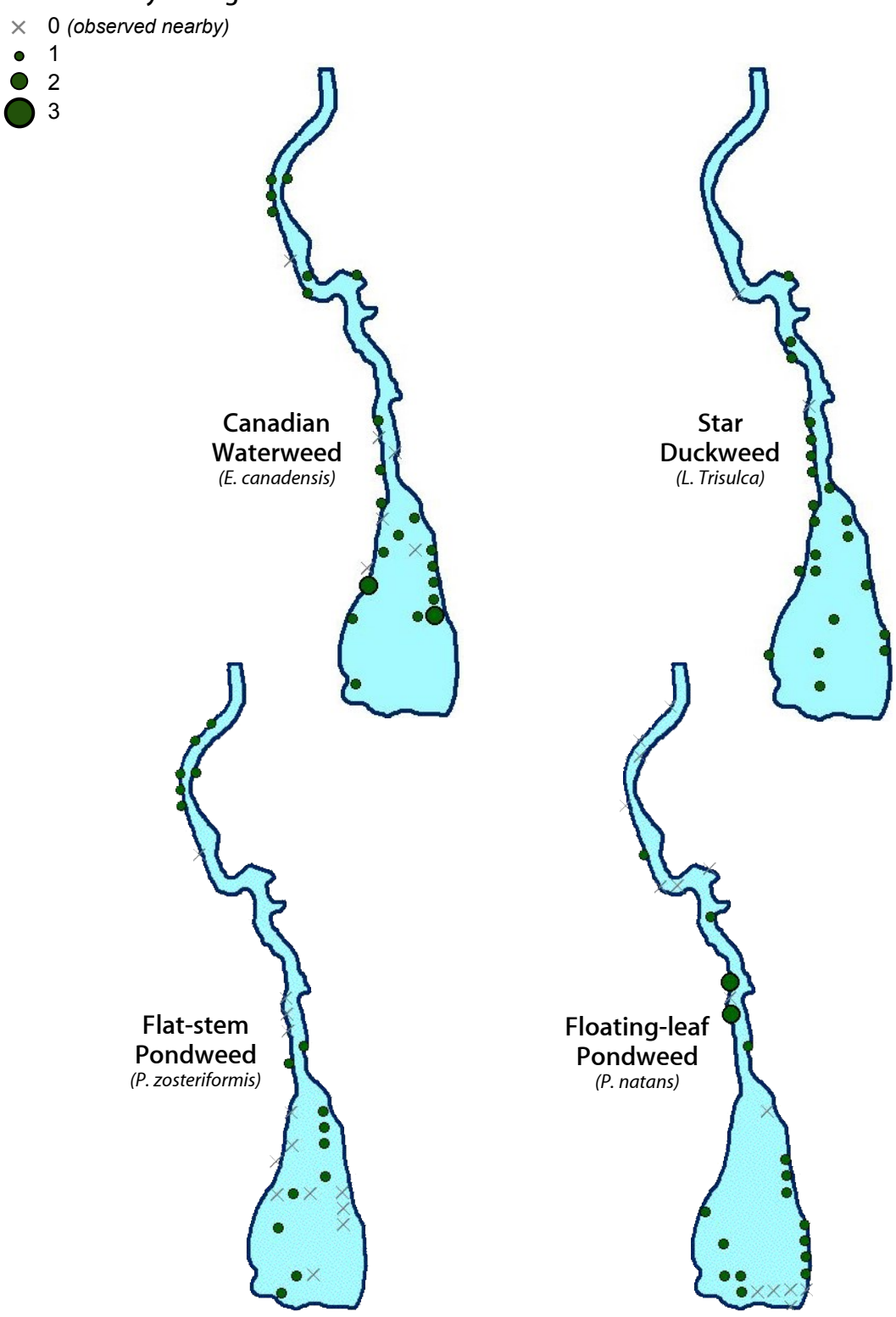
**Figure 33.** *Number of Native Plant Species* at each location sampled in Mud Lake; July 2011.



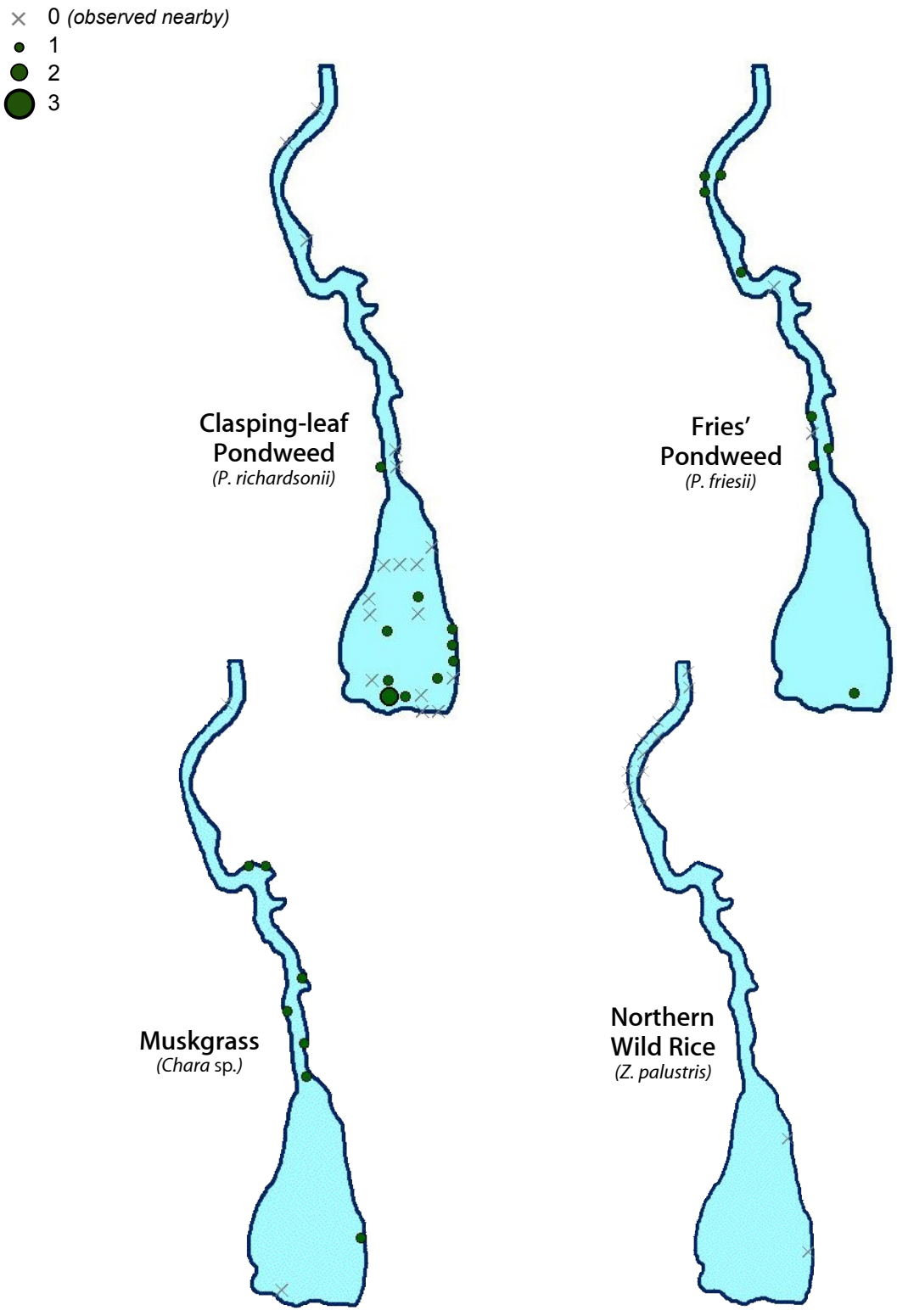
## *Mud Lake: Distribution and Density Maps*



## *Mud Lake*



## *Mud Lake*



## *Descriptions of Common Plant Species*

| | | |
|---|---|---|
| 54 | Canadian Waterweed | *Elodea canadensis* |
| 55 | Coontail | *Ceratophyllum demersum* |
| 56 | Curlyleaf Pondweed | *Potamogeton crispus* |
| 57 | Fern-leaf Pondweed | *Potamogeton robbinsii* |
| 58 | Flat-stem Pondweed | *Potamogeton zosteriformis* |
| 59 | Narrow-leaf Pondweeds | *Potamogeton* spp. |
| 60 | Broad-leaf Pondweeds | *Potamogeton* spp. |
| 61 | Muskgrass / Stonewort | *Chara* sp. / *Nitella* sp. |
| 62 | Northern Watermilfoil | *Myriophyllum sibiricum* |
| 63 | Sago Pondweed | *Stuckenia pectinata* |
| 64 | Slender Naiad | *Najas flexilis* |
| 65 | Star Duckweed | *Lemna trisulca* |
| 66 | Water Lilies | *Nymphaea / Nuphar* |
| 67 | Wild Celery | *Vallisneria americana* |

## Canadian Waterweed *("Elodea")*

*Elodea canadensis*

**Native**
**Ecological Value:** Moderate to High

### Description

Elodea is a very common native aquatic plant that can thrive in many lakes. It tends to grow as a dense carpet on the bottom of lakes, but in shallow water it can also form dense masses of intertwining stems that look like underwater bushes. Dense elodea can form areas of nuisance, surface-matted growth in some lakes, but typically only reaches the water surface in nearshore areas (<5 ft).

Elodea's dense growth makes it a good oxygen producer and provides a great habitat for aquatic insects and other similar sources of food fish. At moderate densities, it can also provide a great place for young and small fish to hide from predators. However, very dense beds of elodea can be too thick for many fish to swim through, making it less valuable as habitat.

### Management

*Harvesting:* removes biomass (temporary), may spread plants via drifting fragments
*Herbicides:* sensitive to fluridone, diquat, and flumioxazin (somewhat tolerant of endothall)

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Coontail

*Ceratophyllum demersum*

**Native**
**Ecological Value:** Moderate to High

### Description

Coontail is a very common native aquatic plant that can thrive in many lakes. Unlike most aquatic plants, it does not produce roots. Consequently, it can drift around lakes and pile up along shorelines on windy days. Coontail tends to grow as a dense carpet on the bottom of lakes, but can also form dense masses of intertwining stems that look like underwater bushes. Dense coontail can form areas of nuisance, surface-matted growth in some lakes, but typically only reaches the water surface in nearshore areas (<5 ft).

Coontail's dense growth makes it a good oxygen producer and provides a great habitat for aquatic insects and other similar sources of food fish. At moderate densities, it can also provide a great place for young and small fish to hide from predators. However, very dense coontail beds can be too thick for many fish to swim through, making it less valuable as habitat.

Coontail can survive in areas with very low light, and is often one of the deepest growing plants found during plant surveys. In addition, its tolerance of low light allows it to over-winter in many lakes, even when ice and snow block most of the sun's rays.

### Management

*Harvesting:* removes biomass (temporary)
*Herbicides:* sensitive to endothall (>4 mg/L) and fluridone

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Curlyleaf Pondweed

*Potamogeton crispus*

**Invasive / Non-Native**

**Ecological Value:** Low

### Description

Curlyleaf has an unusual life-cycle for an aquatic plant. Unlike most native aquatic plants in Minnesota, which sprout in the spring, it sprouts in the fall from turions or "reproductive buds". These sprouts then overwinter as small shoots. When the ice disappears in the spring and the lake water warms, these curlyleaf shoots begin to grow very rapidly. By mid to late May, these plants begin to form very dense mats on the lake's surface and start to make new turions. These dense surface mats can severely impair the recreational use of lakes (Bolduan et al. 1994).

By late June, curlyleaf plants naturally die off and deposit their new turions to the lake sediment. Although this means that the dense, matted growth is generally short-lived and out of the way by the 4th of July, its effects linger on. Curlyleaf's early growth and tendency to form thick, light-blocking surface mats allow it to easily out-compete and displace most native aquatic plants (Madsen and Crowell 2002, Bolduan et al. 1984). This can greatly reduce habitat quality and lead to undesirable changes to the lake's fish community.
Curlyleaf die-off also releases a pulse of nutrients that can promote summer algae blooms in some lakes (James et al. 2001, 2007).

### Management

*Harvesting:* removes biomass and some turions, but no long-term control.
*Herbicides:* sensitive to endothall

## Fern-leaf Pondweed *(Robbin's Pondweed)*

*Potamogeton robbinsii*

**Native**

**Ecological Value:** Moderate to High

### Description

Fern-leaf pondweed is adapted to growth in low light and typically forms a dense carpet of leaves on the lake bottom. This protects sediments from resuspension and provides lots of dense habitat for young fish and insects. When flowering, fern-leaf pondweed can produce taller stems that can reach the surface, but these vertical stems generally do not form dense surface mats. Fern-leaf can persist on lake bottoms throughout the year, and thus provide winter habitat.

### Management

Flat-stem pondweed is rarely the focus of strategies in lakes. However, this species is very sensitive to endothall herbicide. Vegetation management plans should strive to protect and promote areas of this species.

## Flat-stem Pondweed

*Potamogeton zosteriformis*

**Native**
**Ecological Value:** Moderate to High

### Description

Flat-stem pondweed produces long, thin leaves (~6-8 inches long and 1/8 inch wide) on a very flattened stem. This growth form provides vertical structure for fish, but does not provide as much surface area for aquatic insects as some other plants. However, the thin leaves and tall growth of this plant allow it to tolerate turbidity (murky water) better than broad-leaved natives. Flat-stem reproduces via seeds and heavy production of fan-shaped winter buds.

Flat-stem generally does not form large areas of nuisance growth, but can grow to the surface in some lakes.

### Management

Flat-stem pondweed is rarely the focus of strategies in lakes. However, this species is very sensitive to endothall herbicide. Vegetation management plans should strive to protect and promote areas of this species.

## Narrow-leaf Pondweeds (*Fries' Pondweed and Small Pondweed)*

*Potamogeton friesii / Potamogeton pusillus*

**Native**
**Ecological Value:** Moderate

### Description

There are several species that qualify as "narrow-leaf pondweeds". These pondweeds all have long, very narrow leaves (1-3 mm wide), so it is generally difficult to distinguish between species. Fries' pondweed is one of the easiest to identify, as it has very distinctive, fan-shaped winter-buds.

Narrow-leaf pondweeds provide some habitat for fish and wildlife, but generally do not grow very densely. Some species (P. foliosus and P. friesii) can grow to water surface in some areas, and may occasionally be perceived as a slight nuisance. However, narrow-leaf pondweeds generally do not impair recreation and are rarely the target of plant control activities.

### Management

Narrow-leaf pondweeds are rarely the focus of strategies in lakes. However, these species are sensitive to some herbicides. Vegetation management plans should strive to protect and promote areas of these species.

## Broad-leaf Pondweeds *(Large-leaf Pondweed / Clasping-leaf Pondweed)*

*Potamogeton amplifolius / Potamogeton richardsonii*

**Native**
**Ecological Value:** Moderate to High

### Description

Broad-leaf pondweeds thrive in many lakes, particularly those with good water clarity. These species typically produces numerous large leaves on long, vertical stems that can reach the water surface, even in areas over 10 feet deep. Consequently, they create a vertical, forest-like habitat for larger fish. Many of these species can also form oval floating leaves that lay on the water surface like tiny lily pads. In addition to providing habitat for insects and other invertebrates, these plants produces seeds and tubers that are often eaten by waterfowl. Broad-leaf pondweeds do not typically form nuisance growth, but may occasionally grow densely enough to clog boat motors in nearshore areas.

### Management

*Hand-Pulling:* labor intensive, but effective for controlling coontail in small areas

Broad-leaf pondweeds are rarely the focus of strategies in lakes. However, these species are very sensitive to some herbicides. Vegetation management plans should strive to protect and promote areas of these species.

## Muskgrass / Stonewort

*Chara sp. / Nitella sp.*

**Native**
**Ecological Value:** High

## Description

Muskgrass and stonewort are very similar and common in many lakes. Both grow from spores and can rapidly colonize areas of bare sediment. Technically, these species are large forms of algae ("macroalgae") that lack roots, leaves, and other features of the true "vascular" aquatic plants. However, they acts very much like some of their "true plant" neighbors in lakes. Nitella is typically found in deeper water and generally does not form dense growth. Muskgrass tends to grow as a dense carpet in near-shore areas of lakes and can grow to within a foot of the surface in shallow areas. Although muskgrass does not typically form areas of nuisance, surface-matted growth, it may be perceived as undesirable by some lake users on account of its dense growth. Its dense growth and high photosynthetic rate makes it a great oxygen producer. Because it does not produce roots, it gets much of the nutrients it needs directly from the water. Furthermore, it tends to become encrusted with calcium carbonate deposits that can lock up additional phosphorus (via co-precipitation) that would have otherwise fueled planktonic algae growth. Dense beds of muskgrass have been shown to greatly increase water clarity, reduce nutrient release from sediments, and provide a great habitat for aquatic insects and other invertebrates that are an excellent source of food for fish and waterfowl (Kufel 2002).

## Management

*Harvesting:* removes biomass (temporary)
*Herbicides:* sensitive to copper compounds,
tolerant of endothall; may be promoted in areas treated with endothall

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Northern Watermilfoil

*Myriophyllum sibiricum*

**Native**

**Ecological Value:** Moderate to High

### Description

Northern watermilfoil looks very similar to Eurasian watermilfoil (an invasive, non-native plant), but can be identified by carefully examining the leaves. Northern watermilfoil generally has fewer "leaflets" (5 to 12 pairs) on each leaf that remain stiff when removed from the water. Conversely, Eurasian watermilfoil has more numerous leaflets (12 to 20 pairs) that tend to be more limp and clump together when removed from the water. Also, Eurasian watermilfoil tends to branch a lot at the water surface, creating dense, surface matted growth. Although northern watermilfoil can occasionally grow to the surface in shallow areas, it does not branch nearly as much, and also does not typically form dense mats.

### Management

Northern watermilfoil is generally not the target of control activities. However, this species is very sensitive to 2,4-D, triclopyr, and Hydrothol 191 herbicides. In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Sago Pondweed
*Stuckenia pectinata*

**Native**
**Ecological Value:** Moderate to High

### Description
Sago pondweed is a common, native aquatic plant that can thrive in many lakes, but is generally limited to areas shallower than 6 ft. It is adapted for life in murky water and is one of the few plant species that can thrive in hypereutrophic shallow lakes with severe algae blooms. In addition, it is a rapid colonizer, and is often one of the first plants to colonize areas of bare sediment after intensive plant management (such as large-scale herbicide treatment). Sago pondweed produces long, thin, vertical stems with many narrow, thread-like leaves. These stems often reach the water surface, where they form broom-like tufts of thin leaves. Although sago pondweed does not typically form large areas of nuisance growth in lakes, it can form dense beds that can clog boat motors in nearshore areas. In addition to providing habitat for insects and other invertebrates, this plant produces tubers that are a major source of food for waterfowl.

### Management
*Harvesting:* removes biomass
*Herbicides:* sensitive to endothall, imazamox, and some copper compounds
*Hand-Pulling:* labor intensive, but somewhat effective for controlling in small areas

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Slender Naiad

*Najas flexilis*

**Figure 13b.** *Curlyleaf Pondweed Density* in Hemlock, Balsam, and Mud Lake; June 2011.

## Star Duckweed *("Forked Duckweed")*

*Lemna trisulca*

**Native**
**Ecological Value:** Moderate to High

### Description

Star duckweed looks like miniature canoe paddles that have been glued together. This plant forms free-floating clumps of small leaves (called "fronds") that can drift around lakes. Unlike other duckweeds, this plant does not typically float on the surface of lakes. Instead, it can be found tangled among other plants or as a layer on the lake bottom in near-shore areas. Although it can form large, dense clumps in some fertile lakes, it tends to stay near the bottom of lakes and does not typically impair lake recreation.

This plant can provide important cover for aquatic insects and small fish. Furthermore, it is highly digestible (low in structural cellulose) and very high in protein and nutrients. Consequently, it is an important source of food for wildlife – especially waterfowl.

### Management

Star duckweed is rarely the focus of control strategies in lakes, as it does not typically form nuisance growth and is beneficial to wildlife. Furthermore, this plant reproduces very quickly, so any control is likely to be very short lived. However, star duckweed is sensitive to some herbicides.

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

## Water Lilies *(White and Yellow)*

*Nymphaea odorata / Nuphar variegata*

**Native**
**Ecological Value:** Moderate to High

### Description

Water lilies typically form dense patches in shallow (generally less than 6 ft), mucky areas of lakes. Although many lakeshore homeowners dislike lilies because of this dense surface growth, they are valuable for several reasons. Aesthetically, they are valued by many for their ornamental leaves and flowers that last for most of the summer. Ecologically, they (1) buffer wave action, thus reducing shoreline erosion, (2) proved shaded habitat for fish, and (3) their seeds and rhizomes ("roots") are eaten by waterfowl and wildlife.

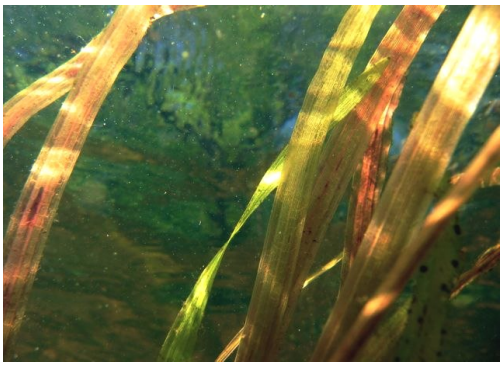
### Management

*Harvesting:* frequent cutting required for control
*Herbicides:* sensitive to glyphosate

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value. Liles are protected in some states.

## Wild Celery

*Vallisneria americana*



**Native**
**Ecological Value:** Moderate to High

### Description

Wild celery is a very common native aquatic plant that can thrive in many lakes. It forms long tape-like leaves that resembles "sea-grass". It spreads mostly by forming runners (horizontal stems). Wild celery typically forms patches of growth, but can form extensive, meadows of grassy growth in shallow areas (generally less than 6 ft). Wild celery can grow to the surface, but typically does not interfere with recreation enough to be the focus of management activities. The long tape-like leaves do not provide as much habitat for insects as other leafy plants, but may be more important as a hiding place for larger fish species.

Wild celery produces tubers that are a very important source of food for waterfowl and wildlife. In fact, the plant gets its "celery" name from the observation by duck hunters that it gave ducks a celery-like flavor. Furthermore, the plant shares part of its Latin name with the canvasback duck (*Aythya valisineria*).

Recent studies have suggested that wild celery may be able to compete well with some invasive plants (Owens et al. 2008).

### Management

In general, vegetation management plans should strive to protect native plants and promote this species for its ecological value.

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# Appendix D

Public Input Survey Results

## 1.0 Public Input Survey Results

A survey questionnaire was distributed to property owners around the Red Cedar Lakes in autumn 2011 to gather information on public use and perception of the lakes. The survey questionnaire was developed by the Red Cedar Lakes Association and SEH with guidance from the Wisconsin Department of Natural Resources Bureau of Science Services. The survey determined lake residency of respondents, solicited knowledge about aquatic invasive species, asked for input regarding possible aquatic plant management needs and alternatives, and made inquiries into the level of community support and public participation residents of the lake would be willing to provide.

Property tax parcel databases for each county (Barron and Washburn) were queried to identify property owners adjacent to the Red Cedar Lakes. The query identified approximately 650 landowners, of which 400 were randomly selected for the survey mailing list. Paper copies of the survey questionnaire were distributed with pre-paid return postage.

The respondent sample is sufficient to provide a reasonable assessment of the Red Cedar Lakes community. Just over 55% (221) of the surveys were returned with usable responses, which is 34% of all property owners around the lakes. The results of the survey are summarized below. Not all respondents answered all questions, so totals on tables and charts do not always add up to 221. A copy of the survey questionnaire can be found at the end of this summary.

### 1.1 Section 1: Residency

Section 1 of the survey collected demographic information including lake of residence and number of people per household. Approximately 81% of respondents were from Red Cedar Lake, with 11% and 8% coming from Balsam and Hemlock respectively. Respondents were asked what type of residence they had on the lakes. Figure 1 shows the breakdown on type of residence. Permanent and second home owners made up the bulk of the respondents, but seasonal cabin owners, undeveloped land owners, and seasonal RV residents were also represented.

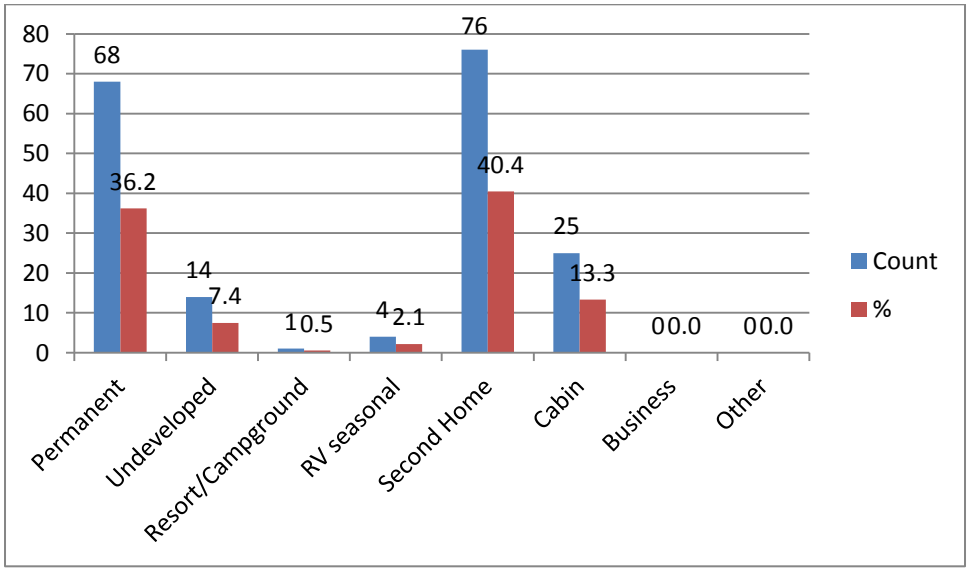



**Figure 1 – Type of Residency for 2011 Survey Respondents**

Another question was asked related to how long a respondent had been a property owner on the lake. Time ranged from 1-61 years on the lakes. No one time period was really more represented than another. For all respondents, an average number of 3.1 people per household spend 171.17 days at the lake. This information can be used to help estimate the amount phosphorus contributed by property owners to the lakes.

## 1.2 Section 2: Aquatic Invasive Species Knowledge

Section 2 explored the knowledge base of respondents related to aquatic invasive species (AIS). More than 50% of respondents had heard of Eurasian watermilfoil (EWM), purple loosestrife (PL), curly-leaf pondweed (CLP), and zebra mussels (ZM), and rusty crayfish (RC). In this grouping, zebra mussels were the most well know (93%), and RC the least (52%). The least known AIS was the New Zealand mudsnail at 9%. Just over 5% of respondents claimed they had not heard of any of the AIS in the survey. Figure 2 shows the responses when asked if respondents knew that certain AIS are present in the lakes.

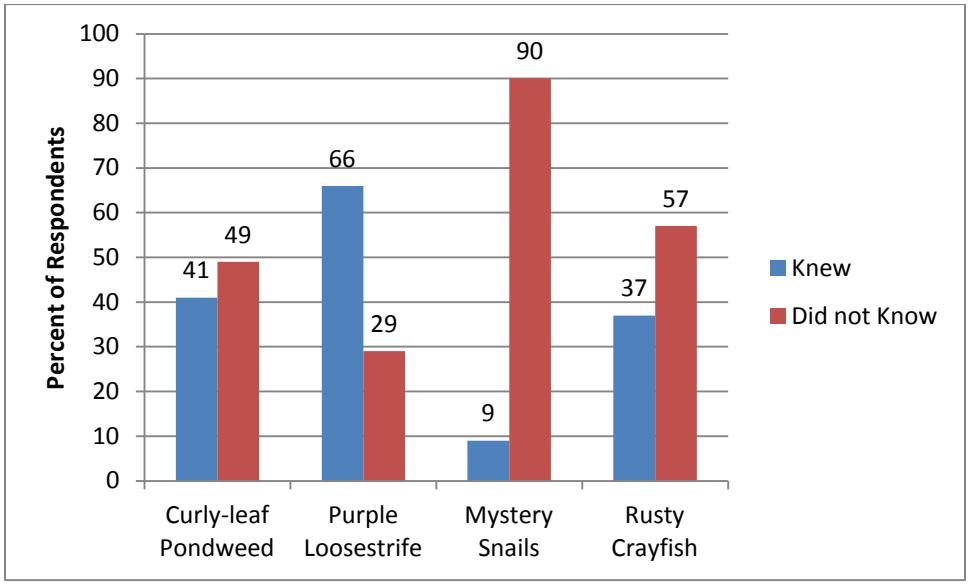



**Figure 2 – Percent of respondents who knew or didn't know certain AIS was present in the Red Cedar Lakes**

EWM is not present in the lakes, though 86% of respondents said they were familiar with it. When asked if they thought they could identify it in the lake only 35% thought probably or definitely could. When asked if they would be willing to attend a training session to help teach them how to identify AIS in the lake, 53% said they probably or definitely would.

## 1.3 Section 3: Aquatic Plant Management

Section 3 asked respondents their opinions related to aquatic plant issues in the lakes. Question 1 asked if respondents thought the level of aquatic plant growth had changes since they became familiar with the lakes and 55% said that it had increased while only 4% said it had decreased. Question 5 asked for a level of support for several different aquatic plant management alternatives that may be incorporated in the Red Cedar Lakes. Figure 3 summarizes the responses to this question.

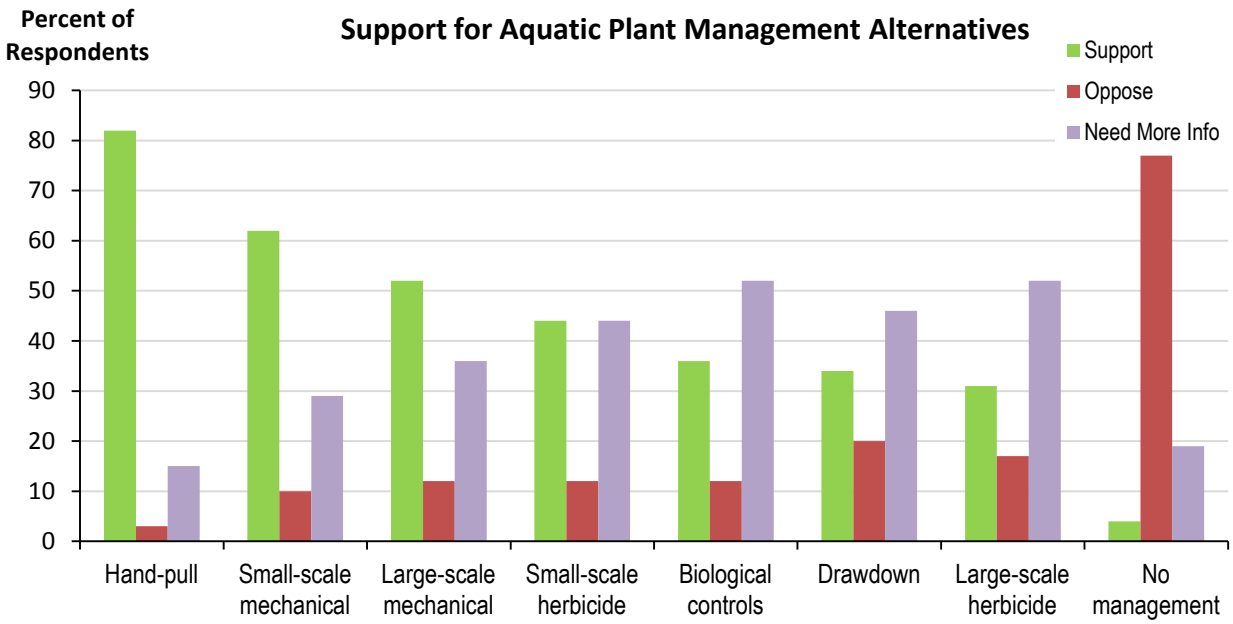



**Figure 3 – Respondents support for various aquatic plant management alternatives**

Greater than 50% of respondents would support the use of small or large-scale mechanical harvesting or physical removal through hand-pulling efforts. Less than 50% of all respondents supported the use of an aquatic herbicide, biological control, or drawdown of the lakes without providing more information about these alternatives. More than 75% of respondents opposed no management as an alternative.

Question 7 in this section asked respondents who they thought should be responsible for aquatic plant management on the lakes. More than 80% of respondents felt that the WDNR and the RCLA were almost equally responsible for aquatic plant management. After the WDNR and the RCLA, the most common answers were the individual property owner and the County.

## 1.4 Section 4: Public Participation and Community Support

Section four asked questions related to community support and public participation in the management of the lakes. The first question provided a long list of possible ways for volunteers to get involved in activities that would help support the RCLA and lake management. Only about 36% of respondents actually selected activities that they would be willing to share their time in accomplishing. The most appealing activities included water quality monitoring, aquatic invasive species monitoring, and helping to develop better fish habitat. The least appealing activities included fund raising, raising purple loosestrife control beetles, and watercraft inspection. When asked how much time volunteers were willing to give in a year most replies came back at a few hours or a few days at year.

Special skills or professional services are also sometimes needed to help support lake association and lake management activities. A little more than 25% of the respondents on average offered such skills in this survey. The most offered services were providing physical labor, gardening and landscaping, and providing assistance with GPS services.

The remaining question is Section 4 had to do with direct support and satisfaction with the existence and operation of the Red Cedar Lakes Association. Almost 98% of respondents were aware that the RCLA existed before receiving this survey. Nearly half (48%) of the respondents have attended an RCLA meeting. When those who have not attended a meeting were asked why, the majority (30%) responded that they do not know when the meetings occur, followed by not having time to attend (25%) and being out of town/not at lake residence at the time of the meeting (20%). More than 80% of respondents said they were current members of the RCLA, 14% said they were not. The main reason given for not being a member was not having enough time.

The last question of the survey asked respondents how satisfied they were with RCLA operations. Figure 4 shows the responses to this question. The majority of respondents were satisfied with most operations of the RCLA; however there were also many respondents who were unsure of the RCLA's activities, suggesting a lack of public knowledge of the activities or a lack of participation in activities. For example, not attending meetings will prevent a resident from knowing the meeting atmosphere and from knowing the financial status of the RCLA. Also, if a resident doesn't ask anything of the RCLA, they will be unsure of how well the Association listens to lake property owners.

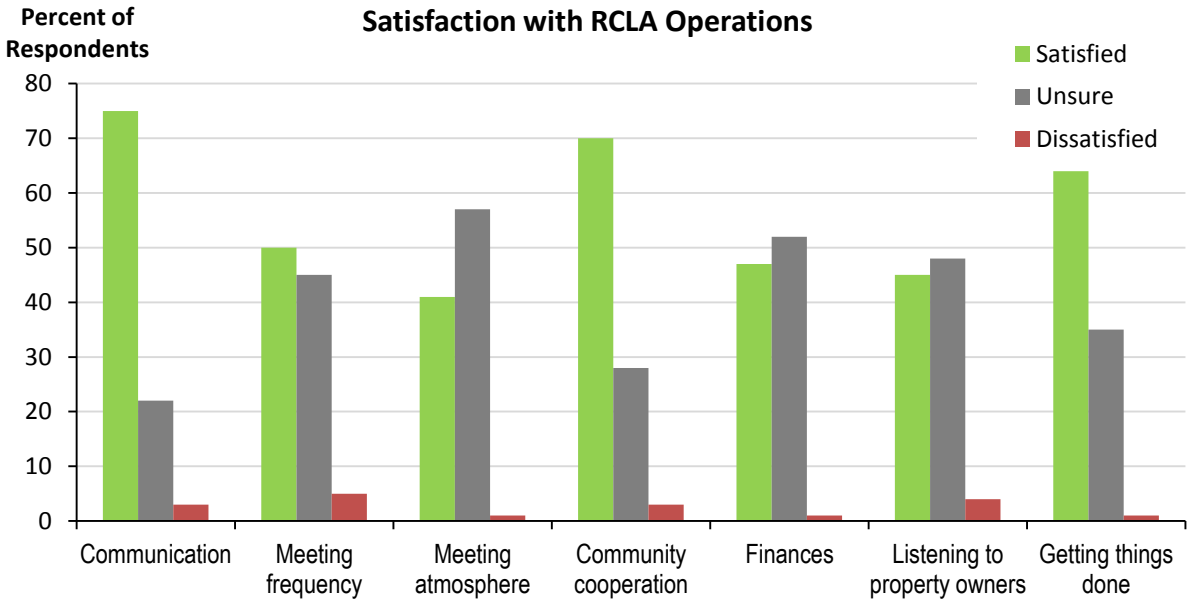



**Figure 4 – Survey respondents satisfaction with RCLA operations**

## 1.5 Section 5: Final Comments

Respondents were offered space to provide comments or to address any additional issues they would like the RCLA to attend to. A total of 53 respondents chose to voice concerns and opinions, offer praise and critique, provide additional observations, or to ask questions. The respondent comments are divided into Questions and General Comments below.

### 1.5.1 Questions

- Vegetation near the shoreline increasing, what are the causes and can it be reversed or treated?
- I still do not know if I have a membership number - since joining I haven't received anything. Possibly it was sent to Florida address - Only received this survey (forwarded). How do I access the "members only" area on the RCLA web site? Thank you for all you do.
- Is there any rule as to if a home owner can leave a motor home tarped on their property all winter (like outside storage)?
- Is there a website? There should be. Your weed mgmt program could help property owner identify weeds; also immediate communication with postings. E-mails could be sent out when a new posting is posted on the site - promoting traffic to site. Also fundraising thru advertising on the site.
- Is "light" pollution being addressed? Need continued emphasis on shoreline buffers to look at decreasing fertilizer levels into lake. Look at shoreline erosion issues.
- What chemical means of weed removal is legal and where to get it and a permit if required

### 1.5.2 General Comments

- Boater etiquette is ongoing issue with boats going too fast and too close to anchored boats who are fishing or slow trolling
- My property is on the channel between Red Cedar and Hemlock. I wonder if there is a better way to educate boat drivers on the meaning of "NO WAKE". It seems the no wake buoys mean nothing to 75% of the boat drivers. Speeding thru the no wake zone has been increasing instead of decreasing.
- Individual lake shore owners should not use chemicals to control non native aquatic plant growth
- More aggressive action to stop property owners who mow and clear down to the water-send them letters
- Early spring/late winter meeting to outline summer projects, more focus on buckthorn by RCLA/county
- Shallow water bogs on south end of Red Cedar Lake are growing, navigation through channel will get impossible
- Attended one RCLA meeting — Directors arrogant, web site info old and outdated, compliments on doing the survey
- Change 18 inch size limit for walleyes, support a slot limit
- Over 45 years RCL hasn't changed. Demise will occur from lakes above us. Mother Nature will control, don't spend big money on problems that are not catastrophic
- Sorry so late returning the survey. I was out of town till now.
- Thanks for the "heads up" on Invasive species. Look forward to receiving more info-photos, mgmt techniques, info
- Thanks to all who do the work. When I retire I will help more. Need aggressive people to protect the lake. Fertilizer/mowing down to shoreline are biggest negatives
- The newsletter sounds like the RCLA is dedicated and hard working. Sorry survey was misplaced

- RCLA member for many years and appreciate all the group has done. To volunteer depends on project and if research can be done from home in Eau Claire.
- Personally two general meetings - 1 spring/1 fall to show progress. (One more chance to solicit funds?) Would it be a lot of extra work for board?
- I am and have been a resident on Red Cedar Lake for 29 years and lived in Angus 1/4 mile from Stout Point all together for 64 years. So I know the area well. I remember when we fished in a rowboat and would be the only boat on the lake and would catch our limit of walleyes in an hour. No one had a boat motor in those days. Not much population on the lake then from 1945 through 1960's. That's when Shorty Landis bought "The Country Club" now called "Tagalong" which was the name when Stout owned it. Shorty cleaned up the overgrown Club and made it a supper club (I cooked there in the 1960's to 1972).
- Buckthorn
- Do a better job of organizing fund raisers.
- The city of Birchwood and its residents use fertilizer which flows into Balsam Lake and increases the growth of weeds and AIS.
- Appreciate what has been done and would like more activity. OK to raise dues! Think the discount coupons are good idea.
- Have you thought of a women's auxiliary for fund raisers? How welcome are new members?
- More on buckthorn.
- Re-enforce with property owners that if you pull/cut weeds you must remove them from the water and not push them out into the lake.
- The heart is willing, but our ages make it hard to help.
- Great Job. Keep it up.
- I am just so thankful we have an active RCLA. We will try to support this organization as much as we can.
- The lakes association needs to take an active part in helping to control our lakes.
- I do not understand the lack of RCLA support for the ban of fertilizers use on lake shore property. Also, do not understand a more aggressive stand against lawns down to the shore line. More support for DNR inspections of septic systems.
- Even though I am not an active member, I support the activities and goals of the RCLA.
- Thanks for all the volunteer hours that were given to AIS activities in the summer of 2011 by our member volunteers and concerned citizens. RCLA's mission should not include zoning rule enforcement or county, township ordinance enforcement.
- Our property is at the end of Hemlock Lake and getting so weedy it's difficult to get our boat out and even the paddle boat gets clogged up. We love the nature and privacy at this end of the lake, but the weeds need to get under control
- Am a weekend warrior, but still feel it's important to be a part of keeping our lakes pristine for the future.
- I own 4 properties there, which currently are only a tax burden. Loch Lomond membership has left me with a negative outlook since its operation seems to be slanted towards a MN playground for the wealthy.
- My place is across from the Deer Path Resort and the no wake zone is obeyed each year less and less and is doing significant damage to my shoreline. It needs rip-rap or sea wall repair. Need help with permits and financing to fix.
- Lower size for fish under 18"
- I do not like surveys
- I wonder about the efficiency of establishing a coast guard auxiliary flotilla to monitor invasive species on boats, control shoreline erosion and promoting education
- Silt buildup south end of Red Cedar

# RED CEDAR LAKES USER SURVEY

As a part of an Aquatic Invasive Species (AIS) Education grant awarded to the Red Cedar Lakes Association, a short survey of residents from the Red Cedar Lakes (Balsam, Hemlock, & Red Cedar) is being conducted to determine how to better protect and enhance the quality of the lakes. Your participation in this survey is very important and should take only a few minutes. All information will be used for research purposes only. Thank you for your time.

**SECTION 1 – Residency**

1. What type of property do you have on Red Cedar Lakes? If you have more than one type of property, please report on only the property you have had the longest. ***(Please select one)***

___ permanent residence ___ second home
___ undeveloped land ___ cabin (not intended to support long term residency)
___ resort/campground ___ business (other than a resort/campground)
___ RV seasonal camper ___ other ***(please specify)*** _____

2. How long have you owned or rented your property on the Red Cedar Lakes? ***(If you have been on the lakes less than 1 year please write '1' in the space provided. If you own multiple properties, please comment on the one you have owned or rented for the longest period of time.)***

I have owned/rented the property for ___ year(s).

3. Which lake is your property in Question 1 located on?

___ Balsam ___ Red Cedar ___ Hemlock

4. During a 12-month period (Jan. 1 – Dec. 31) how many days are you, members of your family, or guests at the property indicated in Question 1? ***(Please provide your best estimate in the space below)***

There are people at the property approximately _____ days a year.

5. On average, about how many people are at the property each time it is being used? _____

6. If you are a resort/campground owner, please answer the following questions about your establishment. ***(If you are not a resort owner, skip to Section 2)***

a) How many cabins do you maintain? _____
b) How many RV sites do you maintain _____
c) How many campsites do you maintain? _____
d) How many bathroom facilities do you maintain?
   i. with shower and toilet _____
   ii. with shower only _____
   iii. with toilet only _____
   iv. biffy (port-a-potty) only _____
e) How many separate drain fields do you have? _____
f) How many holding tanks do you have? _____



7. On average, how many guests are staying at your resort on any given day? ***(Please fill in a response for each time period below)***

Memorial Day through Labor Day _____ September through October _____
April through May _____ November through March _____

**SECTION 2 – Knowledge of Aquatic Invasive Species (AIS) in the Red Cedar Lakes**
**This section of the survey seeks to determine how much lake residents know about AIS. Aquatic invasive species are plants and animals that are foreign to the Red Cedar Lakes and do not belong there.**

1. Please check all of the following aquatic invasive species that you have heard of before.

___ curly-leaf pondweed ___ hydrilla ___ banded mystery snail
___ purple loosestrife ___ freshwater jellyfish ___ rusty crayfish
___ zebra mussels ___ New Zealand mudsnail ___ spiny waterflea
___ giant reed grass ___ Eurasian water milfoil ___ Japanese knotweed
___ had not heard of any

2. In order to gauge potential community interest, would you be willing to take part in a training session to help you identify AIS in the lakes?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not

**Curly-leaf pondweed (CLP)**
CLP has been documented in the Red Cedar Lakes. CLP can create nuisance conditions by forming dense beds of vegetation that interfere with many lake uses.

3. Before responding to this survey, did you know that CLP is present in the Red Cedar Lakes?

___ yes ___ no ___ I had heard but did not know for sure

4. Do you think you would recognize CLP in the lakes if you saw it?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not

**Purple Loosestrife**
Purple loosestrife, a shore land and wetland flowering non-native, invasive plant species has been documented in the Red Cedar Lakes. Purple loosestrife can take over areas of the shoreline and adjacent wetlands displacing more beneficial native plants.

5. Before this survey, did you know purple loosestrife is present in the Red Cedar Lakes?

___ yes ___ no ___ I had heard, but did not know for sure

6. Do you think you would recognize purple loosestrife in the lake if you saw it?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not

**Chinese Mystery Snails**
Chinese Mystery Snails have been found in the Red Cedar Lakes. These invasive snails may compete with the native snails and fish for food and habitat. Large die offs of this invasive snail are common and can be aesthetically displeasing.

7. Before responding to this survey, did you know that Chinese Mystery Snails are present in the Red Cedar Lakes?

___ yes ___ no ___ I had heard, but did not know for sure

8. Do you think you would recognize a Chinese Mystery Snails in the lake if you saw it?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not

**Rusty Crayfish**
Rusty Crayfish have also been found in the Red Cedar Lakes. The most serious impact they can cause is destruction of aquatic plant beds. They can also displace native crayfish, decrease the amount and variety of smaller water bugs and reduce some fish populations.

9. Before responding to this survey, did you know that Rusty Crayfish are present in the Red Cedar Lakes?

___ yes ___ no ___ I had heard, but did not know for sure

10. Do you think you would recognize a Rusty Crayfish in the lake if you saw it?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not

**Eurasian Water Milfoil (EWM)**
Eurasian water milfoil has not been found in any waters of the Red Cedar Lakes but could be a threat in the future. In some lakes EWM becomes just another "weed". In other lakes it can form dense beds of vegetation present all season that can interfere with many lake uses.

11. On a scale of 1 to 7, where 7 is extensive knowledge of EWM, and 1 is no knowledge of EWM please indicate your level of knowledge about this aquatic invasive species by circling the appropriate number.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| no knowledge | | | some knowledge | | | extensive knowledge |

12. Do you think you would recognize EWM in the lake if you saw it?

___ definitely yes ___ unsure ___ probably not
___ probably yes ___ definitely not



**SECTION 3 – Aquatic Plant Management in the Red Cedar Lakes**
**Aquatic plants in a lake, whether native or non-native, can be managed in many different ways. In most cases management is ongoing and long-term. Sometimes no aquatic plant management may be the best option.**

1. In the time that you have owned/rented the property indicated in Section 1, Question 1, would you say the amount of visible aquatic plant growth in the lake, excluding algae, has:

___ increased ___ stayed the same ___ decreased ___ I don't know

2. Do you know what aquatic plants are present in the water adjacent to your shoreland property?

___ yes ___ no __I know what some of them are, but not all of them

3. Since you have owned or rented the property indicated in Section 1, Question 1, have any attempts been made to remove or control aquatic plants by your shoreland property?

___ yes ___ no ***(skip to Question 5)***
___ I do not own or rent lake shore property ***(skip to Question 5)***

4. What has been done to remove aquatic plants from the lake by your property? ***(Check all that apply)***

___ someone was hired to hand-pull or rake ___ self hand pull or rake
___ someone was hired to apply chemical herbicide ___ self application of chemical herbicide
___ mechanical plant removal with boat and motor or other apparatus
___ other ***(please specify)*** _____

**Non Native Aquatic Plant Management Alternatives**
If management of a non native aquatic plant species like curly-leaf pondweed is recommended for the Red Cedar Lakes, what alternatives might you support? Please assume that the following management alternatives are safe and legal, and would only be used if approved by the State of Wisconsin and the Red Cedar Lakes Association.

5. The following is a list of potential aquatic plant management alternatives for Red Cedar Lakes. Please mark if you would support, oppose, or if you need more information about each method. ***(Mark only one option per alternative)***

| **Non Native Aquatic Plant Management Alternative** | **Support** | **Oppose** | **Need more information** |
|---|---|---|---|
| a) Small-scale (less than 10 acres) mechanical harvesting | _____ | _____ | _____ |
| b) Large-scale (10 acres of greater) mechanical harvesting | _____ | _____ | _____ |
| c) Hand pulling and raking in shallow water | _____ | _____ | _____ |
| d) Small-scale (less than 10 acres) chemical herbicide application | _____ | _____ | _____ |
| e) Large-scale (10 acres or greater) chemical herbicide application | _____ | _____ | _____ |
| f) Biological control (using one live species to control another) | _____ | _____ | _____ |
| g) Winter drawdown of the lakes surface water level to freeze out undesirable plants | _____ | _____ | _____ |
| h) No management ( the lakes are what they are, leave them alone) | _____ | _____ | _____ |

6. Of the management alternatives presented in Question 5, which two would you most support; and which two would you least support? ***(Please place the letters corresponding to your choices in the spaces provided)***

**Most Support:** _____ and _____ **Least Support:** _____ and _____

7. Who do you feel should be responsible for managing non native aquatic plant growth in the Red Cedar Lakes? ***(Check all that apply)***

___ Wisconsin DNR
___ individual lake shore property owners
___ "Mother Nature" (i.e. no management)
___ I don't know
___ local township government
___ county government
___ Red Cedar Lakes Association
___ other ***(please specify)*** _____

**SECTION 4 – Public Participation and Community Support**

**Local, county, state, and federal resources will be sought in addition to Red Cedar Lakes Association (RCLA) funds to implement management recommendations for the Red Cedar Lakes. Donations of volunteer time, services, materials, and equipment can be used as match funding for many grant programs reducing the overall financial burden to the RCLA.**

1. Following are activities that lake residents could participate in. Please check all those activities you might be willing to volunteer your time if additional assistance is needed. ***(Check all that apply.)***

___ watercraft inspection at the boat landings
___ lake monitoring for AIS
___ organizing RCLA fund raising events
___ water quality monitoring
___ shore land monitoring for AIS
___ raising beetles that eat purple loosestrife
___ photography to document lake conditions and improvements
___ native aquatic plant monitoring and identification
___ wildlife monitoring (ex. frogs, turtles, loons, other waterfowl, mussels & clams)
___ reestablishing rooted aquatic vegetation adjacent to your shoreline
___ helping lake shore property owners with planting projects related to shoreland buffers, restoration projects, and rain gardens
___ improving fish and wildlife habitat by adding woody debris in the shallow water adjacent to your shore line

___ I am not interested in volunteering any time ***(skip to question 3)***

2. How much time would you be willing to contribute to support any of the activities in Question 1 above?

___ a few hours a year ___ a few days a year ___ longer periods of time



3. Professional services or special skills are sometimes needed to accomplish goals set by the RCLA. Do you have any special skills or services that you might be willing to provide if appropriate? Please check all services that you might be willing to donate to help the RCLA manage the Red Cedar Lakes. This is not a commitment but rather a measure of possible assistance if needed.

___ GPS use
___ grant writing
___ printing services
___ physical labor
___ sewing
___ graphic design
___ legal services
___ construction services
___ gardening/landscaping design
___ gardening/landscaping implementation
___ web development
___ scuba diving
___ outdoor sign design
___ other ***(please specify)*** _____

___ I am not interested in or not able to provide any services

4. Prior to receiving this survey, did you know that there was a RCLA?

___ yes ___ no ***(skip to Section 5)***

5. Have you ever attended an RCLA meeting?

___ yes ***(skip to question 7)*** ___ no

6. If you answered "no" in Question 5, what has prevented you from attending a RCLA meeting?

___not interested ___I don't have time __I never know when they are occurring
___other ***(please explain)*** _____

7. What is your affiliation with the RCLA?

___ current member ***(skip to Question 10)*** ___ former member
___ I've never been a member

8. Please help us understand your reasons for not being a current member of the RCLA. ***(Check all that apply)***

___ not interested
___ membership dues are too high
___ I do not have enough time
___ I disagree with what they are doing
___ I haven't been asked to be a member
___ I feel there is no benefit for being a member
___ other ***(please specify)*** _____

9. If you are not a current member of the RCLA, do you wish to be contacted to become a new member?

___ yes ***(please fill out contact information in Section 5)*** ___ no

10. How satisfied are you with the following aspects of RCLA activity? ***(Please place a check mark under one column only for each activity)***

| **RCLA Activity** | **Very Satisfied** | **Somewhat Satisfied** | **Unsure** | **Somewhat Dissatisfied** | **Very Dissatisfied** |
|---|---|---|---|---|---|
| RCLA communication within the community | _____ | _____ | _____ | _____ | _____ |
| RCLA meeting frequency | _____ | _____ | _____ | _____ | _____ |
| RCLA meeting atmosphere (parliamentary procedure) | _____ | _____ | _____ | _____ | _____ |
| Promoting community cooperation to achieve goals and objectives | _____ | _____ | _____ | _____ | _____ |
| Management of RCLA finances | _____ | _____ | _____ | _____ | _____ |
| Listening to/addressing property owners concerns | _____ | _____ | _____ | _____ | _____ |
| Getting things done | _____ | _____ | _____ | _____ | _____ |

**SECTION 5 - Final Comments**

1. **If there are any additional issues you would like the RCLA to address, or comments you would like to make, please use the space below.**

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

2. **Thank you for your time and your answers! Providing your contact information is optional, but if you wish to, please do! Contact information will be used for follow up if needed.**

Name: _____
Addres_____
City: _____ State: _____ Zip: _____
Phone number: _____
Email address: _____

# Appendix E

WDNR Northern Region APM Strategy

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR
## Summer, 2007

# AQUATIC PLANT MANAGEMENT STRATEGY
# Northern Region WDNR

## ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

## BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

## GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a" whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.
4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

## BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

**State Statute 23.24 (2)(c)** states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.

7. The requirements for plans that the department may require under sub. (3) (b). “

**State Statute 23.24(3)(b)** states:
“The department may require that an application for an aquatic plant management permit contain a plan for the department’s approval as to how the aquatic plants will be introduced, removed, or controlled.“

**Wisconsin Administrative Code NR 109.04(3)(a)** states:
“The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.”

# AQUATIC PLANT MANAGEMENT STRATEGY
# Northern Region WDNR

## APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
   a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
   b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

---

* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

# AQUATIC PLANT MANAGEMENT STRATEGY
# Northern Region WDNR

## DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

**Documentation of *impairment of navigation*** by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

**Documentation of the *nuisance*** must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

# AQUATIC PLANT MANAGEMENT STRATEGY
# Northern Region WDNR

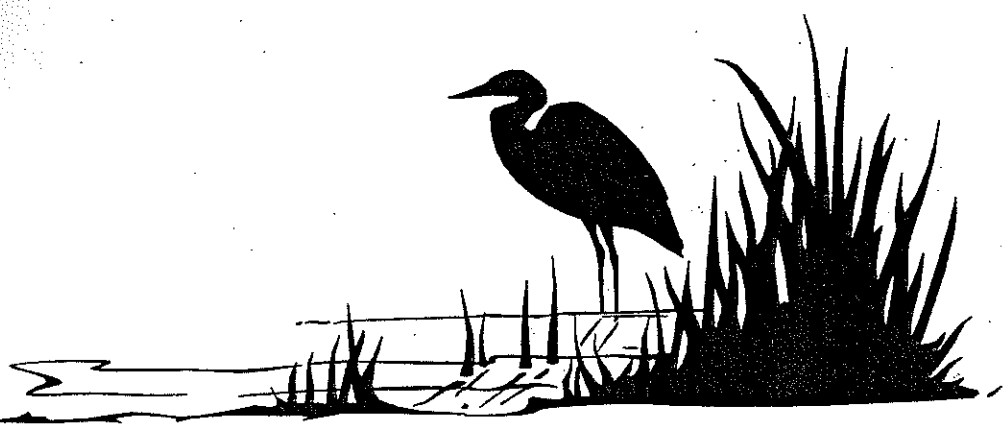
## DEFINITIONS

| | |
|---|---|
| Manual removal: | Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver. |
| Native aquatic plants: | Aquatic plants that are indigenous to the waters of this state. |
| Invasive aquatic plants: | Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health. |
| Sensitive area: | Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water). |
| Rapid Response protocol: | This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established. |

# Appendix F

Sensitive Areas Report for Balsam Lake

# BALSAM LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES



**This document is to be used with its companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas"**

# BALSAM LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES

James M. Cahow
Water Resources Biologist
DNR, Northern Region, Spooner

Richard R. Cornelius
Fisheries Biologist
DNR, Northern Region, Washburn

## CONTENTS

# A BRIEF SUMMARY OF BALSAM LAKE, WASHBURN COUNTY, SENSITIVE AREAS AND MANAGEMENT GUIDELINES

The following is a brief summary of the Balsam Lake sensitive area sites and the management guidelines. A detailed description of Balsam Lake's sensitive areas can be found in the attached "Integrated Sensitive Area Assessment". Also, the attached "Guidelines For Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines for the sensitive areas. It is hoped that these two attached documents will be used as guidance when dealing with the valuable resource that is Balsam Lake.

I. The following sensitive areas contain aquatic plant communities which provide important fish and wildlife habitat: A, C, and I (see attached map). Management guidelines for these sites are:

1. Limit aquatic vegetation removal to navigation channels no greater than 20 feet wide where necessary. These channels should be mechanically harvested, if possible, but chemical treatment will be allowed in some circumstances.

2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem.

3. Leave large woody debris, logs, trees, and stumps, in the littoral zone to provide habitat for fish and other aquatic organisms.

4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover.

5. Prevent erosion, especially at construction sites.

6. Strictly enforce zoning ordinances.

7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.

8. There is an additional guideline specifically for Site C. This undeveloped bay is a valuable and unique resource. The land surrounding the bay should be zoned conservancy and should be considered for acquisition by the lake association or district or by a conservation agency.

II. The following sensitive areas provide gravel and coarse rock rubble habitat which are important for walleye spawning: B, D, E, F, G, and H (see map). The management guidelines for gravel and coarse rock sensitive areas are, with the exception of guideline number 8, basically similar to the guidelines for the aquatic plant community sensitive areas. The emphasis may be somewhat different in that:

1. It is <u>critically</u> important that no alteration of the gravel and coarse rock substrate occur at these sites, unless such alterations would improve walleye spawning. Such alterations are regulated by Chapter 30, Wisconsin Statutes.

2. Erosion control on or near shorelines is especially important adjacent to walleye spawning areas to prevent siltation of spawning habitat.

3. Chemical treatment and mechanical removal of aquatic plants need not be quite as restrictive as in aquatic plant sensitive areas. However, no removal of aquatic plants should be done unless necessary.

It should be noted that the recommendations made in these sensitive area management guidelines are in general good guidelines for managing the entire lake, but are especially important in the designated sensitive areas.

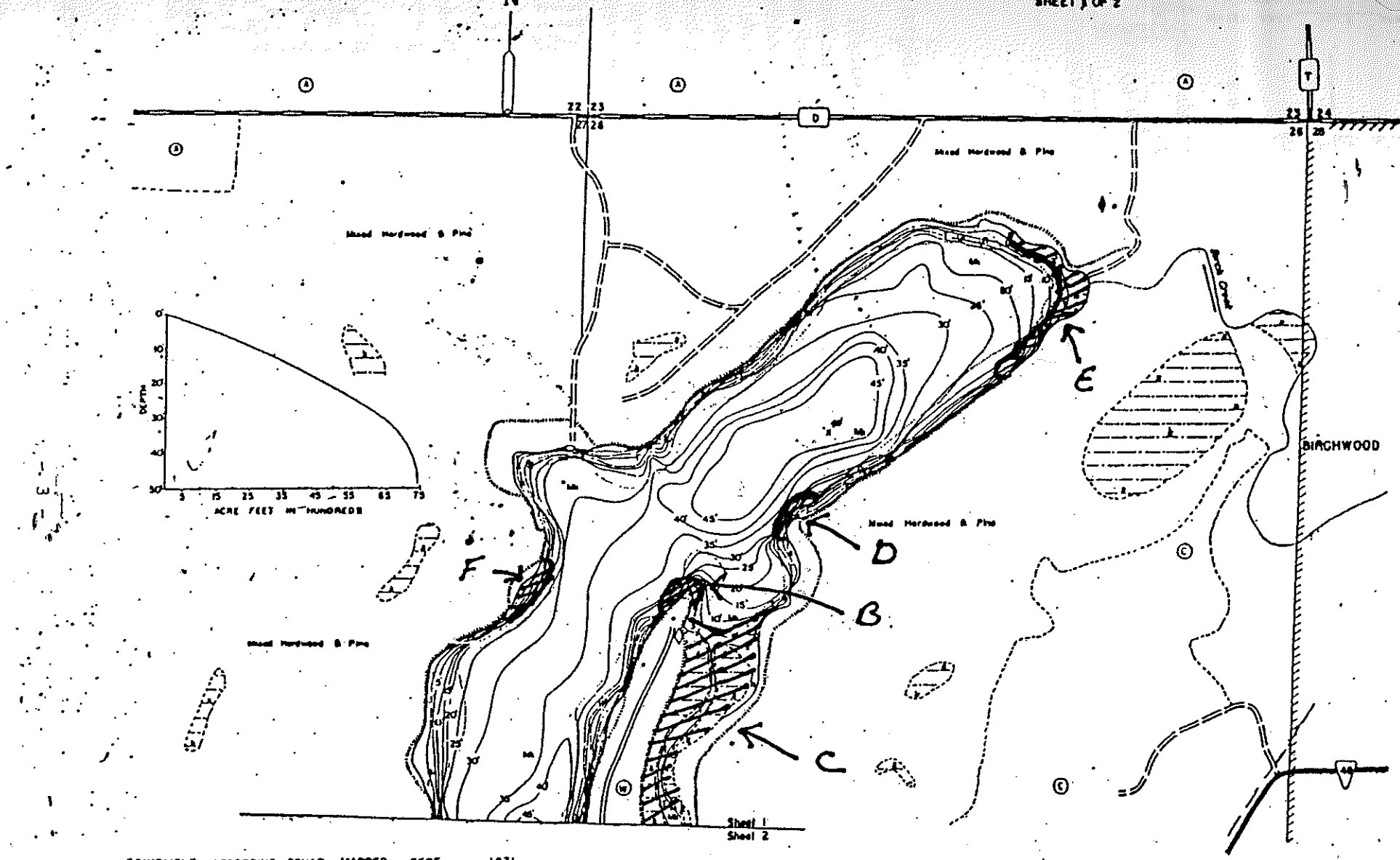
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

BALSAM LAKE — WASHBURN COUNTY

SEC. 26,27,34,35 T. 37 N. R. 10 W.

SHEET 1 OF 2




EQUIPMENT RECORDING SONAR MAPPED SEPT 1971
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Brush; Steep slope; Partially wooded; Indistinct shoreline; Wooded; Marsh; Cleared; Spring; Pastured; Intermittent stream; Agricultural; Permanent inlet; Bench Mark; Permanent outlet; Dwelling; Dam; Resort; D.N.R. State owned land

LAKE BOTTOM SYMBOLS

P. Peat; Mk. Muck; C. Clay; M. Marl; Sd. Sand; St. Silt; Gr. Gravel; R. Rubble; Bd. Bedrock; B Boulders; Stumps & Snags; Rock ranger to navigation; S Submergent vegetation; E Emergent vegetation; Floating vegetation; Brush shelters

500' 0' 500' 1000' 1500' 2000'
SCALE

Access; Access with Parking; Boat Livery

Drawn by: C Hay
Field work by: C Burch G Lind I Sather

SPECIES OF FISH

| | Abundant | Common | Present |
|---|---|---|---|
| Muskie | | | |
| N. Pike | | X | |
| Perch | | X | |
| Bass | | | X |
| Sunfish | X | | |
| Trout | | | |

WATER AREA 286.2 ACRES
UNDER 3 FT. 8 %
OVER 20 FT. 67 %
MAX. DEPTH 48 FEET.
TOTAL ALK. 72 P.P.M.
VOLUME 7423.3 ACRE FT.
SHORELINE 7.30 MILES
SHORELINE 7.44 MILES WITH IS.

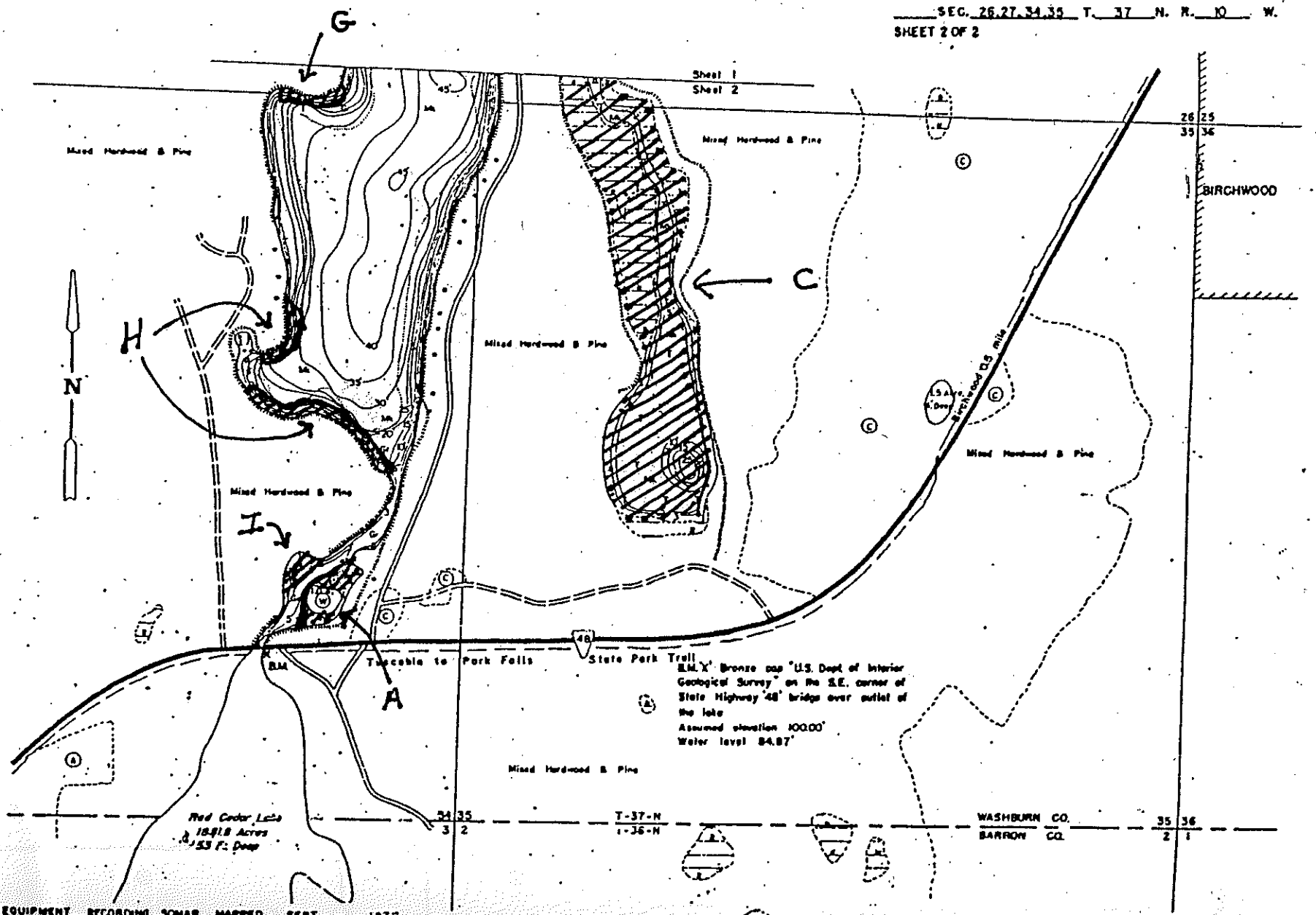
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

BALSAM LAKE — WASHBURN COUNTY

SEC. 26,27,34,35 T. 37 N. R. 10 W.

SHEET 2 OF 2




EQUIPMENT RECORDING SONAR MAPPED SEPT 1976
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Brook — Hills, Steep slope
Partially wooded — Undrained depression
Wooded — Marsh
Cleared — Spring
Pastured — Intermittent stream
Agricultural — Permanent inlet
B.M. Bench mark — Permanent outlet
Dwelling — Dam
Road — U.S.H., State or County highway

P. Peat
Mk. Muck
C. Clay
M. Marl
Sd. Sand
St. Silt
Gr. Gravel
R. Rubble
Bd. Bedrock

LAKE BOTTOM SYMBOLS

B Boulders
Stumps & Snags
Rock dumps to navigation
T Submerged vegetation
E Emergent vegetation
Floating vegetation
Brush shallows

SCALE 500' 0' 500' 1000' 1500' 2000'

Access — Access with Parking — Boat Livery

Drawn by: F. Hart
Plotted by: C.A. — Checked by: L.J.S.

SPECIES OF FISH

| | Abundant | Common | Present |
|---|---|---|---|
| Bluegill | | | |
| N. Pike | | | |
| Bullhead | | | |
| L. Mouth Bass | | | |
| S. Mouth Bass | | | |
| Walleye | | | |
| Perch | | | |

WATER AREA 286.2 ACRES
UNDER 3 FT. 8 %
OVER 20 FT. 67 %
MAX. DEPTH 68 FEET
TOTAL ALK. 72 P.P.M.
VOLUME 7423.3 ACRE FT.
SHORELINE 7.30 MILES
SHORELINE MILES

# LAKE MANAGEMENT

## INTEGRATED SENSITIVE AREA ASSESSMENT SUMMARY

LAKE: Balsam Lake COUNTY: Washburn

DATE OF SURVEY: 28 August 1997 NUMBER OF SENSITIVE AREAS: 9

SITE EVALUATORS: DNR Fish Manager: Rick Cornelius
DNR Water Resources Manager: Jim Cahow
DNR Wildlife Manager: Kevin Morgan
DNR Water Regulations and Zoning Specialist: Ed Slaminski
DNR Fisheries Technician: Gary Lund

**Introduction**

This sensitive area lake survey is an integrated approach to resource management providing lake associations, individual property owners, zoning officials, boards of adjustment, and other interested groups or individuals with specific management recommendations that can be used to improve and protect the overall health of the Balsam Lake ecosystem. Some of these recommendations will provide guidance as to what should be maintained or protected to insure future health of the lake ecosystem, while also acknowledging special and exceptional resource areas; other recommendations will focus on what should be restored or fixed to insure the different functional attributes of the ecosystem are all properly functioning together to insure full ecosystem health and biotic integrity. Readers of this document should refer to the accompanying companion document **"Guidelines for protecting, maintaining, and understanding lake sensitive areas"** which provides specific recommendations on how to protect the identified sensitive areas, while also helping the reader better understand why they are important to a healthy lake ecosystem.

This sensitive area survey was conducted on Balsam Lake, which lies in the southeast corner of Washburn County, about two miles west of the Village of Birchwood. Balsam Lake, which is 295 acres in size, is the northernmost lake in the Red Cedar Lakes Chain, which also includes 1,841-acre Red Cedar Lake, and 357-acre Hemlock Lake. There is navigable water access between the lakes.

The water of Balsam Lake is fairly fertile, with an MPA of 72 ppm. Average summer Secchi disk readings are around nine feet. There is an inlet which flows from Birch Lake on the north end of Balsam Lake, and the channel to Red Cedar Lake on the south end has an outlet flow of about 40 cfs.

Primary gamefish and panfish species are largemouth bass (present), northern pike (common, smallmouth bass (common), walleye (common), bluegills (common), black crappies (common), yellow perch (common), pumpkinseed (present), rock bass (present), and bullheads (common).

Vegetation on much of the shoreline is composed of natural plant cover consisting of all three layers that should be present in any healthy lake shoreline buffer (trees, shrubs, herbaceous ground cover). Efforts

should be made to educate residents about the importance of retaining the existing natural plant cover in shoreline areas while encouraging the restoration of those areas that have been previously converted to lot-wide mowed lawns to the water's edge.

Sensitive areas were assigned a letter designation beginning with A and continuing in a counter clockwise direction starting at the channel to Red Cedar Lake (Figure 1). Sensitive areas fell into two basic categories, aquatic plant communities providing important fish and wildlife habitat (sensitive areas: A, C, and I), and gravel and coarse rock rubble which provide important walleye spawning habitat (sensitive areas: B, D, E, F, G, and H).

## Resource Value of Site A

This is a small bay containing a wooded island which is located on the southeast side of the channel between Balsam Lake and Red Cedar Lake. The bay contains stumps and logs which provide cover for fish and the stumps and logs should not be removed. The bay contains a variety of aquatic vegetation which provides good fish and wildlife habitat. Some species present include largeleaf pondweed, fern pondweed, white water lily, northern water milfoil, coontail, and eel grass. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Readers of this document should refer to the more in-depth companion document ("Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas") which provides specific recommendations on how to protect the identified sensitive areas, while also helping to understand why they are important to a healthy ecosystem. Recommendations include limiting plant removal, providing shoreline buffer areas and preventing erosion, prohibiting littoral zone alterations such as filling or dredging, leaving logs, stumps, and woody debris in the water, enforcing zoning ordinances, and eliminating nutrient inputs.

## Resource Value of Site B

A point of land with rock and rubble substrate used by walleyes for spawning. The littoral zone substrate should not be altered in any way. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site C

This long, narrow bay on the east side of the lake is a valuable and unique resource. In actuality, the bay consists of a large spring pond with an outlet to Balsam Lake. The bay is completely undeveloped and a considerable wetland area adjoins much of the bay, providing very valuable habitat for a wide variety of wildlife. Furbearers, waterfowl, reptiles and amphibians all make use of the area. The bay also provides good fish habitat, and is likely an esocid and centrarchid spawning area. Aquatic vegetation includes a substantial stand of wild rice, as well as bulrush, cattail, arrowhead, white and yellow water lily, elodea, milfoil, coontail, and a variety of pondweeds. Stumps are present and should not be removed. The entire bay should be a "slow no wake" zone. Because of the valuable nature of this undeveloped bay, consideration should be given to acquisition by a lake association or district or by a conservation agency. The bay should be zoned conservancy. No aquatic vegetation removal should occur. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site D

This site has rock and rubble substrate which is used by walleyes for spawning. The littoral zone substrate should not be altered in any way. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site E

This site is located on the northeast end of the lake at the inlet of Birch Creek. Aquatic vegetation, including elodea, bulrush, and water lily, along with stumps provide fish and wildlife habitat. Walleye spawning occurs on rock and rubble shoreline near the inlet, and there is a walleye spawning run into Birch Creek. The littoral zone substrate should not be altered in any way. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site F

This shoreline has rock and rubble substrate which is used by walleyes for spawning. The littoral zone substrate should not be altered in any way. Some eel grass and coontail are present. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site G

This shoreline has rock and rubble substrate which is used by walleyes for spawning. The littoral zone substrate should not be altered in any way. Logs in the water should not be removed. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site H

This shoreline has rock and rubble substrate and is an important walleye spawning area. About 1,800 feet of shoreline are in this sensitive area. The littoral zone substrate should not be altered in any way. Logs and aquatic vegetation which includes largeleaf pondweed, fern pondweed, coontail, and water lilies provide additional fish and wildlife habitat. Ducks, deer, and turtles were observed using this site. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site I

This site is located in a bay on the northwest side of the channel between Balsam Lake and Red Cedar Lake. Logs and aquatic vegetation provide fish and wildlife habitat. Vegetation includes water lilies, coontail, milfoil, elodea, and a variety of pondweeds. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested. Logs should be left in place. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

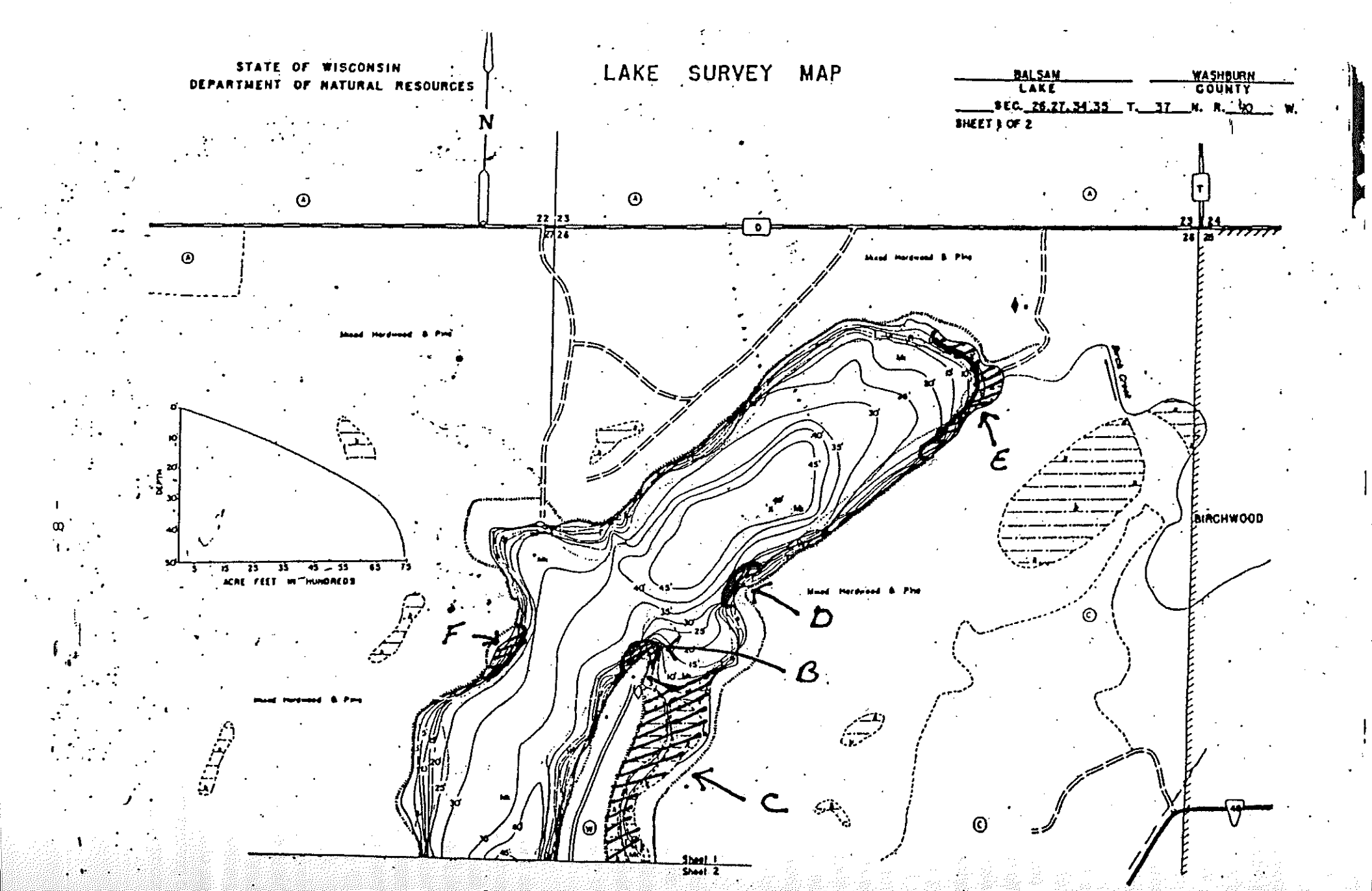
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

BALSAM LAKE — WASHBURN COUNTY

SEC. 26,27,34,35 T. 37 N. R. 10 W.

SHEET 1 OF 2




EQUIPMENT RECORDING SONAR MAPPED SEPT 1971
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Beach — Steep slope — Intermittent stream — Permanent inlet — Permanent outlet — Dam — Spring — Marsh — Cleared — Pastured — Agricultural — Bench mark — Building

LAKE BOTTOM SYMBOLS

F. Peat — Mk. Muck — C. Clay — M. Marl — Sd. Sand — St. Silt — G. Gravel — R. Rubble — B. Boulders — S. Stumps & Snags — Rock danger to navigation — T. Submergent vegetation — E. Emergent vegetation — Floating vegetation — Brush shelters

SCALE 500' 0' 500' 1000' 1500' 2000'

Access — Access with Parking — Boat Livery

Drawn by: C. Hay

SPECIES OF FISH

| | Abundant | Common | Present |
|---|---|---|---|
| Walleye | | | |
| N. Pike | | | |
| Perch | | | |
| S. Bass | | | |
| L.M. Bass | | | |
| Panfish | | | |
| Trout | | | |

WATER AREA 286.2 ACRES
UNDER 3 FT. 8 %
OVER 20 FT. 67 %
MAX. DEPTH 49 FEET
TOTAL ALK. 72 P.P.M.
VOLUME 7423.3 ACRE FT.
SHORELINE 7.30 MILES
SHORELINE 7.44 miles WITH rip

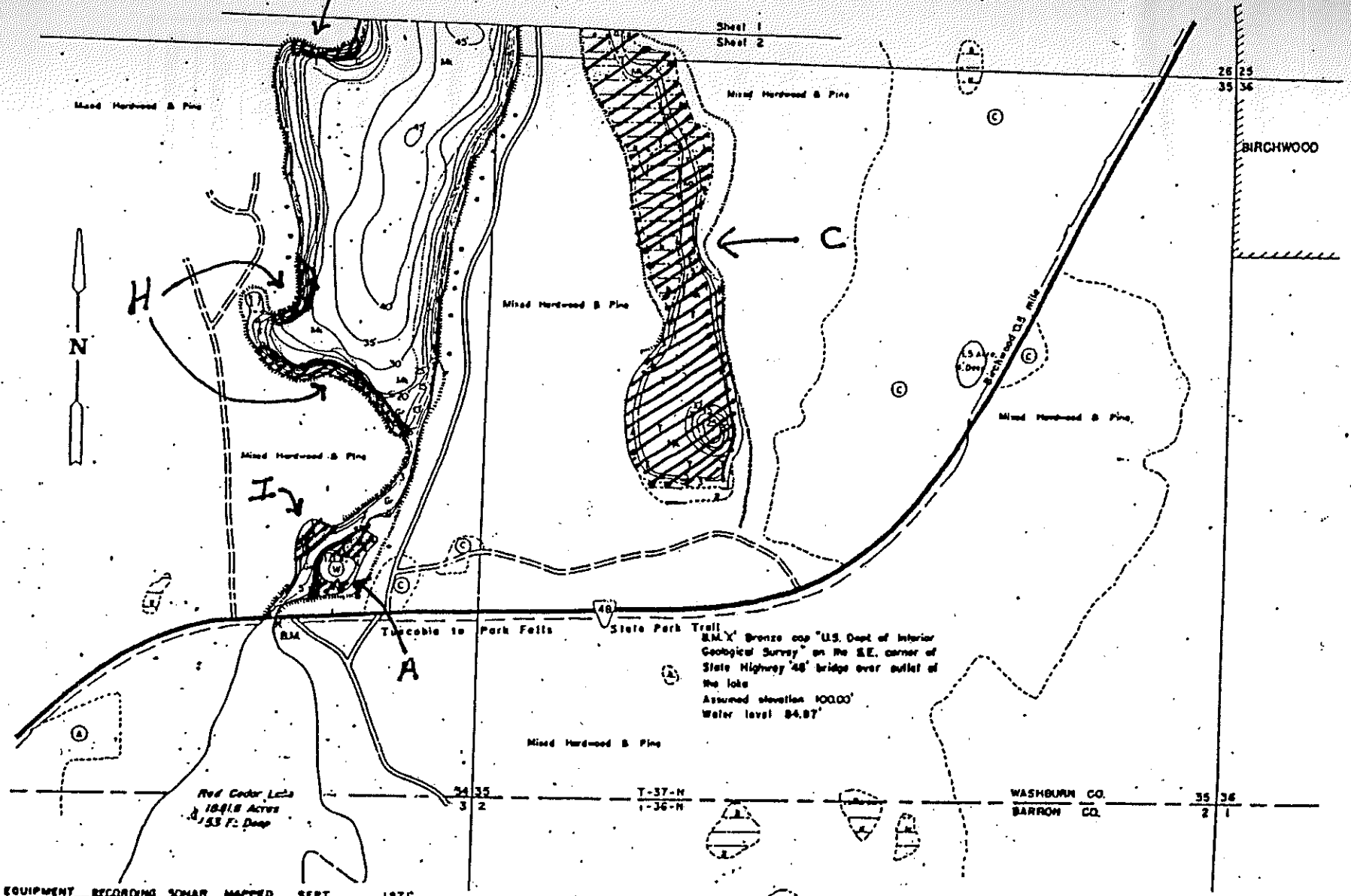
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

BALSAM LAKE — WASHBURN COUNTY

SEC. 26,27,34,35 T. 37 N. R. 10 W.

SHEET 2 OF 2




B.M. 'X' Bronze cap "U.S. Dept of Interior Geological Survey" on the S.E. corner of State Highway '48' bridge over outlet of the lake
Assumed elevation 100.00'
Water level 84.87'

EQUIPMENT RECORDING SONAR MAPPED SEPT 1976
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Brush — Steep slopes
Partially wooded — Intermittent shoreline
Wooded — Marsh
Cleared — Spring
Pastured — Intermittent stream
Agricultural — Permanent inlet
B.M. Bench Mark — Permanent outlet
Dwelling — Dam
Resort — D.N.R. State owned land
Camp

LAKE BOTTOM SYMBOLS

| | | | |
|---|---|---|---|
| P. | Peat | B | Boulders |
| Mk. | Muck | | Stumps & Snags |
| C. | Clay | | Rock dangerous to navigation |
| M. | Marsh | T | Submergent vegetation |
| Sd. | Sand | E | Emergent vegetation |
| St. | Silt | | Floating vegetation |
| Gr. | Gravel | | Brush shelters |
| R. | Rubble | | |
| Bd | Bedrock | | |

500' 0' 500' 1000' 1500' 2000'
SCALE

Access — Access with Parking — Boat Livery

Drawn by: C Hall
Field work by: C Hall, G Lund, J Sather

SPECIES OF FISH

| | Abundance | Size |
|---|---|---|
| Muskie | | |
| N. Pike | R | |
| Walleye | R | |
| L.M. Bass | R | |
| S.M. Bass | | |
| Panfish | R | |
| Trout | | |

WATER AREA 785.2 ACRES
UNDER 5 FT. 8 %
OVER 20 FT. 67 %
MAX. DEPTH 49 FEET
TOTAL ALK. 72 P.P.M.
VOLUME 7423.3 ACRE FT.
SHORELINE 7.30 MILES
SHORELINE 7.44 MILES WITH IS.

## General Lake Wide Recommendations

The following different areas/RECOMMENDATIONS were identified as priorities by the DNR's integrated team of biologists and water regulations and zoning staff for the maintenance and protection of a healthy Balsam Lake ecosystem. To help better understanding the specific management recommendations that should be followed for each of the following areas the reader should refer to the accompanying companion document **"Guidelines for protecting, maintaining, and understanding lake sensitive areas".**

I. Protection and restoration of shoreline buffers. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

II. Protection of existing aquatic plant communities

III. Aggressive erosion control measures for all bare soil areas with an emphasis on all construction and ground breaking. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

IV. Limit the use of fertilizers on lakeshore lawns.

V. Support the aggressive application of existing zoning regulations and support the development of future ones to prevent unnecessary impacts to the ecosystem which could be avoided if future development is accomplished in a wise and careful manner considerate of the resource.

VI. Encourage the retention of large woody debris in near shore areas. Fallen trees provide critical habitat.

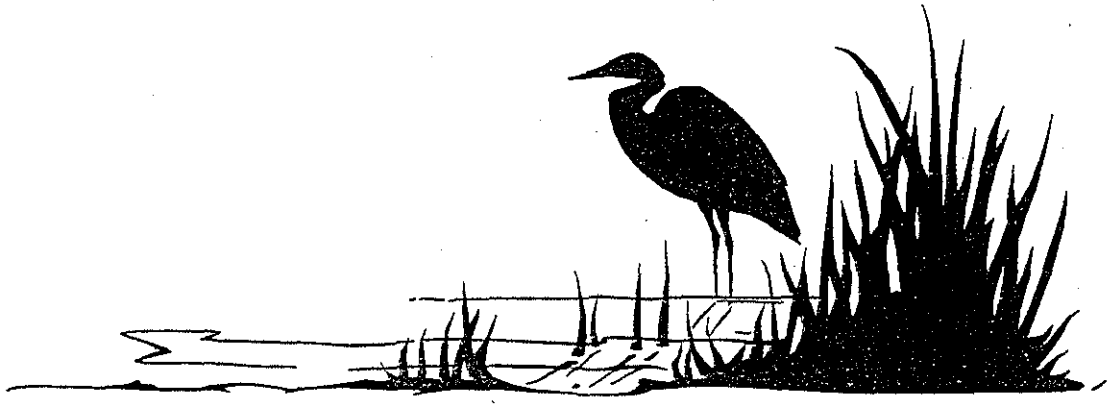
# Balsam Lake Aquatic Plant Species List

| PLANT SPECIES | COMMON NAME |
|---|---|
| Ceratophyllum demersum | Coontail |
| Elodea canadensis | Elodea |
| Lemna trisulca | Forked Duckweed |
| Myriophyllum sp. | Northern Water Milfoil |
| Najas sp. | Slender Naiad |
| Nuphar sp. | Yellow Water Lily |
| Nymphaea sp. | White Water Lily |
| Potamogeton sp. | Narrow Leaf Pondweed |
| Potamogeton amplifolius | Largeleaf Pondweed |
| Potamogeton nodosus | Longleaf Pondweed |
| Potamogeton praelongus | White-stem Pondweed |
| Potamogeton Richardsonii | Claspingleaf Pondweed |
| Potamogeton Robbinsii | Fern Pondweed |
| Potamogeton zosteriformis | Flat-stem Pondweed |
| Sagittaria sp. | Arrowhead |
| Scirpus sp. | Bulrush |
| Sparaganium sp. | Burreed |
| Typha sp. | Cattail |
| Vallisneria americana | Eel Grass |
| Zizania aquatica | Wild Rice |

# Appendix G

Sensitive Areas Report for Red Cedar Lake

# RED CEDAR LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES



**This document is to be used with its companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas"**

# RED CEDAR LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES

James M. Cahow
Water Resources Biologist
DNR, Northern Region, Spooner

Richard R. Cornelius
Fisheries Biologist
DNR, Northern Region, Barron

## CONTENTS

# A BRIEF SUMMARY OF RED CEDAR LAKE, BARRON COUNTY, SENSITIVE AREAS AND MANAGEMENT GUIDELINES

The following is a brief summary of the Red Cedar Lake sensitive area sites and the management guidelines. A detailed description of Red Cedar Lake's sensitive areas can be found in the attached "Integrated Sensitive Area Assessment". Also, the attached "Guidelines For Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines for the sensitive areas. It is hoped that these two attached documents will be used as guidance when dealing with the valuable resource that is Red Cedar Lake.

I. The following sensitive areas contain aquatic plant communities which provide important fish and wildlife habitat: A, B, D, E, F, H, I, J, K, L, Q, T, and V (see map). Management guidelines for these sites are:

1. Limit aquatic vegetation removal to navigation channels no greater than 20 feet wide where necessary. These channels should be mechanically harvested, if possible, but chemical treatment will be allowed in some circumstances.

2. Attempts should be made to control the exotic plant purple loosestrife. Small infestations should be treated by removing the flowers and seedheads and placing them in a garbage bag for disposal, and treating the plant with the herbicide "Rodeo™". Large infestations require introduction of a loosestrife eating beetle.

3. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem.

4. Leave large woody debris, logs, trees, and stumps, in the littoral zone to provide habitat for fish and other aquatic organisms.

5. Leave an adequate shoreline buffer of un-mowed natural vegetative cover.

6. Prevent erosion, especially at construction sites.

7. Strictly enforce zoning ordinances.

8. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.

9. There is an additional guideline specifically for Site F. This largely undeveloped bay should be zoned conservancy and should be considered for acquisition by the lake association or district or by a conservation agency.

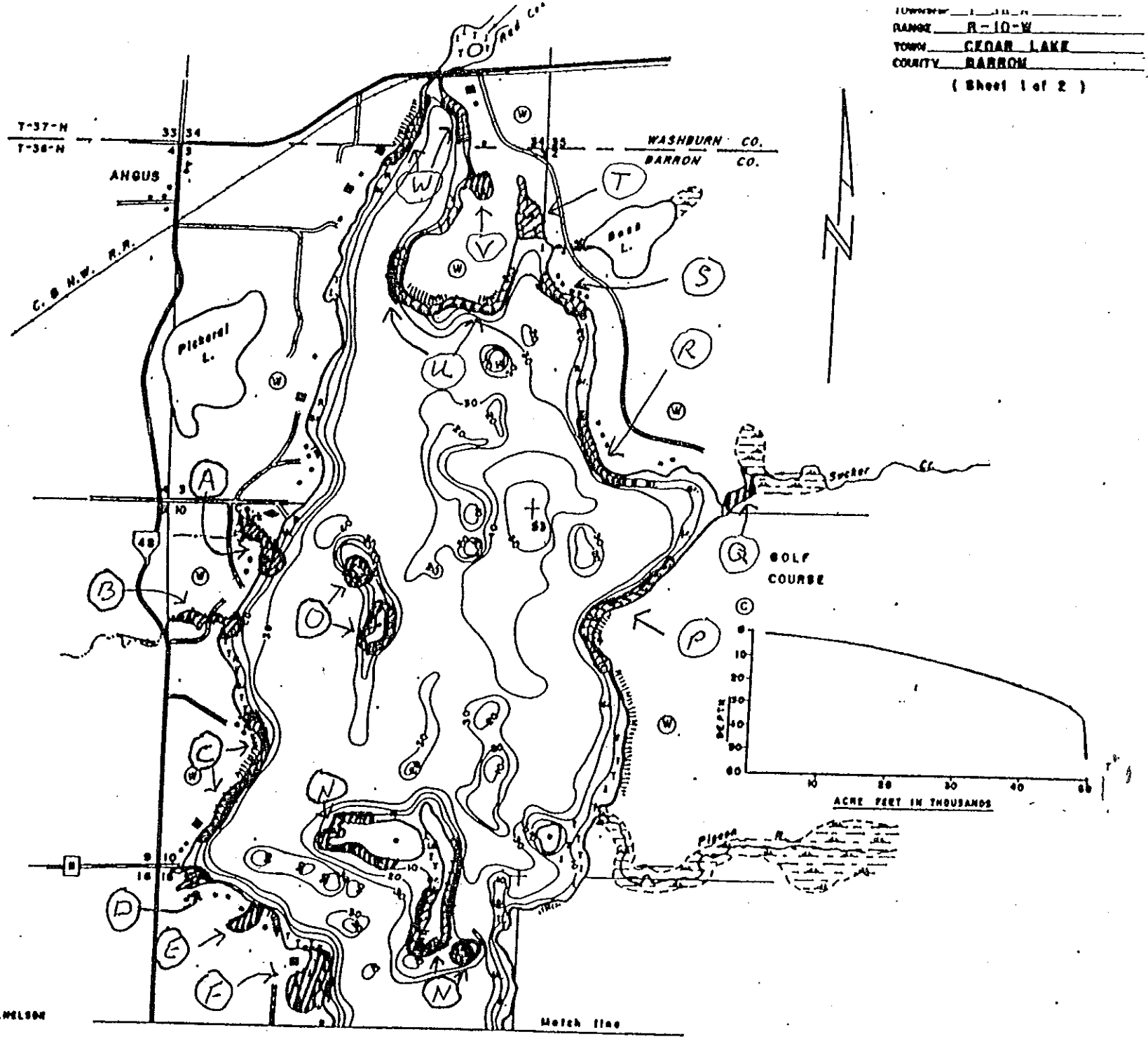
II. The following sensitive areas provide gravel and coarse rock rubble habitat which are important for walleye spawning: C, G, M, N, O, P, R, S, U, and W (see map). The management guidelines for gravel and coarse rock sensitive areas are, with the exception of guideline number 9, basically similar to the guidelines for the aquatic plant community sensitive areas. The emphasis may be somewhat different in that:

1. It is critically important that no alteration of the gravel and coarse rock substrate occur at these sites, unless such alterations would improve walleye spawning. Such alterations are regulated by Chapter 30, Wisconsin Statutes.

2. Erosion control on or near shorelines is especially important adjacent to walleye spawning areas to prevent siltation of spawning habitat.

3. Chemical treatment and mechanical removal of aquatic plants need not be quite as restrictive as in aquatic plant sensitive areas. However, no removal of aquatic plants should be done unless necessary.

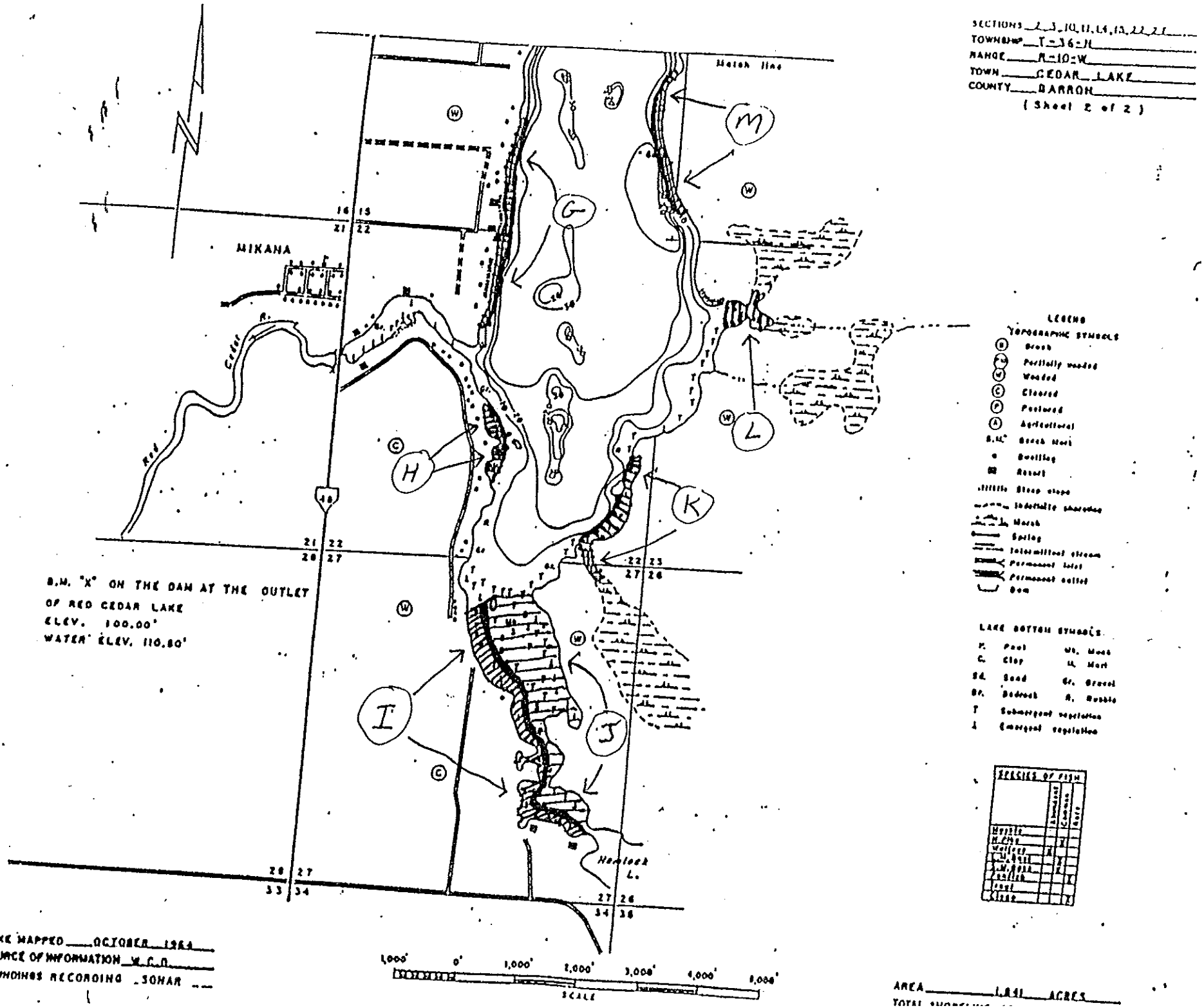
It should be noted that the recommendations made in these sensitive area management guidelines are in general good guidelines for managing the entire lake, but are especially important in the designated sensitive areas.




FIELD WORK BY: R.HOPKE E.NELSON
DRAWN BY: E.EATON
LAKE MAPPED OCTOBER 1964
SOURCE OF INFORMATION W.C.D.

1,000' 0' 1,000' 2,000 3,000 4,000 5,000

AREA 1,861 ACRES


SECTIONS 2, 3, 10, 11, 14, 15, 22, 23
TOWNSHIP T-36-N
RANGE R-10-W
TOWN CEDAR LAKE
COUNTY BARRON
(Sheet 2 of 2)
MIKANA
Cedar R.
Red
B.M. "X" ON THE DAM AT THE OUTLET OF RED CEDAR LAKE
ELEV. 100.00'
WATER ELEV. 110.80'
Hemlock L.
LEGEND
Topographic symbols
Brush
Partially wooded
Wooded
Cleared
Pastured
Agricultural
B.M. Bench Mark
Dwelling
Resort
Steep slope
Intermittent shoreline
Marsh
Spring
Intermittent stream
Permanent inlet
Permanent outlet
Dam
LAKE BOTTOM SYMBOLS
M. Muck
C. Clay
M. Marl
Sd. Sand
Gr. Gravel
Br. Bedrock
R. Rubble
Submergent vegetation
Emergent vegetation
SPECIES OF FISH
Smallmouth
Common
Other
Muskie
N. Pike
Walleye
L. Bass
Perch
Sunfish
Rock
Trout
1,000' 0' 1,000' 2,000' 3,000' 4,000' 5,000'
SCALE
LAKE MAPPED OCTOBER 1964
SOURCE OF INFORMATION W.C.D.
SOUNDINGS RECORDING SONAR
AREA 1,841 ACRES

# LAKE MANAGEMENT

## INTEGRATED SENSITIVE AREA ASSESSMENT SUMMARY

LAKE: Red Cedar Lake COUNTY: Barron

DATE OF SURVEY: 21 August 1997 NUMBER OF SENSITIVE AREAS: 23

SITE EVALUATORS: DNR Fish Manager: Rick Cornelius
DNR Water Resources Manager: Jim Cahow
DNR Wildlife Manager: Kevin Morgan
DNR Water Regulations and Zoning Specialist: Ed Slaminski
DNR Fisheries Technician: Gary Lund

## INTRODUCTION

This sensitive area lake survey is an integrated approach to resource management providing lake associations, individual property owners, zoning officials, boards of adjustment, and other interested groups or individuals with specific management recommendations that can be used to improve and protect the overall health of the Red Cedar Lake ecosystem. Some of these recommendations will provide guidance as to what should be maintained or protected to insure future health of the lake ecosystem, while also acknowledging special and exceptional resource areas. Other recommendations will focus on what should be restored or fixed to insure the different functional attributes of the ecosystem are all properly functioning together to insure full ecosystem health and biotic integrity. Readers of this document should refer to the accompanying companion document "**Guidelines for protecting, maintaining, and understanding lake sensitive areas**" which provides specific recommendations on how to protect the identified sensitive areas, while also helping the reader better understand why they are important to a healthy lake ecosystem.

This sensitive area survey was conducted on Red Cedar Lake, which lies in the northeastern corner of Barron County, about twelve miles northeast of the City of Rice Lake.. Red Cedar Lake, which is 1,841 acres in size, is the middle lake in the Red Cedar Lakes Chain, which also includes 357-acre Hemlock Lake, and 295-acre Balsam Lake. There is navigable water access between the lakes.

The outlet of Red Cedar Lake at the Village of Mikana is the headwaters of the Red Cedar River. A dam with an 11-foot head is located at the outlet. Average summer Secchi disk readings range from 7.1 to 11.9 feet.

Primary gamefish and panfish species are walleye (common), smallmouth bass (common), largemouth bass (common), northern pike (common), muskellunge (rare), bluegills (common), black crappies (common), yellow perch (common), pumpkinseed (present), rock bass (present), cisco (present), and bullheads (common).

Vegetation on much of the shoreline is composed of natural plant cover consisting of all three layers that should be present in any healthy lake shoreline buffer (trees, shrubs, herbaceous ground cover). Efforts should be made to educate residents about the importance of retaining the existing natural plant cover in shoreline areas while encouraging the restoration of those areas that have been previously converted to lot-wide mowed lawns to the water's edge.

Sensitive areas were assigned a letter designation beginning with A and continuing in a counter clockwise direction starting at the Waldo Carlson Park on the northwest side of the lake, (Figure 1). Sensitive areas fell into two basic categories, aquatic plant communities providing important fish and wildlife habitat (sensitive areas: A, B, D, E, F, H, I, J, K, L, Q, T, and V), and gravel and coarse rock rubble (sensitive areas C, G, M, N, O, P, R, S, U, and W).

## Resource Value of Site A

Sensitive area A is located in a small bay on the south side of Waldo Carlson Park. This bay contains a variety of aquatic vegetation which provides spawning, feeding, and nursery habitat for fish. Habitat is also provided for a range of wildlife, including furbearers, waterfowl, reptiles, and amphibians. Vegetation present includes cattail, burreed, arrowhead, eel grass, elodea, coontail, and white and yellow water lilies. A variety of pondweeds, including largeleaf pondweed, clasping leaf pondweed, and flatstem pondweed are present in the bay and a good bed extends out into the lake, providing valuable habitat. Purple loosestrife, an unwanted exotic which crowds out native vegetation, is also present. An effort should be made to eliminate the loosestrife by removing the flowers and seedheads and putting them into a garbage bag for disposal, and treating the loosestrife with the herbicide "Rodeo™". No other vegetation removal should occur except a navigation channel at the public boat landing, if necessary. Readers of this document should refer to the more in-depth companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas" which provides specific recommendations on how to protect the identified sensitive areas, while also helping the reader to better understand why they are important to a healthy lake ecosystem. Recommendations include limiting plant removal, providing shoreline buffer areas and preventing erosion, prohibiting littoral zone alterations such as filling or dredging, leaving logs, stumps, and woody debris in the water, enforcing zoning ordinances, and eliminating nutrient inputs.

## Resource Value of Site B

This is a small bay located where an intermittent inlet enters the lake. Aquatic vegetation which includes yellow water lilies, arrowhead, burreed, cattail, eel grass, and elodea, provides fish and wildlife habitat. As with Site A, a variety of pondweeds extend out into the lake providing beneficial habitat. Several landowners keep boats in this bay. If landowners on the bay also have land fronting the main lake, no dredging or navigation channels should be allowed in the bay to improve boat access for these landowners. However, for landowners whose land fronts only the bay and not the main lake, dredging and vegetation removal for 20-foot wide navigation channels may be allowed. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site C

This site encompasses about 1,800 feet of sand, gravel and coarse rock rubble shoreline which is used by walleyes for spawning. The littoral substrate should not be altered in an way, unless rip-rap is necessary to solve an erosion problem. Shoreline buffers are important on this shoreline, some of which is steep, to prevent erosion. Downed trees should be left in the water. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site D

This site is a small bay which contains cattails, burreed, yellow and white water lilies, and largeleaf pondweed. This bay provides good fish and wildlife habitat, and ducks were observed using the bay. Purple loosestrife is also present, and should be treated as in Site A (flowers and seedheads removed, plants treated with Rodeo™). Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site E

This bay contains cattails, burreed, yellow water lily, elodea, coontail, and several species of pondweeds. However, this bay is also heavily infested with purple loosestrife, which is replacing native vegetation. There is probably too much loosestrife to effectively control with herbicides, but biological control (introduction of insects which feed on loosestrife) may provide some benefit, and biological control will be pursued. Native vegetation should not be removed, as this will enhance the spread of loosestrife.

## Resource Value of Site F

This bay provides high quality fish and wildlife habitat. A variety of aquatic vegetation including largeleaf pondweed, white and yellow water lilies, burreed, arrowhead, clasping leaf pondweed, elodea and coontail are present, providing excellent habitat for furbearers and waterfowl. Northern pike and centrarchid spawning areas are present, and this site is a fish nursery and feeding area. The shoreline is mostly undeveloped, and the wild nature of this bay could be preserved by a conservancy zoning or acquisition by the lake association or a conservation agency. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site G

This site is about 3,000 feet of sand, gravel, rock and rubble shoreline which is used by walleyes for spawning. There should be no alterations of littoral substrate, unless rip-rap is necessary to solve an erosion problem. Some of the shoreline is steep, and maintaining shoreline buffers to prevent erosion is important. In some cases, buffer areas need to be re-established. Logs and large woody debris should not be removed from the water. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site H

Site H consists of several small, shallow bays which contain cattails, water lilies, and eel grass. These shallow bays provide good fish and wildlife habitat. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, when necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site I

Site I comprises the southwest shore of Red Cedar Lake down through the "narrows" to the entrance to Hemlock Lake. This area is shallow and contains a variety of aquatic vegetation, including yellow and

white water lilies, water marigold, largeleaf pondweed, fern pondweed, clasping leaf pondweed, coontail, eel grass, milfoil, and slender naiad. This site has high wildlife value, and also provides good fish habitat, including centrarchid spawning habitat. Logs and woody debris should be left in the water. In 1998, two shoreline property owners received permits to chemically treat a total of 132 feet of shoreline in the sensitive area. These two permits may be "grandfathered" in the future, but all other aquatic vegetation removal should be restricted to navigation channels, preferably mechanically harvested, where necessary. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site J

This site covers the south end of Red Cedar Lake, including the southeast shore, through the "narrows" to the entrance to Hemlock Lake. As with Site I, the shallow south end of Red Cedar Lake provides high quality habitat for wildlife, including waterfowl, furbearers, reptiles, and amphibians. Fish habitat is especially good for largemouth bass, northern pike and panfish, which all use this area of the lake for spawning. Aquatic vegetation is similar to Site I, except that there are scattered areas of purple loosestrife located on several bog islands. The purple loosestrife should be treated as recommended at Site A. Logs and woody debris should be left in the water. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site K

This site contains a variety of aquatic vegetation which provides good fish and wildlife habitat. This site is a likely northern pike spawning area. Cattails, water lilies, largeleaf pondweed, burreed, claspingleaf pondweed, and coontail are present. In 1998, two permits were issued to chemically treat a total of 100 feet of shoreline in the sensitive area. These two permits may be "grandfathered" in the future, but all other aquatic vegetation removal should be restricted to navigation channels, preferably mechanically harvested, where necessary. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value Site L

This site is a moderate-sized bay which contains cattails, water lilies, milfoil, water marigold, elodea, eel grass, coontail, and several species of pondweeds. This bay contains valuable habitat for waterfowl and furbearers. Largemouth bass, northern pike and panfish use the area for spawning and feeding. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site M

This site consists of approximately 2,000 feet of rock, rubble, gravel and sand shoreline which is used by walleyes for spawning. The littoral substrate should not be altered in any way. Fallen logs should be left in the water. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site N

This site consists of about 4,600 feet of rock, rubble, and gravel shoreline used by walleyes for spawning. This shoreline is located on parts of two islands collectively known as Stout Island, and also on a small island off the southeast end of Stout Island. The littoral substrate should not be altered in any way in the sensitive area. Fallen trees should be left in the water. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site O

This site encompasses the entire shoreline (about 1,200 feet) of two small islands located southeast of Waldo Carlson Park. This shoreline consists of rock, rubble, and gravel used by walleyes for spawning. The littoral substrate should not be altered in any way. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site P

This site consists of about 2,000 feet of rock, rubble, and gravel shoreline used by walleyes for spawning. The littoral substrate should not be altered in any way. Part of the shoreline is steep, and providing a good shoreline buffer area to prevent erosion is important. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site Q

This site is a small bay located at the inlet of Sucker Creek. This bay contains a variety of aquatic vegetation which provides good habitat for waterfowl, furbearers, and bass, northern pike, and panfish. Vegetation includes bulrush, cattail, arrowhead, water marigold, elodea, coontail, and largeleaf pondweed. A small amount of purple loosestrife is present and should be treated as recommended at Site A. Other aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site R

This site consists of approximately 1,000 feet of rock, rubble, gravel, and sand shoreline used by walleyes for spawning. The littoral area should not be altered in any way, and logs in the water should not be removed. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site S

This site has about 1,000 feet of rock, rubble, gravel, and sand shoreline used by walleyes for spawning. Recommendations are the same as at Site R.

## Resource Value of Site T

This site is a bay on the northeast end of the lake. This bay contains burreed, arrowhead, eel grass, yellow water lilies, water marigold, elodea, coontail, and a variety of pondweeds. The bay provides valuable fish and wildlife habitat. A small amount of purple loosestrife is present, and should be treated as in Site A. Other aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site U

This site is a large point on the north end of the lake which has about 2,100 feet of rock, rubble, gravel and sand shoreline which is used by walleyes for spawning. The littoral substrate should not be altered in any way. Some of the shoreline is steep, and providing an adequate shoreline buffer to prevent erosion is important. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document

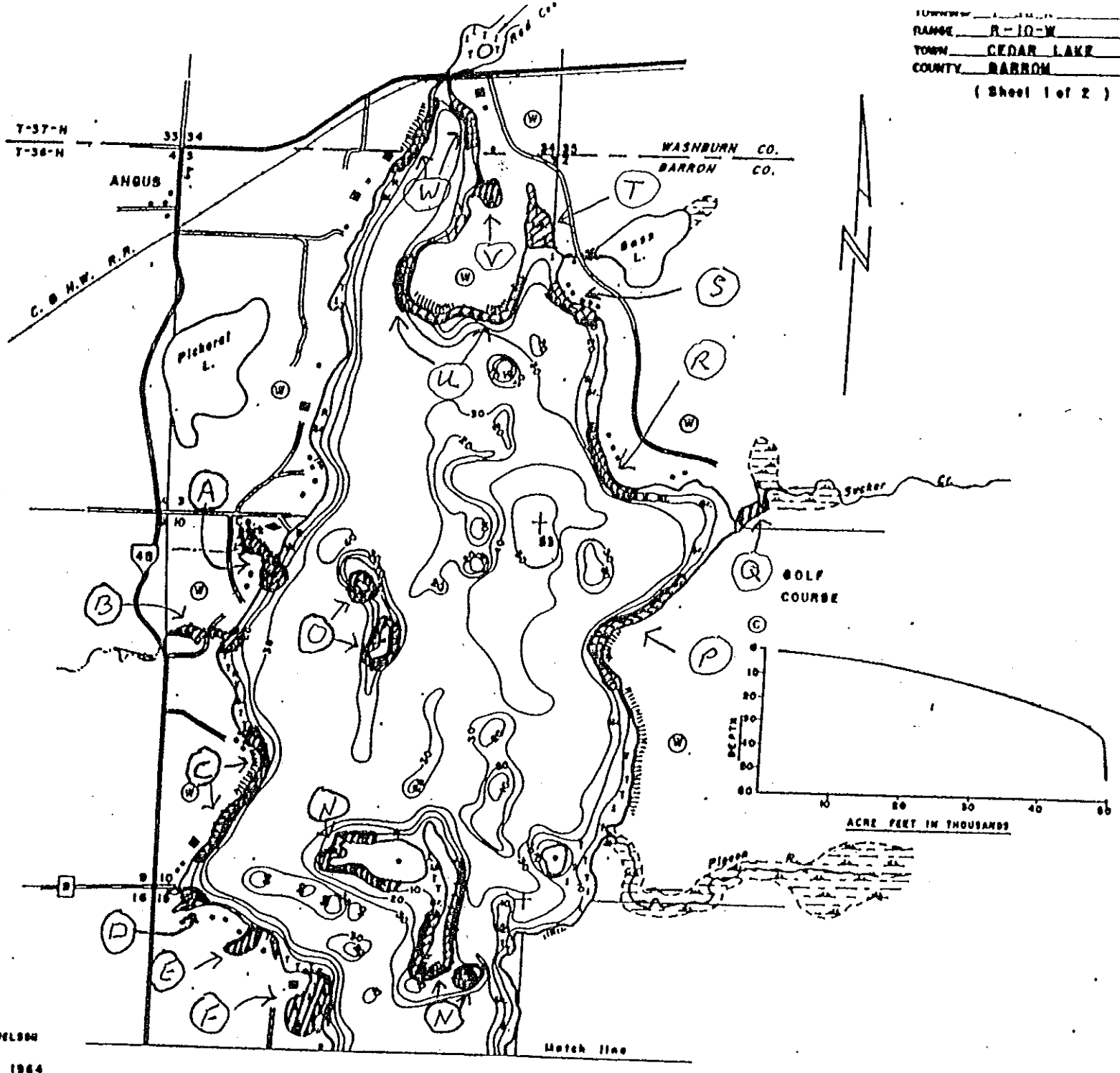
## Resource Value of Site V

This is a small bay which contains valuable fish and wildlife habitat. This bay is a likely spawning area for bass, northern pike, and panfish. Ducks and an eagle were observed using the area. Aquatic vegetation present includes burreed, arrowhead, yellow water lilies, eel grass, elodea, milfoil, sender naiad, and a variety of pondweeds. A small amount of purple loosestrife is present which should be treated as recommended in Site A. Other aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, if necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site W

This site is located on the east and west shorelines of the far north end of the lake just south of the channel to Balsam Lake. About 1,800 feet of gravel, rock, and rubble shoreline used by walleyes for spawning make up this site. Littoral substrate should not be altered in any way, and logs and woody debris should be left in the water. Management efforts to protect the rock rubble walleye spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

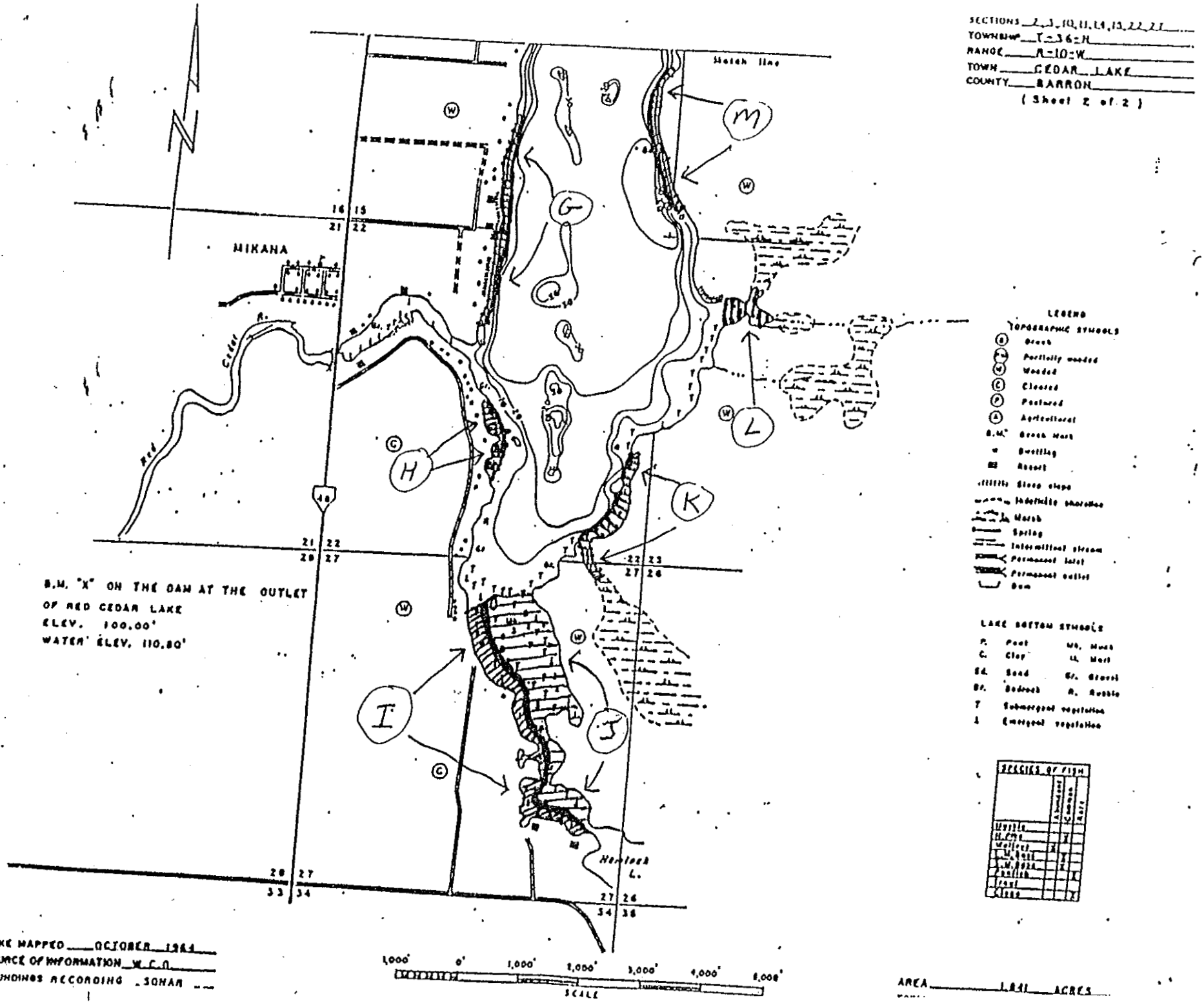
RANGE R-10-W
TOWN CEDAR LAKE
COUNTY BARRON
( Sheet 1 of 2 )




FIELD WORK BY: R.HOPKE E.NELSON
DRAWN BY: R.EATON
LAKE MAPPED OCTOBER 1964
SOURCE OF INFORMATION W.C.D.

1,000' 0' 1,000' 2,000 3,000 4,000 5,000

AREA 1,861 ACRES


SECTIONS 2, 3, 10, 11, 14, 15, 22, 23
TOWNSHIP T-36-N
RANGE R-10-W
TOWN CEDAR LAKE
COUNTY BARRON
( Sheet 2 of 2 )
Match line
MIKANA
Red Cedar R.
B.M. "X" ON THE DAM AT THE OUTLET OF RED CEDAR LAKE
ELEV. 100.00'
WATER ELEV. 110.80'
Hemlock L.
LEGEND
TOPOGRAPHIC SYMBOLS
Brush
Partially wooded
Wooded
Cleared
Pastured
Agricultural
B.M. Bench Mark
Dwelling
Resort
Steep slope
Intermittent shoreline
Marsh
Spring
Intermittent stream
Permanent inlet
Permanent outlet
Dam
LAKE BOTTOM SYMBOLS
P. Peat
C. Clay
Sd. Sand
Br. Bedrock
Mk. Muck
M. Marl
Gr. Gravel
R. Rubble
T Submerged vegetation
E Emergent vegetation
SPECIES OF FISH
Abundant
Common
Scarce
LAKE MAPPED OCTOBER 1964
SOURCE OF INFORMATION W.C.D.
SOUNDINGS RECORDING SONAR
1,000' 0' 1,000' 2,000' 3,000' 4,000' 5,000'
SCALE
AREA 1,841 ACRES

## General Lake Wide Recommendations

The following different areas/RECOMMENDATIONS were identified as priorities by the DNR's integrated team of biologists and water regulations and zoning staff for the maintenance and protection of a healthy Red Cedar Lake ecosystem. To help better understanding the specific management recommendations that should be followed for each of the following areas the reader should refer to the accompanying companion document **"Guidelines for protecting, maintaining, and understanding lake sensitive areas".**

I. Protection and restoration of shoreline buffers. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

II. Protection of existing aquatic plant communities

III. Aggressive erosion control measures for all bare soil areas with an emphasis on all construction and ground breaking. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

IV. Limit the use of fertilizers on lakeshore lawns.

V. Support the aggressive application of existing zoning regulations and support the development of future ones to prevent unnecessary impacts to the ecosystem which could be avoided if future development is accomplished in a wise and careful manner considerate of the resource.

VI. Encourage the retention of large woody debris in near shore areas. Fallen trees provide critical habitat.

VII. Develop an aggressive education program by local lake association to promote the above mentioned guidelines.

VIII. Implement land acquisition or easements to protect critical areas from any possible future development.

# Red Cedar Lake Aquatic Plant Species List

| PLANT SPECIES | COMMON NAME |
|---|---|
| Calla palustris | Wild Calla |
| Ceratophyllum demersum | Coontail |
| Chara vulgaris | Musk Grass |
| Elodea canadensis | Elodea |
| Lemna trisulca | Forked Duckweed |
| Lythrum salicaria | Purple Loosestrife |
| Megalodonta beckii | Water Marigold |
| Myriophyllum sp. | Northern Water Milfoil |
| Najas sp. | Slender Naiad |
| Nuphar sp. | Yellow Water Lily |
| Nymphaea sp. | White Water Lily |
| Potamogeton sp. | Narrow Leaf Pondweed |
| Potamogeton amplifolius | Largeleaf Pondweed |
| Potamogeton gramineus | Variable Pondweed |
| Potamogeton illinoensis | Illinois Pondweed |
| Potamogeton praelongus | White-stem Pondweed |
| Potamogeton Richardsonii | Claspingleaf Pondweed |
| Potamogeton Robbinsii | Fern Pondweed |
| Potamogeton zosteriformis | Flat-stem Pondweed |
| Sagittaria sp. | Arrowhead |
| Scirpus americanus | Three-square Rush |
| Sparaganium sp. | Burreed |
| Typha angustifolia | Cattail |
| Vallisneria americana | Eel Grass |

# Appendix H

Sensitive Areas Report for Hemlock Lake

# HEMLOCK LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES

James M. Cahow
Water Resources Biologist
DNR, Northern Region, Spooner

Richard R. Cornelius
Fisheries Biologist
DNR, Northern Region, Barron

## CONTENTS

# A BRIEF SUMMARY OF HEMLOCK LAKE, BARRON COUNTY, SENSITIVE AREAS AND MANAGEMENT GUIDELINES

The following is a brief summary of the Hemlock Lake sensitive area sites and the management guidelines. A detailed description of Hemlock Lake's sensitive areas can be found in the attached "Integrated Sensitive Area Assessment". Also, the attached "Guidelines for Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines for the sensitive areas. It is hoped that these two attached documents will be used as guidance when dealing with the valuable resource that is Hemlock Lake.

I. The following sensitive areas contain aquatic plant communities which provide important fish and wildlife habitat: A, B, C, D, E, F, G, H, J, L, and I (see map). Management guidelines for these sites are:

1. Limit aquatic vegetation removal to navigation channels no greater than 20 feet wide where necessary. These channels should be mechanically harvested, if possible, but chemical treatment will be allowed in some circumstances.

2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem.

3. Leave large woody debris, logs, trees, and stumps in the littoral zone to provide habitat for fish and other aquatic organisms.

4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover.

5. Prevent erosion, especially at construction sites.

6. Strictly enforce zoning ordinances.

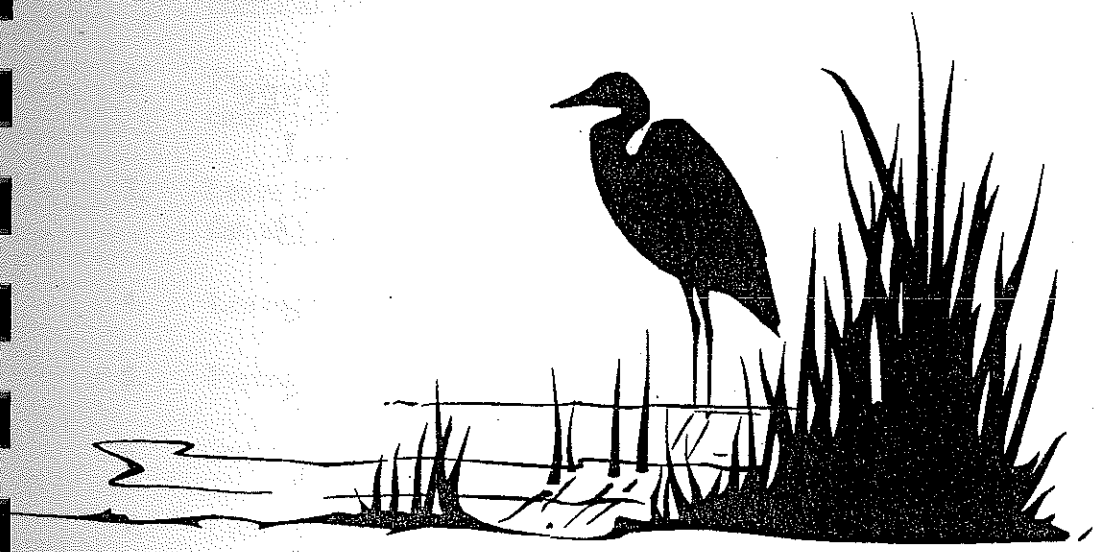
7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.

8. There is an additional guideline specifically for Site H. This undeveloped bay is a valuable and unique resource. The land surrounding the bay should be zoned conservancy and should be considered for acquisition by the Lake Association or district or by a conservation agency.

II. The following sensitive areas provide gravel and coarse rock rubble habitat which are important for walleye spawning K, (see map). The management guidelines for gravel and coarse rock sensitive areas are, with the exception of guideline number 8, basically similar to the guidelines for the aquatic plant community sensitive areas. The emphasis may be somewhat different in that:

1. It is <u>critically</u> important that no alteration of the gravel and coarse rock substrate occur at these sites, unless such alterations would improve walleye spawning. Such alterations are regulated by Chapter 30, Wisconsin Statutes.

# HEMLOCK LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES



**This document is to be used with its companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas"**

2. Erosion control on or near shorelines is especially important adjacent to walleye spawning areas to prevent siltation of spawning habitat.

3. Chemical treatment and mechanical removal of aquatic plants need not be quite as restrictive as in aquatic plant sensitive areas. However, no removal of aquatic plants should be done unless necessary.

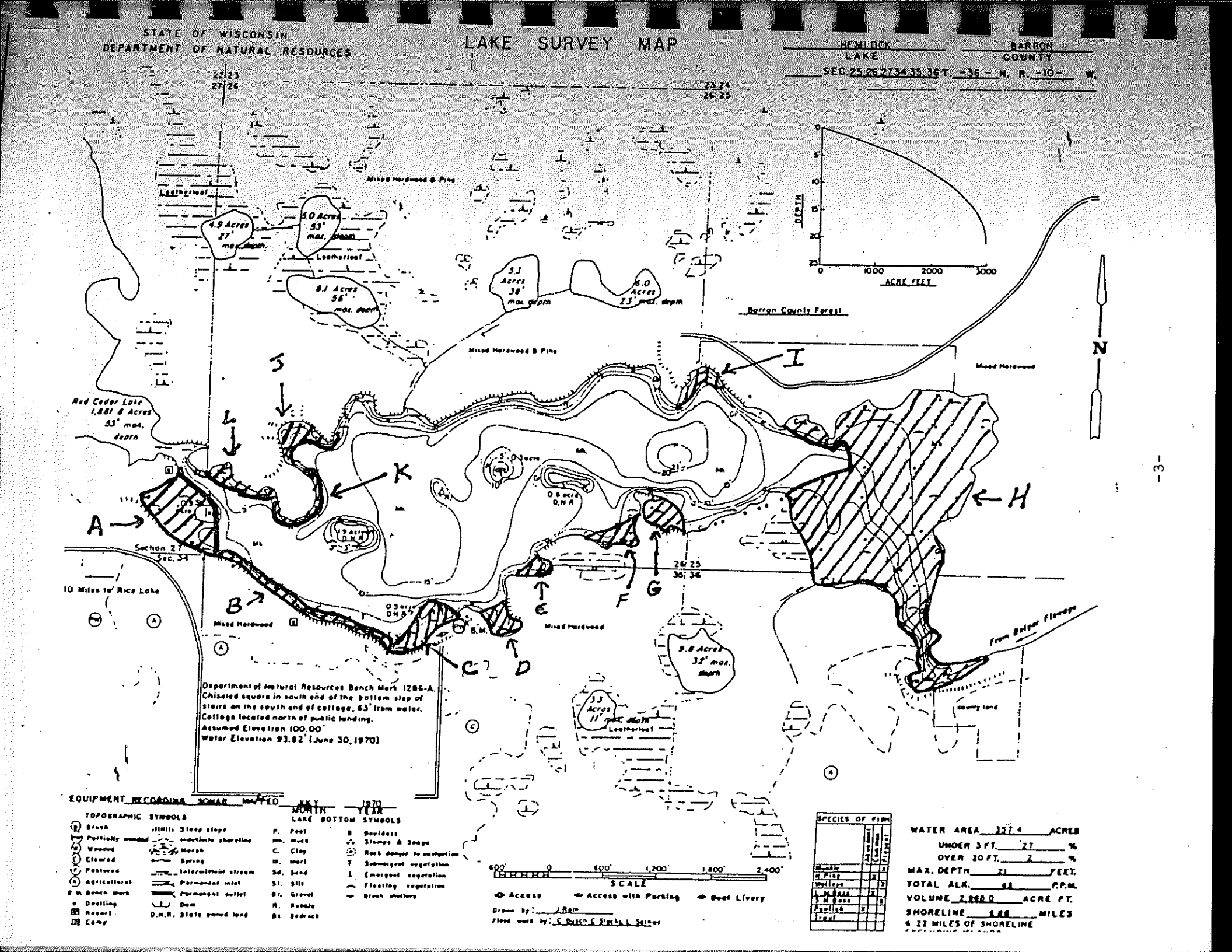
It should be noted that the recommendations made in these sensitive area management guidelines are in general good guidelines for managing the entire lake, but are especially important in the designated sensitive areas.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

HEMLOCK LAKE — BARRON COUNTY

SEC. 25,26,27,34,35,36 T. -36- N. R. -10- W.




Department of Natural Resources Bench Mark 1286-A.
Chiseled square in south end of the bottom step of stairs on the south end of cottage, 63' from water. Cottage located north of public landing.
Assumed Elevation 100.00'
Water Elevation 93.82' (June 30, 1970)

EQUIPMENT RECORDING SONAR MAPPED MAY 1970
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Brush; Partially wooded; Wooded; Cleared; Pastured; Agricultural; B.M. Bench Mark; Dwelling; Resort; Camp
Steep slope; Indefinite shoreline; Marsh; Spring; Intermittent stream; Permanent inlet; Permanent outlet; Dam; D.N.R. State owned land

LAKE BOTTOM SYMBOLS

P. Peat; Mk. Muck; C. Clay; M. Marl; Sd. Sand; Si. Silt; Gr. Gravel; R. Rubble; Rk. Bedrock
B Boulders; Stumps & Snags; Rock danger to navigation; Submergent vegetation; Emergent vegetation; Floating vegetation; Brush shelters

600' 0 600' 1,200' 1,800' 2,400'
SCALE

Access; Access with Parking; Boat Livery

Drawn by: J.Barr
Field work by: S.Bolch & S.Barr, J.Skinner

| SPECIES OF FISH | | | |
|---|---|---|---|
| | Abundant | Common | Present |
| N. Pike | X | | |
| Walleye | | | X |
| L.M. Bass | X | | |
| S.M. Bass | | | X |
| Panfish | X | | |
| Trout | | | |

WATER AREA 327.4 ACRES
UNDER 5 FT. 27 %
OVER 20 FT. 2 %
MAX. DEPTH 27 FEET.
TOTAL ALK. 48 P.P.M.
VOLUME 2,950.0 ACRE FT.
SHORELINE 6.88 MILES
6.22 MILES OF SHORELINE

# LAKE MANAGEMENT

## INTEGRATED SENSITIVE AREA ASSESSMENT SUMMARY

LAKE: Hemlock Lake COUNTY: Barron

DATE OF SURVEY: 28 August 1997 NUMBER OF SENSITIVE AREAS: 12

SITE EVALUATORS: DNR Fish Manager: Rick Cornelius
DNR Water Resources Manager: Jim Cahow
DNR Wildlife Manager: Kevin Morgan
DNR Water Regulations and Zoning Specialist: Ed Slaminski
DNR Fisheries Technician: Gary Lund

**Introduction**

This sensitive area lake survey is an integrated approach to resource management providing lake associations, individual property owners, zoning officials, boards of adjustment, and other interested groups or individuals with specific management recommendations that can be used to improve and protect the overall health of the Hemlock Lake ecosystem. Some of these recommendations will provide guidance as to what should be maintained or protected to insure future health of the lake ecosystem, while also acknowledging special and exceptional resource areas; other recommendations will focus on what should be restored or fixed to insure the different functional attributes of the ecosystem are all properly functioning together to insure full ecosystem health and biotic integrity. Readers of this document should refer to the accompanying companion document "**Guidelines for protecting, maintaining, and understanding lake sensitive areas**" which provides specific recommendations on how to protect the identified sensitive areas, while also helping the reader better understand why they are important to a healthy lake ecosystem.

This sensitive area survey was conducted on Hemlock Lake, which lies in the northeast corner of Barron County, about eleven miles northeast of the City of Rice Lake.. Hemlock Lake, which is 357 acres in size, is the southernmost lake in the Red Cedar Lakes Chain, which also includes 1,841-acre Red Cedar Lake, and 295-acre Balsam Lake. There is navigable water access between the lakes.

The water of Hemlock Lake is fairly fertile, with an MPA of 45 ppm, and moderate summer algae blooms are common. Average summer Secchi disk readings range from 4.5 to 7.0 feet.

Primary gamefish and panfish species are largemouth bass (common), northern pike (common, smallmouth bass (present), walleye (present), muskellunge (rare), bluegills (common), black crappies (common), yellow perch (common), pumpkinseed (present), rock bass (present), and bullheads (common).

Vegetation on much of the shoreline is composed of natural plant cover consisting of all three layers that should be present in any healthy lake shoreline buffer (trees, shrubs, herbaceous ground cover). Efforts should be made to educate residents about the importance of retaining the existing natural plant cover in shoreline areas while encouraging the restoration of those areas that have been previously converted to lot-wide mowed lawns to the water's edge.

Sensitive areas were assigned a letter designation beginning with A and continuing in a counter clockwise direction starting at the channel to Red Cedar Lake (Figure 1). Sensitive areas fell into two basic categories, aquatic plant communities providing important fish and wildlife habitat (sensitive areas: A, B, C, D, E, F, G, H, J, L, and I), and gravel and coarse rock rubble (sensitive area K) which provide important walleye spawning habitat.

## Resource Value of Site A

Sensitive area A (Figure 1) is a moderate-sized bay on the west end of the lake. This bay contains an extensive bed of white and yellow water lilies, as well as containing a variety of pondweeds including largeleaf pondweed and fern pondweed, as well as coontail, northern water milfoil, and eel grass. This bay contains valuable fish habitat as well as centrarchid and esocid spawning areas. Wildlife habitat is common for waterfowl, furbearers, reptiles, and amphibians. In 1997, five property owners used herbicides to create navigation channels in this bay. These limited treatments may continue, but any additional navigation channels should be minimized as much as possible. Mechanical harvesting is preferable to herbicide treatment. Readers of this document should refer to the more in-depth companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas" which provides specific recommendations on how to protect the identified sensitive areas, while also helping the reader to better understand why they are important to a healthy lake ecosystem. Recommendations include limiting plant removal, providing shoreline buffer areas and preventing erosion, prohibiting littoral zone alterations such as filling or dredging, leaving logs, stumps, and woody debris in the water, enforcing zoning ordinances, and eliminating nutrient inputs.

## Resource Value of Site B

Approximately 2,000 feet of shore on the southwest side of the lake that contains a mix of aquatic vegetation, which includes coontail, northern water milfoil, eel grass, fern pondweed, and white & yellow water lilies. This site provides good fish and wildlife habitat. The lakeshore is fairly steeply sloped and providing a shoreline buffer strip and preventing erosion are important. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site C

A 600-foot area by the public access that contains numerous stumps. There are about two acres of water lily present, and other vegetation includes largeleaf pondweed, flatstem pondweed, fern pondweed, northern water milfoil, coontail and eel grass. Good fish and wildlife habitat is provided. Stumps and logs provide cover for fish and are resting areas for turtles, frogs, waterfowl and furbearers. Stumps and logs should not be removed, and any vegetation removal should be limited to navigation channels, preferably mechanically harvested. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site D

This bay has about one acre of water lilies, as well as stumps and woody debris, which provide cover for fish. Other aquatic vegetation includes coontail, milfoil, a variety of pondweeds and eel grass. The lakeshore is steeply sloped, so leaving a vegetated buffer strip and preventing erosion are especially important. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically

harvested, and stumps and woody debris should not be removed. Other management efforts to protect the aquatic community in this area should not follow the general recommendations found in the accompanying companion document.

## Resource Value of Site E

A small bay which contains about 0.7 acre of water lily and other vegetation, including pondweeds. Stumps and deadfalls are present which provide fish cover. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, and stumps and woody debris should not be removed. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site F

This bay contains about two acres of water lilies. Other aquatic vegetation includes burreed, cattails, and largeleaf pondweed. Stumps and logs are present. This site contains good fish and wildlife habitat, possible centrarchid and esocid spawning areas. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, and stumps and logs should not be removed. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site G

This bay contains about three acres of water lilies, as well as northern water milfoil, eel grass, coontail, and a variety of pondweeds. Stumps and fallen logs are present. As with other similar sites, aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, and stumps and logs should not be removed. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site H

This site encompasses approximately the east 25% of Hemlock Lake, which is essentially a large, shallow bay where Hemlock Creek enters the lake. This site has a large area of white and yellow water lilies, and other aquatic plants include largeleaf pondweed, water marigold, fern pondweed, coontail, bladderwort, and burreed. This largely undeveloped area has high wildlife values for furbearers, waterfowl, amphibians and reptiles. It is a feeding and nursery area for fish, and contains centrarchid and esocid spawning habitat. It is likely an important spawning area for northern pike. Shoreline development is light and the undeveloped shoreline should be protected from development by being zoned conservancy or acquired by a lake association or district or by a conservation agency. Purchasing a conservation easement which restricts development is another option. Aquatic vegetation removal should be limited to navigation channels in developed areas, preferably mechanically harvested, and stumps and logs should not be removed. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site I

This site contains a narrow band of water lilies, which, along with pondweeds and milfoil, provides a feeding and nursery area for fish. Centrarchid spawning habitat is present. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, where necessary. Other

management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site J

This bay contains a band of water lilies along the shoreline, and other aquatic vegetation including pondweeds and northern water milfoil are present. Logs in the water also provide fish habitat, and should not be removed. In 1997, one landowner had a permit to chemically treat the aquatic vegetation in front of his property. This treatment can be continued in future years, but the treatment should be no more than 50 feet of shoreline. Other aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested. Other management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value of Site K

This point of land on the northwest side of the lake is a gravel and coarse substrate area used by walleyes for spawning. It is important that the littoral zone substrate is not altered in any way. Management efforts to protect the rock rubble spawning habitat in this area should follow the general recommendations found in the accompanying companion document.

## Resource Value Site L

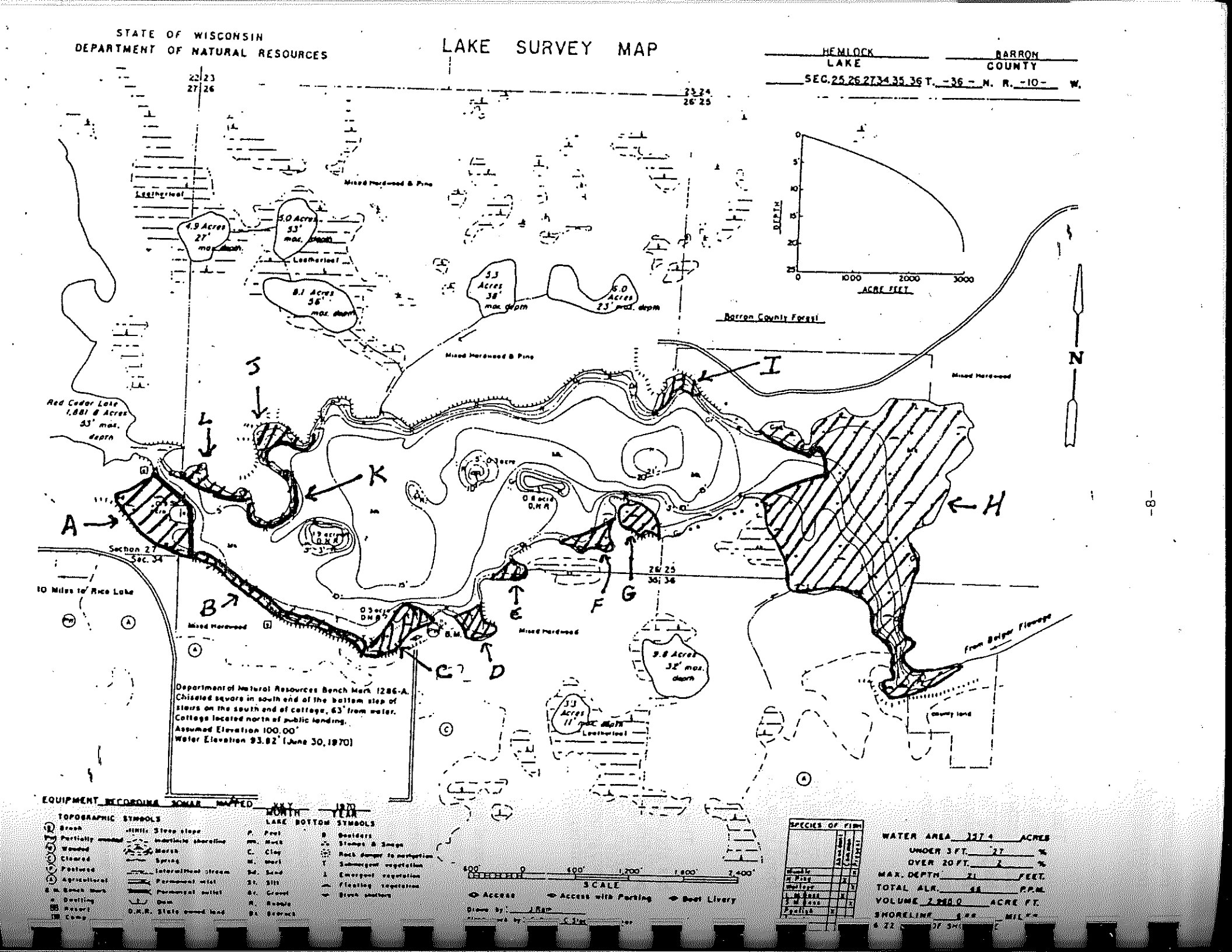
This site consists of about 1,200 feet of shore that leads to the channel to Red Cedar Lake. This site has about three acres of water lilies, as well as other aquatic vegetation including largeleaf pondweed, providing good fish and wildlife habitat. Stumps and logs are present and should not be removed. Aquatic vegetation removal should be limited to navigation channels, preferably mechanically harvested, if necessary. Management efforts to protect the aquatic plant community in this area should follow the general recommendations found in the accompanying companion document.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

# LAKE SURVEY MAP

HEMLOCK LAKE — BARRON COUNTY

SEC. 25 26 27 34 35 36 T. -36- N. R. -10- W.




Department of Natural Resources Bench Mark 1286-A.
Chiseled square in south end of the bottom step of stairs on the south end of cottage, 63' from water.
Cottage located north of public landing.
Assumed Elevation 100.00'
Water Elevation 93.82' (June 30, 1970)

EQUIPMENT RECORDING SONAR MAPPED MAY 1970
MONTH YEAR

TOPOGRAPHIC SYMBOLS

Beach; Partially wooded; Wooded; Cleared; Pastured; Agricultural; B.M. Bench Mark; Dwelling; Resort; Camp
Steep slope; Moderate slope; Marsh; Spring; Intermittent stream; Permanent inlet; Permanent outlet; Dam; D.N.R. State owned land

LAKE BOTTOM SYMBOLS

P. Peat; Mk. Muck; C. Clay; M. Marl; Sd. Sand; St. Silt; Gr. Gravel; R. Rocks; Br. Brush
B Boulders; Stumps & Snags; Rock dumped for navigation; T Submergent vegetation; E Emergent vegetation; Floating vegetation; Brush markers

SCALE
600' 0 600' 1,200' 1,800' 2,400'

Access; Access with Parking; Boat Livery

Drawn by: J.R.H.
Traced by: C.S.H.

SPECIES OF FISH

| | Abundant | Common | Present |
|---|---|---|---|
| Muskie | | | |
| N. Pike | | X | |
| Walleye | | | X |
| S. M. Bass | | X | |
| L. M. Bass | | | X |
| Panfish | X | | |

WATER AREA 137.4 ACRES
UNDER 3 FT. 27 %
OVER 20 FT. 2 %
MAX. DEPTH 21 FEET
TOTAL ALK. 48 P.P.M.
VOLUME 2,260.0 ACRE FT.
SHORELINE 8.8 MILES
0.22 OF SHORELINE

## General Lake Wide Recommendations

The following different areas/RECOMMENDATIONS were identified as priorities by the Department of Natural Resources' integrated team of biologists and water regulations and zoning staff for the maintenance and protection of a healthy Hemlock Lake ecosystem. To help better understanding the specific management recommendations, which should be followed for each of the following areas, the reader should refer to the accompanying companion document **"Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas".**

I. Protection and restoration of shoreline buffers. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

II. Protection of existing aquatic plant communities.

III. Aggressive erosion control measures for all bare soil areas with an emphasis on all construction and ground breaking. This provides protection for water quality, aquatic plant communities, and coarse rock rubble walleye spawning habitat.

IV. Limit the use of fertilizers on lakeshore lawns.

V. Support the aggressive application of existing zoning regulations and support the development of future ones to prevent unnecessary impacts to the ecosystem, which could be avoided if future development is accomplished in a wise and careful manner considerate of the resource.

VI. Encourage the retention of large woody debris in near shore areas. Fall trees provide critical habitat.

VII. Develop an aggressive education program by the local lake association to promote the above mentioned guidelines.

VIII. Implement land acquisition or easements to protect critical areas from any possible future development.

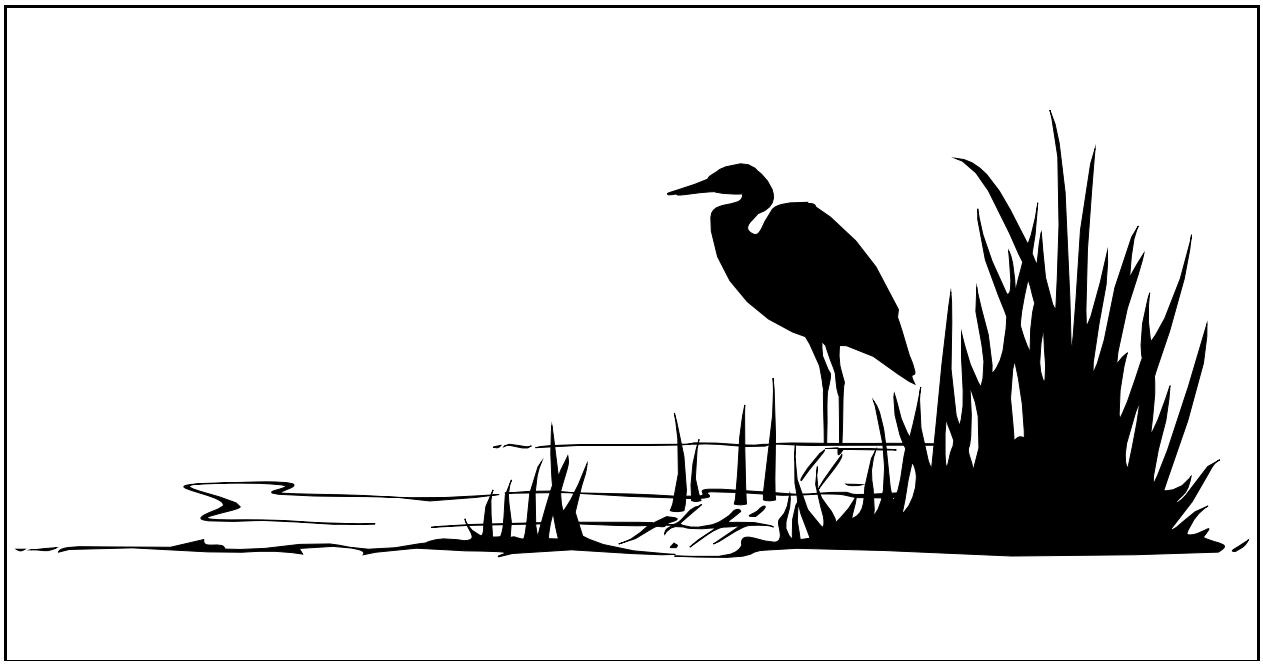
# Hemlock Lake Aquatic Plant Species List

| PLANT SPECIES | COMMON NAME |
|---|---|
| Ceratophyllum demersum | Coontail |
| Lemna trisulca | Forked Duckweed |
| Megalodonta beckii | Water Marigold |
| Myriophyllum sp. | Northern Water Milfoil |
| Najas sp. | Slender Naiad |
| Nuphar sp. | Yellow Water Lily |
| Nymphaea sp. | White Water Lily |
| Potamogeton sp. | Narrow Leaf Pondweed |
| Potamogeton amplifolius | Largeleaf Pondweed |
| Potamogeton praelongus | White-stem Pondweed |
| Potamogeton richardsonii | Claspingleaf Pondweed |
| Potamogeton Robbinsii | Fern Pondweed |
| Potamogeton zosteriformis | Flat-stem Pondweed |
| Sagittaria sp. | Arrowhead |
| Sparganium sp. | Burreed |
| Utricularia vulgaris | Bladderwort |
| Vallisneria americana | Eel Grass |

# Appendix I

Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas

# GUIDELINES FOR PROTECTING, MAINTAINING, AND UNDERSTANDING LAKE SENSITIVE AREAS AND CRITICAL HABITAT



**A companion document to help understand lake sensitive area and critical habitat reports**

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# GUIDELINES FOR PROTECTING, MAINTAINING, AND UNDERSTANDING LAKE SENSITIVE AREAS AND CRITICAL HABITAT

**A companion document to help understand lake sensitive area and critical habitat reports**

**James M. Cahow**
**Water Resources Biologist**
**DNR, Northern Region, Barron**

**Richard R. Cornelius**
**Fisheries Biologist**
**DNR, Northern Region, Barron**

## TABLE OF CONTENTS

## INTRODUCTION TO PROTECTING, MAINTAINING, AND UNDERSTANDING LAKE SENSTIVE AREAS AND CRITICAL HABITAT AREAS

This document was originally designed to be used in conjunction with specific lake sensitive area survey reports; **but it can also be useful to other parties interested in protecting lakes by helping them understand important factors which affect water quality and lake ecosystem health**. This document will concentrate on several main areas within the lake and its' shoreline areas that can be protected or restored to maintain water quality and lake ecosystem health. These main areas include aquatic plant sensitive areas, shoreline land use and lakeshore buffers, gravel and coarse rock rubble habitat, large woody debris, and various water regulations and zoning concerns.

This document will not attempt to deal with land use problems that do not fall within the immediate shoreline areas; although it should be recognized that lakes may have problems that occur in these outlying areas of their watershed resulting in significant nutrient and sediments additions that threaten the overall health of the lake ecosystem and should be dealt with through land acquisition and subsequent deed restrictions and implementation of non-point source control best management practices.

## UNDERSTANDING AQUATIC PLANT SENSITIVE AREAS

The importance of aquatic plant communities is frequently underappreciated and their importance to a lake's ecosystem health misunderstood. This is often evident by the way people refer to aquatic plant habitat as problem weeds or weed beds. A weed by definition is a plant that is out of place or a plant of no value. The vast majority of native aquatic plants grow where they should be growing based on available light (water clarity & light penetration), water depth, and bottom substrate or soils and are not out of place and as previously stated are extremely important for the proper functioning of a healthy lake ecosystem and are an integral part of the biotic integrity.

Aquatic plants (macrophytes & algae) are the primary energy source upon which the rest of the lakes food chain is based and dependent upon. Fisheries are dependent upon them for cover, spawning habitat, important habitat and cover for fingerlings and young of the year, critical habitat for aquatic insects and other important food or forage species (minnows). They also serve an important function in reducing the shoreline erosion associated with

wave action while stabilizing sediments in place, and aquatic plants lock up available phosphorus which would otherwise be available to drive undesirable algae blooms.

Aquatic plants also provide many important functional values for wildlife: Loons require aquatic vegetation for their nests, and waterfowl and furbearers require aquatic vegetation for food and cover. Songbirds, shoreline water-birds, frogs and other amphibians, reptiles, and a host of other wildlife require aquatic vegetation for some critical need throughout different life cycles.

**Use of Aquatic Herbicides**

Because the potential ecological risks associated with aquatic herbicide applications are so high, most aquatic herbicide applications must be approved through the DNR permitting system and the application must be completed by a DATCP certified aquatic herbicide applicator. Those herbicides that don't require a DNR permit are often inappropriate for the existing site conditions or species present resulting in potential impacts without real nuisance relief.

The herbicides that don't require a permit are restricted to granular or pelletized forms and usually will only work in a narrow set of environmental conditions. If the site conditions include much of any fine flocculent sediments effectiveness can be dramatically reduced or eliminated. Many of these herbicides will work on only a limited number of species which may not even occur on the site increasing the importance of having a qualified applicator capable of identifying the species present and the site conditions which can limit herbicide effectiveness. In the long run most people would be far better off trying to limit vegetation by hand pulling or raking and if these are not feasible contacting a DATCP certified aquatic herbicide applicator to have them assess the different control methods suitable for the site.

In most cases aquatic herbicide applications should be discouraged because:

I. Less invasive or less destructive methods of control are feasible for the site and may include one or more of the following: mechanical harvesting, hand pulling, hand raking, hand cutting, and nutrient controls within the watershed. All too often herbicide treatments are conducted adjacent to private docks in situations where hand pulling or raking were easily a viable option and should have been the only allowable practice.

**Before taking action,** a careful assessment of existing conditions should be conducted and should include: importance of existing habitat areas, actual needs for clearing of aquatic plant habitat (navigational access does not require removal of all vegetation; only a reduction in density), and consideration of the cumulative impacts of removing aquatic plant habitat or treating it and the organisms living in it or around it with herbicides.

II. Can result in an overall reduction or fragmentation of important native aquatic plant habitat.

III. Creates openings in areas that should be colonized by native aquatic plant species. These openings provide increased opportunities for exotic species to become established in the lake and once established provide opportunities for their expansion.

IV. Results in direct and indirect mortality of sensitive or intolerant immobile species such mussels and other invertebrates. Some treatments can also result in the gradual build up of copper in the lake bed sediments to the point of being toxic to aquatic organisms. Several lakes in Northwestern Wisconsin have already reached or are approaching copper concentrations or levels that would be toxic or considered a lethal dose to 50% (LD50) of selected aquatic organisms exposed to similar concentrations under laboratory conditions. A serious problem that needs to be carefully considered is that copper does not break down, and it continues to build in concentration in the lake bed sediments with each subsequent treatment containing copper.

If people are going to treat aquatic plants they must understand that the available phosphorus will be expressed in larger plants or algae. Any attempts to suppress the expression of the available phosphorus will usually be very short term (7 days). It is difficult to justify adding toxic chemicals which do not break down and continue to build up towards toxic levels with each subsequent treatment. For this reason, aquatic herbicide treatments containing copper should be restricted to exceptional circumstances and not used on a regularly reoccurring basis.

V. If the average landowner width is l00’ or less and the minimum effective herbicide treatment width of 30’ is applied by most shoreline property owners around a lake, the cumulative impacts of the treatment could eliminate or seriously impact greater than 30% of the available habitat. This reduction in available habitat can result in an even greater percentage reduction in the overall fish populations for the lake. Elimination of habitat in even a small percentage of a lake, especially in critical habitat areas, can cause the collapse of a fishery.

VI. Aquatic plants lock up available phosphorus which would otherwise be available to drive undesirable algae blooms.

VII. Aquatic plants serve an important function in reducing the shoreline erosion associated with wave action while stabilizing sediments in place.

VIII. Aquatic plant management staff routinely hears complaints from shoreline property owners who expected their contracted aquatic herbicide application to eliminate all of the vegetation from the treatment area for a significant portion of the summer period. Most aquatic herbicides are effective on only a portion of the total aquatic plant community at a given site (species selective).

Free-floating species such as coon tail (*Ceratophyllum* sp.) and duckweed (*Lemna* sp.) also often drift back into treated areas with the next pervasive wind, eliminating the benefits they had expected from the chemical treatment. Other species such as Elodea, curly-leaf pondweed, milfoil, and other species easily fragment at times of the year and also drift into treatment areas eliminating or reducing the benefits of the previous treatment.

Hand raking or pulling near docks and in front of private developed properties eliminates the guess work out of what will be removed or eliminated when compared to expensive herbicide treatments with health concerns, use restrictions, and limited effectiveness.

## Recent changes affecting mechanical removal and hand pulling of aquatic vegetation

Prior to the passing of Senate Bill 55 in September 2001, mechanical removal of aquatic plants was unregulated provided the lake bottom was not disturbed, the cut plants were removed from the lake and not allowed to drift free, and the plants cut and removed did not include rice or those that are a part of a floating bog mat.

As exotic species, such as Eurasian Watermilfoil, expand their distribution within the state, more opportunities for spreading these exotics will occur. The risk of an exotic becoming established in a new lake is dramatically increased if the native species of aquatic plants that normally occupy a specific habitat type have been eliminated or reduced. When exotics are introduced into an area they have to find a suitable location to become established. If all the suitable growing sites are occupied by native species the exotic will have a much more difficult time establishing a reproducing population.

The Department has recently developed the necessary administrative rules within NR 109 to comply with the legislative mandates of SB 55. These focus on protecting native aquatic plant habitat to reduce the risk of exotic species invasions, while also recognizing the importance of protecting and maintaining the native aquatic plant habitat and the functions it performs in maintaining overall lake health. These rules limit shoreline removals of aquatic plant habitat without a permit to less than a 30' width; with the restrictions that this 30' width also include docks and other human activity areas that result in the loss or degradation of aquatic plant habitat.

If individual shoreline owners would like to consider removing vegetation by hand pulling or raking in widths greater than 30' they must apply for an aquatic plant management permit with their local DNR aquatic plant management specialist. It is unlikely that the Department will approve many alterations beyond the standard 30' width because of the concerns related to: creating more areas devoid of native vegetation which increases opportunities for possible colonization sites for exotics, cumulative losses of overall habitat, and the fragmentation and degradation that impairs the remaining habitat.

**Summary of management recommendations for the protection and restoration of aquatic plant communities**

The following management recommendations provide some basic concepts that can be used or implemented to insure the long term health of aquatic plant communities and the overall health of lakes ecosystems.

1. Prohibit chemical treatment of aquatic plants accept under extenuating circumstances such as:
    A. The habitat to be treated is a dominant feature in the lake and the cumulative treatment of small areas will not reduce the overall percentage of coverage from historic coverages.
    B. There is no other management alternative that will work to clear necessary navigational access channels identified in a Department approved management plan (post 2000)
    C. Treatment will not result in a loss of critical habitat
    D. It can be shown that chemical treatment will result in an improvement to the overall health of the ecosystem.
    E. A serious use problem clearly exists
2. Discourage mechanical harvesting of aquatic plants in most circumstances. Clear only Department approved NR 109 permitted navigational channels 20'-30' wide. If small areas adjacent to docks are to be cleared of vegetation hand raking or pulling should be used if at all possible. Please consider the cumulative impacts if everyone was to duplicate the actions you take on your property around the rest of the lake.
3. Educate lake users about the value and importance of native aquatic plant habitats. Lake districts and associations should try to educate new property owners as soon as possible about the value of critical habitat and the laws associated with protecting lakes and lake front property.
4. Apply aggressive erosion control measures to all bare soil areas
5. **Protect** existing natural plant cover in upland areas within at least a 50'-60' corridor of the water's edge and **reestablish** an **effective buffer** of natural plant cover where it has been eliminated. This corridor or buffer is an important component in protecting water quality and habitat against eutrophication and sedimentation and provides critical habitat for our shoreline species of wildlife. Lake districts and associations should try to educate new property owners as soon as possible about the value of **shoreline buffers** and the laws associated with protecting lakes and lake front property.

6. Encourage the strict enforcement of existing zoning regulations and encourage their strengthening and uniform enforcement.
7. Provide follow through and feed back with public officials when it comes to waivers and variances of existing zoning regulations and building codes
8. Encourage the requirement of mandatory erosion control plans for all building permits that require ground breaking
9. Filling, dredging, or other shoreline or littoral zone alterations covered by chapter 30, Wisconsin Statutes, should be prohibited unless there is clear evidence that such an alteration would benefit the lake's ecosystem.
10. Lake districts should carefully consider the value of purchasing shallow water bays with extensive aquatic plant communities to insure that future development does not result in an impact or a loss of this valuable habitat.

## SHORELINE LANDUSE AND LAKESHORE BUFFERS

The impacts that can result from shoreline development can be greatly reduced if done carefully with respect to the many important functional values that must exist to maintain a healthy lakes ecosystem. Natural shoreline vegetation provides important protection for lake water quality as well as ecosystem health and should be maintained for at least a 50-60' buffer strip adjacent to any waterbody. If shorelines have a steeper gradient than 10-15% the buffer strip width should be increased. Access corridors through this buffer zone are restricted by most county zoning regulations. Restrictions usually prevent the clearing of woody vegetation and mowing to no more than a 30' width of the shoreline. Property owners that care about the health of their lake's ecosystem can go a step further by reducing the clearing of vegetation to a narrow foot path. The best design for a foot path is an irregular trail that does not go in a direct line to the lake but has irregular meanders much like a stream with small berms and humps to prevent runoff from flowing directly down the path and preventing the path from become an area of concentrated flow for the direct delivery of sediments and nutrients.

The importance of maintaining the zone of no disturbance of the natural vegetation along the lake shoreline is important for several reasons. As land is cleared and developed irregular surface areas are lost, leveled, and filled in by earth moving equipment, reducing infiltration and increasing runoff. The natural spongy layer of decaying leaves and plant matter is also

removed further reducing infiltration and increasing runoff. Soil porosity is also decreased, decreasing infiltration and increasing runoff. As we lose or simplify the layers present (trees, shrubs, and unmowed herbaceous ground cover) in the shoreline areas we decrease the layers present for the interception of rainfall; each layer present reduces the energy and volume of rainfall striking the grounds surface thereby reducing what is available for the mobilization and transport of sediments and nutrients from the ground's surface to the lake. The greater the volume of runoff the more energy available for the transport of nutrients and sediments from surrounding land uses into the lake to drive algae blooms and bury important shoreline habitats.

Shoreline buffers also increase the buildup of leaf litter forming a spongy layer to absorb more precipitation and runoff reducing the amount of sediment and nutrients reaching the lake and negatively impacting water quality and habitat. The denser unmowed vegetation also filters sediments and nutrients from runoff.

Each of these three layers (trees, shrubs, and herbaceous ground cover) provides different important habitat components for different life cycle requirements of various wildlife. If any one layer is missing the ability of certain wildlife species to survive may be compromised. Leaving wider areas of uncut vegetation (Buffer Zones) increases the likelihood that adequate habitat will exist for many species of songbirds, which are at risk from the loss of this valuable lake shoreline habitat. Furbearers, raptors, frogs, deer, and other wildlife also benefit from these wider natural areas.

The aesthetic perspective also needs to be evaluated. Everyone likes to look out and see the lake, but very few people like to look at an intensively developed shoreline that reminds them of the urban yards and hectic pace they were trying to get away from. Maintaining the natural wild character of a lake should be the highest priority guiding any development activities. Both man and wildlife will lose if the natural character is allowed to be manipulated to the point our lakeshores begin to resemble urban yards and lawns. This emphasizes the importance of insuring that development is done carefully to maintain as many of the important functional values that the natural undeveloped shoreline had.

The restoration of a naturally vegetated buffer for at least 50'-60' from water's edge should be a very high priority for properties that have been cleared or converted. As previously stated a healthy buffer includes the native trees, shrubs, and herbaceous ground cover that would naturally have

existed on a given site or location. The native species can usually be identified by looking at undeveloped shoreline areas.

**Summary of management recommendations for the protection and restoration of natural vegetative shoreline buffers**

1. Educate landowners about the importance of a healthy lakeshore buffer
2. Encourage the strict enforcement of existing zoning regulations and encourage their strengthening and uniform enforcement.
3. Provide follow through and feed back with public officials when it comes to waivers and variances of existing zoning regulations and building codes
4. Encourage the requirement of mandatory erosion control plans for all building permits that require ground breaking
5. Provide direct oversight of all building crews and insure that as little as possible of the natural plant cover is disturbed during the construction phases.
6. Utilize only the native indigenous species for shoreline buffer restoration efforts and carefully consider site limitations (soil type, soil moisture regime, and shade preferences of plantings) when selecting appropriate species. Restoration efforts should follow a least disturbance scenario; by first halting mowing within at least the shoreline buffer zone (35' back from the water's edge and with no more than 30' width of the shoreline cleared for access purposes; landowners that care about the health of their lake ecosystem are encouraged to go beyond the minimum requirements of the law and increase buffer width and decrease the length of shoreline cleared of vegetation for access). It is important to remember that any ground breaking activities increases the opportunity for transport of sediments and nutrients into the lake; especially within the lakeshore buffer zone.

   Landowners should expect that initial recovery of the natural vegetation within the ground cover layer may take one or two full growing seasons, after halting mowing activities. Vegetation can usually re-establish itself from the natural seed bank available within the existing soils and from the seeds and rootstalks of adjacent plant communities. Plug plantings of the native herbaceous groundcover species can be used to achieve adequate density and diversity if recovery appears to be sparse in successive years. Supplemental

plantings to establish adequate densities for the tree and shrub layer will have to be used in most situations.

The native species that should be used to restore the lakeshore buffer in order to provide the proper habitat and water quality protection functions necessary to insure a healthy Northern Wisconsin lake ecosystem are available through County Land and Water Resources District Conservation staff; please refer to the list of contact names and numbers at the end of this document.

## ZONING AND REGULATION CONSIDERATIONS FOR LAKE PROTECTION

Filling, dredging, or other shoreline or littoral zone alterations covered by chapter 30, Wisconsin Statutes, should be prohibited unless there is clear evidence that such an alteration would benefit the lake's ecosystem. Sea-walls should not be used and sand blankets should not be allowed in almost all situations. Rock rip-rap should be used only when anchoring difficult shorelines with problematic erosion which cannot be handled with just restoration of the native vegetation. If questions arise or problem areas exist, lakeshore property owners should call their local DNR Water Regs Staff for assistance or to report a problem area which may be negatively impacting lake water quality or habitat. A list of locally available technical assistance contact names and phone numbers is provided at the end of this document for easy reference.

County shoreland and wetland zoning regulations apply to the areas within 1000 feet of lakes, ponds, and flowages and within 300 feet of rivers, streams, and creeks. The intent of zoning regulations is to promote wise land use planning while allowing careful development around our precious surface water resources. Most of the counties in northwestern Wisconsin now have lakes classifications which require or prescribe certain setbacks for all structures and the maintenance or re-establishment of shoreline buffers to protect water quality and habitat needs. Most of them **as a minimum** allow for reasonable use of shoreline areas by allowing a 30' wide access/viewing corridor through the buffer. The remainder of the lot from the water's edge back 35'should be restored to a natural condition with trees, shrubs, and unmowed herbaceous ground cover including various grasses, sedges, forbs, and wildflowers.

On more sensitive lakes, county classifications may require or prescribe a wider buffer width and lakeshore property owners are encouraged to contact

their **local county conservationist** and determine what the specific requirements are for shoreline buffers on their lake. A list of locally available technical assistance contact names and phone numbers is provided at the end of this document for easy reference.

In all cases during development, the maintenance of a naturally vegetated buffer zone is critical to preserve a healthy lake ecosystem. In situations where the vegetation has been removed or altered landowners are encouraged to reestablish a buffer zone composed of the natural plant communities that belong there. For technical assistance in restoring your shoreline buffer please contact your local county conservationist or county shoreline BPM technician using the names and numbers provided at the end of this document. This ensures that you not only get water quality protection, but you also get the important functional values that the native plants provide for food and cover for shoreline species of wildlife dependent upon them.

## EROSION CONTROL DURING LOT DEVELOPMENT

This is one area that can have a dramatic effect on water quality and habitat if it is not done correctly. The volume of sediments and nutrients that can be transported to a lake during the construction phase can equal the amount that would normally have only come off from the same parcel of land over a period of hundreds of years. The compounding effect of this nutrient load can have a dramatic effect on long term lake water quality. By following some basic rules during the construction phase we can keep most of these sediments and nutrients in place and prevent them from becoming a part of the lakes internal nutrient cycle that could cause a shift from a clear lake to one that has ample nutrients to drive extensive algae blooms each year.

Adequate soil erosion control measures and their proper maintenance during construction are very important and should become a very high priority for individual property owners. Lake association members could play an active part in reaching property owners before the damage is done or minimizing impacts by identifying active sites that need erosion control measures and contacting property owners to encourage proper implementation of erosion control measures. County zoning staff and officials need public support to get more effective zoning regulations on the books. Public support needs to be expressed if adequate county staff are to be hired to meet the increasing demands that are being placed on them by expanding development. As is most counties suffer from inadequate staff to deal with existing work demands. Mandatory erosion control plans should be a requirement for all

building permits that will involve ground breaking. This needs to be coupled with adequate staff to insure that erosion control plans are being followed and properly implemented and that erosion control measures are properly maintained. More recently county governments have begun to deal with these difficult issues.

Until county wide erosion control ordinances can be established it is strongly recommended that individuals require contractors to develop erosion control plans prior to the initiation of any construction, then the landowner should ensure that it is adequate. Aggressive follow through after construction has begun is also important to insure erosion control practices are properly implemented and maintained.

By giving erosion control careful consideration prior to construction serious impacts to our lakes and streams can be minimized or avoided entirely. Yards can be designed with subtle berms to divert runoff into internally drained areas or into constructed depressions to allow sediments and nutrients to settle out and be trapped before reaching our streams and lakes. Silt screen fences, properly installed during construction can protect against "sheet" runoff. Other erosion control methods are required on steep slopes or difficult sites. Your county land conservation staff or DNR technical support can provide expert advice about erosion control.

Protect all top soil piles by properly locating them away from drainage ways and as far away from the lake as possible. Surround them with a ring of silt screen fence while also seeding them down with an annual rye grass to provide additional stabilization until they are needed.

Never divert rainfall runoff from driveways, roofs, or access roads directly to the lake through drain tiles, culverts, or waterways. Instead, divert runoff into internally drained areas, constructed depressions to allow for settling of sediments and nutrients, or at least into a thickly vegetated site that will provide some degree of filtration and infiltration of runoff.

**Management recommendations for constructions site erosion control**

1. Minimize disturbance of natural plant communities within shoreline areas (50'-60' from water's edge) so they can continue to act as a buffer protecting lake water quality by filtering runoff and providing for infiltration before it reaches the lake.
2. Provide direct oversight of the construction crew during development. Insure that clearing of vegetation is kept to the minimum needed to accomplish the desired construction and avoid any disturbances within at least 50'-60' of any shoreline
    A. Insure that silt screen fences are installed and maintained.
    B. Apply mulch to all bare soil areas that may be exposed to precipitation during none work hours, and especially make sure mulch is applied before weekends. Purchase and use excelsior erosion control mats and other products where necessary.
    C. Provide coarse gravel and crushed rock cover for all areas that have regular heavy equipment traffic, i.e. driveways. Keep all vehicle traffic confined to these protected road surfaces.
    D. Include landscape designs for the protection of water quality i.e., such as holding ponds and depressions which provide for the opportunity to capture and hold runoff while maximizing infiltration and allowing sediments and nutrients to settle out.
    E. Try to eliminate or minimize areas of concentrated flow by reducing the surface area draining through a single path or channel and encouraging flow over multiple paths into depressional areas through the use of berms and other best management practices (BMPs).
3. Report serious erosion control problems that aren't being dealt with in a timely manner; before, they can result in significant impacts to water quality and habitat.

## PROTECTION OF GRAVEL AND COARSE ROCK RUBBLE HABITAT

Gravel and coarse rock rubble free of silt and sediments are critical to the successful reproduction of some walleye stocks. Gravel and coarse rock rubble free of silt and sediments are also critical to the survival of different components of the aquatic food chain that supports a healthy lake ecosystem, including aquatic insects, crayfish, and other forage or food species. The greatest threat to these critical habitats is shoreline development that is not accomplished in a manner that maintains an adequate buffer of undisturbed land and does not implement and maintain proper erosion control measures. This buffer is particularly important during ground breaking and construction of lake shoreline areas, because it traps sediments and nutrients within the vegetation and irregular surface areas and small depressions preventing them from reaching the lake and driving algae blooms or burying important habitat.

### Summary of management recommendations for the protection of rock rubble *walleye spawning* habitat

1. Educate landowners about the importance of a healthy lakeshore buffer (filter out sediments)
2. Encourage the strict enforcement of existing zoning regulations and encourage their strengthening and uniform enforcement.
3. Provide follow through and feed back with public officials when it comes to waivers and variances of existing zoning regulations and building codes
4. Encourage the requirement of a mandatory erosion control plan for all building permits that require ground breaking
5. Provide direct oversight of all building crews and insure that as little as possible of the natural plant cover is disturbed during the construction phases.
6. Do not use sand blankets to convert natural bottom types to sterile beach sand.
7. Filling, dredging, or other shoreline or littoral zone alterations covered by chapter 30, Wisconsin Statutes, should be prohibited unless there is clear evidence that such an alteration would benefit the lake's ecosystem.

## MAINTENANCE OF LARGE WOODY DEBRIS

Large woody debris or trees should be left in the lake as they naturally collapse and fall into the lake. Large woody debris is often overlooked for its importance in providing critical fish habitat. Species such as largemouth bass require some sort of cover to successfully nest and rear offspring. Bluegills and other species also benefit from the presence of large woody debris. The conversion or removal of natural plant cover within a 50'-60' corridor of the lake reduces or eliminates completely the opportunity for the replacement of large woody debris as well as other important functional areas important the any lake's ecosystem health and should be discouraged. The way we look at large woody debris should in the context of its importance to the health of the lake ecosystem. Pre-formulated perceptions drawn from urban experiences or practices used in urban areas can be very destructive to the way natural environments function in a complex interconnected fashion. A shoreline ringed with fallen trees should not be looked at as untidy or unkempt but one that is providing important habitat for fish and wildlife. Fishermen have recognized for decades that fallen trees are often some of the best habitat to fish for bass and panfish. This emphasizes the need to re-assess our value system and begin leaving them for important habitat. Fisheries managers in recent years have begun to increase their educational efforts in this particular area but still have a majority of the public to reach with this important message.

### Management recommendations for woody debris

1. Educate lake shore owners about the value of allowing trees to fall into the lake naturally in order to provide valuable habitat for fish and wildlife.
2. Encourage lake shore property owners to become involved in the long term planning for woody debris on their property. Plant young trees for the replacement of older trees.

## USE OF FERTILIZERS ON LAKE SIDE LAWNS

From a water quality standpoint lawn fertilizers are a recognizable source of nutrients that property owners can eliminate or control through proper application. More is not better. Landowners are also encouraged to strongly consider the consequences of having a large lawn that extends into the recommended buffer area (within 50'- 60' of the lakeshore). By reducing your lawn size you not only reduce the amount of sediments and nutrients entering the lake you also provide important habitat necessary to support Wisconsin's wildlife species dependent upon this important shoreline habitat that is quickly disappearing in the face of increasing development pressures. Another benefit to decreasing lawn size is the reduction in work load necessary to maintain it; hence you can spend more time relaxing and enjoying your property.

If you feel the need to fertilize your lawn have your soil tested for phosphorus and potassium levels. When applying fertilizers consider the need to have soil phosphorus levels at the maximum recommended level. By applying fertilizers at a lesser rate you can still enhance your lawn without the increased risk of having excess drain into the lake to drive undesirable algae blooms. Remember that fertilizer suppliers are in the business to sell chemicals. The recommended bag application rates are often too high. Get advice from your county or university extension offices and remind them that you are applying the fertilizers to a lakeshore lawn and do not want to over-apply.

Never burn brush or leaves, especially along the lakeshore, in road ditches, or in drainage ways that drain into the lake. The ashes are very high in phosphorus and nitrogen and are soluble in rainwater. The best way to deal with leaves is to compost them. Spreading them in a wooded area that does not drain to the lake is also a good way to deal leave disposal. If neither of these is an option, bag your leaves and take them to a yard waste collection site for proper disposal.

Do not remove grass clippings from lawns. They contain all the nitrogen and phosphorus your lawn needs which you will not have to replace with annual fertilizer applications. Use a mulching lawnmower it recycles the clippings into your lawn more efficiently. Never spread wood stove ashes in areas draining to the lake; instead dispose of them with your household garbage during normal refuse pickup times.

**Management recommendations for fertilizer use**

1. Apply fertilizers only if a soils test has determined that it is nutrient deficient and add less than the maximum recommended.
2. The use of a low phosphorus content fertilizers or no-phosphorus fertilizers is strongly recommended if the fertilizer is to be applied on lakeshore property.

## SEPTIC SYSTEM MAINTENANCE AND NECESSARY REPLACEMENT OF OLD FAILING SYSTEMS

Failing septic systems can pose a significant threat to water quality, especially when large portions of shoreline are developed and when the overall percentage of a lakes watershed is dominated by lakeshore properties. Septic systems that are older than 20 years should be looked at to insure that the filtration field is properly functioning and that waste is not perching above the drain field and entering the lake directly without adequate filtration of nutrients and other components. There is no specific rule that septic systems have to be evaluated to determine if they are functioning properly, unless there is a complaint filed.

It is generally recommended that you have your septic system pumped of the normal sludge buildup every two to three years. This sludge removal is essential for maintaining the absorptive capacity of your drain field.

Inspect your system regularly for surfacing effluent around the drain field. Are there wet areas or strong odors? Do the drains in your home seem to work properly or are they sluggish? Do they make noisy gurgling sounds? If your septic system has any of these systems you should have it inspected by a licensed installer.

Never make any changes to your sanitary system or wastewater piping. This work must be done by a licensed installer. It is not only dangerous to health and human safety, as well as water quality, it is also illegal and can result in fines or penalties.

Avoid using a garbage disposal with private septic systems. Put kitchen scraps in a compost pile if at all possible; otherwise, as a last resort put them in with your household garbage. Limit the use washing machines, if possible. Laundry wash water is high in lint, synthetic fibers, and pet hair all of which can cause premature failure of your drain field. Use a commercial laundry if possible or if you are a weekend resident with a lakeshore septic

system wait until you return to your midweek residence with public water and sewer.

A septic system is only intended to break down organic wastes. Never put solvents, furniture stripping solutions, degreasers, petroleum compounds, oil based paints and stains, or other chemicals into your sanitary system.

Diverting sink and shower drains (so called gray water) to lawns and other properties adjacent to the lake will not only impact lake water quality it is also illegal. Gray water must be run through your septic system to allow for the proper filtration of pollutants. There are no exceptions to this without first obtaining necessary permits.

# Appendix J

NR 109 - Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations

# Chapter NR 109

## AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL AND MECHANICAL CONTROL REGULATIONS



**NR 109.01 Purpose.** The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.07, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter. Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non−native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03; **correction made under s. 13.92 (4) (b) 7., Stats., Register March 2011 No. 663.**

**NR 109.02 Applicability.** A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non−native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.03 Definitions.** In this chapter:

**(1)** "Aquatic community" means lake or river biological resources.

**(2)** "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

**(3)** "Body of water" means any lake, river or wetland that is a water of this state.

**(4)** "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

**(5)** "Department" means the Wisconsin department of natural resources.

**(6)** "Manual removal" means the control of aquatic plants by hand or hand−held devices without the use or aid of external or auxiliary power.

**(7)** "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

**(8)** "Permit" means aquatic plant management permit.

**(9)** "Plan" means aquatic plant management plan.

**(10)** "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.04 Application requirements and fees.** **(1)** Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

**Note:** Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

**(2)** The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. $30 for a proposed project to manage aquatic plants on less than one acre.

2. $30 per acre to a maximum of $300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one−half the original application fee, but not less than $30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a description of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

(h) A description of other introduction or control methods considered and the justification for the method selected.

(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

**(3)** (a) The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long−term sustainability of beneficial water use activities.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

**(4)** The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.05 Permit issuance. (1)** The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

**(2)** The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

**(3)** The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long−term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Stuckenia pectinata (Potamogeton pectinatus), Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania spp., Zannichellia palustris and Brasenia schreberi.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

**(4)** The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

**(5)** (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3−year term.

(b) The department may issue an aquatic plant management permit for a one−year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department−approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3−year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5−year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

**(6)** The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03; reprinted to restore dropped language from rule order, Register October 2003 No. 574.

**NR 109.06 Waivers.** The department waives the permit requirements under this chapter for any of the following:

**(1)** Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

**Note:** A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non−navigable waters of the state is not required to obtain a permit for the activities.

**(2)** A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30−foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on−shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

**(4)** Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re−growth of purple loosestrife or other nonnative vegetation.

**(5)** Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

**(6)** Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

**Note:** Scientific collectors permit requirements are still applicable.

**(7)** Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.07 Invasive and nonnative aquatic plants. (1)** The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

**(2)** The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

**(3)** Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.08 Prohibitions. (1)** No person may distribute an invasive aquatic plant, under s. NR 109.07.

**(2)** No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

**(3)** No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

**(4)** (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re−launched on the same body of water without having visited different waters, provided the re−launching will not introduce or encourage the spread of existing aquatic species within that body of water.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.09 Plan specifications and approval. (1)** Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

**(2)** The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

**(3)** The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.10 Other permits.** Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

**NR 109.11 Enforcement. (1)** Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

**(2)** Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

**History:** CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

# Appendix K

Licensed Harvester Companies in MN, 2009

# 2009 LICENSED MECHANICAL HARVESTERS

Aquatic Engineering (1)
c/o Joshua Britton
P.O. Box 3634
LaCrosse, WI 54602-3634
(877) 781-8770 x243
info@aquaticengineering.org

Aquatic Plant Management (3)
c/o Ron Duy
12871 Little Pine Trail S.W.
Brainerd, MN 56401-7501
(218) 829-3441

Aquatic Vegetation Grooming (5)
Division of CCI Products, Inc.
c/o Doug Lien, Jr.
P.O. Box 67
Osakis, MN 56360
(320) 859-4957

Aquatic Weed Harvesting (5)
c/o Melinda Borg
29724 St. Hwy 108
Henning, MN 56551
Day: (218) 385-6436
Night: (218) 583-3546

Geldner Construction (5)
c/o Robert L. Geldner
P.O. Box 416
St. Peter, MN 56082
(507) 931-4230

Hollenkamp's Waterfront Services (5)
c/o Amy Hollenkamp
12943 Tigua Road
Pine City, MN 55063
(320) 629-5201

J&N Weed Harvesting, Inc. (1)
c/o Jeremy Ketterling/Noel Sand
301 West 5th Street
Bottineau, ND 58318
Jeremy Cell Phone: (701) 871-1388
Noel Cell Phone: (701) 871-1035

Jacobson Environmental, PLLC (1)
c/o Wayne Jacobson
8070 12th Avenue South #105
Bloomington, MN 55425
(612) 802-6619
jacobsonenv@msn.com
www.jacobsonenvironmental.com

S. King Lakes Harvesting (5)
c/o Stephen L. King
20466 East Maud Lk Road
Detroit Lakes, MN 56501
Home: (218) 847-6931
Cell: (701) 799-7994

Lake Management, Inc. (1)
c/o Mathew Barnes
10400 185th St. N.
Marine on St. Croix, MN 55047
(651) 433-3283

Lake Management / Clearwater Cutting Co. - c/o Mike O'Connell (3)
29810 Broadway Street
Lindstrom, MN 55045

Lakeland General Store (5)
c/o Robin Johnson
22438 Old 59 Road
Pelican Rapids, MN 56572
(218) 863-5703

Lakeshore Aquatic (5)
c/o Dale Spaulding
8229 Robinhood Way
Lakeshore, MN 56468
(218) 963-0202

Lakeshore Potential (5)
c/o Dan Sendle
18624 Shelby Ct.
Waterville, MN 56096
(507) 382-5067
www.lakeshorepotential.com

Midwest Weed Harvesting, Inc. (5)
c/o Rick Thompson
8160 Co. Rd. 42, Suite 300-344
Savage, MN 55378
(763) 238-1012

Otter Tail Aquatic Control Co. (5)
c/o H. Whitey Mensching
38530 Walker Lake Drive
Richville, MN 56576
(218) 495-2779

Pratt's Affordable Excavating (3)
c/o Shawn, Steven, Jerry Pratt
23069 Swan Lane
Merrifield, MN 56465
(218) 765-4244

R.R. Handyman Service / Aquatic Weed Harvesting (3)
c/o Randy W. Rider
23058 County Road 4
Nisswa, MN 56468
(218) 851-7383

R&T Aquatic Weed Removal (1)
c/o Ryan Brown and Cheryl Swanson
2955 48th Street West
Webster, MN 55088
(951) 201-8018 (Ryan)
(952) 994-5725 (Cheryl)

Shoreline Solutions (1)
c/o Gregg Martinson
P.O. Box 1084
Bemidji, MN 56619-1084
(218) 751-5167

Tonka Freshwater Harvesting Services, Inc. (2)
c/o Brandon Weinzierl
11225 Hwy 7
Waconia, MN 55387
(952) 472-8700

Waterfront Restoration LLC (1)
c/o Thomas R. Suerth
P.O. Box 783
Long Lake, MN 55356
(952) 201-5253
(888) 381-9746

Weedy Knights (5)
c/o Mark D. Jirik
830 Orange Ave.
St. Paul, MN 55106
(651) 793-5697
www.weedyknights.com

Key
(1) = Statewide
(2) = Metro Area Only
(3) = Brainerd Area Only
(4) = Minnetonka Only
(5) = Other (Call Harvester for details)

May 2009

# 2009 LICENSED COMMERCIAL AQUATIC PESTICIDE APPLICATORS

Applied Ecological Services, Inc.
c/o Aaron Kubichka
17921 Smith Road
P.O. Box 256
Brodhead, WI 53520
(608) 897-8641

Applied Ecological Services, Inc.
c/o Aaron Kubichka
21938 Mushtown Rd
Prior Lake, MN 55372

Aquatic Engineering
c/o Joshua Britton
P.O. Box 3634
LaCrosse, WI 54602-3634
(608) 781-8770
info@aquaticengineering.org

Aquatic Plant Management
c/o Ron Duy
12871 Little Pine Trail S.W.
Brainerd, MN 56401-7501
(218) 829-3441
(formerly R&J Aquatic Weed Control)

Jacobson Environmental, PLLC
c/o Wayne Jacobson
8070 12th Avenue South #105
Bloomington, MN 55425
(612) 802-6619
jacobsonenv@msn.com
www.jacobsonenvironmental.com

Lake Improvement Consulting, Inc.
c/o Mark Teien
5300 Glenbrae Circle
Edina, MN 55436
(952) 944-2565

Lake Management, Inc.
10400 185th St. N.
Marine on St. Croix, MN 55047
(651) 433-3283

Lake Restoration, Inc.
c/o Kevin Kretsch
12425 Ironwood Circle
Rogers, MN 55374
(763) 428-9777

Minnesota Shoreline Restoration, Inc.
c/o Ron Duy, Jr.
26735 Middle Cullen Road
Nisswa, MN 56468
(218) 963-0132

Natural Reflections, LLC
c/o Carl Rausch
13411 Arrowood Lane N.
Dayton, MN 55327
(763) 682-2080

Barry Oberg Co.
3690 80th Street North
Glydon, MN 56547
(701) 361-4925

PLM Lake & Land Management Corp.
c/o Patrick Selter
4597 Morehouse Drive
Pequot Lakes MN 56472
(218) 568-5379

# Appendix L

*Galerucella* Beetle Rearing Guide

# How to Raise and Release *Galerucella* Beetles Outdoors for Controlling Purple Loosestrife in Wisconsin

Prepared by the Wisconsin Purple Loosestrife Biological Control Program - PLBCP

Raising and releasing these beetles is easy and fun. Simply, it includes collecting purple loosestrife roots from your local wetland, potting the plants and growing them in a child's wading pool, adding beetles to the plants, and dropping the pots off in your local loosestrife patch about a month or so later with 100 times as many beetles. There are, however, a few crucial details laid out here that you need to know to ensure successful beetle production. But this is also a project whose parts can be accomplished in many ways and you have the freedom to do it as it suits you, as long as you produce healthy—and hungry—beetles! Please read the guide carefully then make it your own by accomplishing the necessary steps in your own way. If you find what you think is an effective and unique way of doing so, please share it with us.

**Getting Ready**

In order to plan ahead, please consider the following typical, first-year, outdoor project timeline, based on the biology of the plants and beetles and our temperate climate (Table A.2.1, Figure A.2.1).

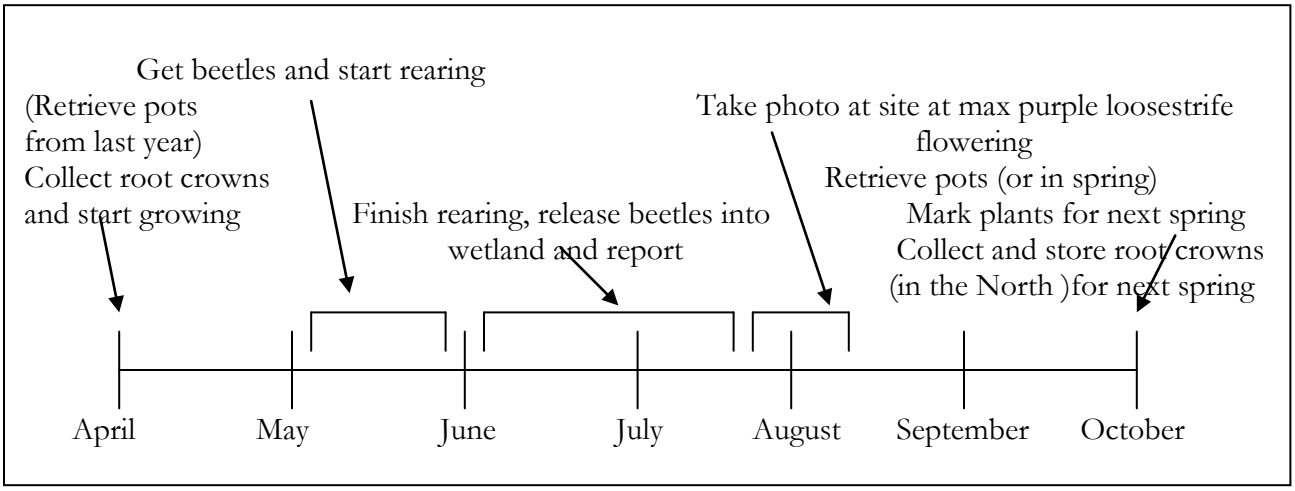
| Autumn | Winter | Spring | Summer (early) | Summer (late) |
|---|---|---|---|---|
| Locate and mark loosestrife plants | Gather tools and | Dig, pot, and cage loosestrife plants | Take pots to your wetland and | Photograph site |
| Gather tools and materials | | Set up rearing pools | Release beetles | |
| Dig and store roots* | Sew net cages | Receive and/or add beetles | Record and send release data | |

* Usually only in the North where spring can be very late or cold, slowing the start of the project

**Table A.2.1.** *Typical seasonal tasks for purple loosestrife biological control.*

In the fall or summer, before rearing, search your local wetland for the purple loosestrife plants that you want to use and mark them if you are not certain you can identify them in spring when all the leaves and flowers will be gone. In the North you should also consider digging the plants in the fall after a few hard frosts, rather than in spring when a late thaw could delay digging the roots, making your plants too small to support beetles on time, later in the spring. (Fill out a loosestrife cultivation permit before doing this.) Also, consider buying a wading pool in fall since they are often unavailable until late in spring.

**Figure A.2.1.** *Yearly beetle rearing and maintenance activities (approximate)*




The winter is a good time to start collecting other needed tools and materials. A complete list of everything you may need is attached, along with some sources for specialized equipment. Some materials may be available from the Wisconsin DNR Purple Loosestrife Bio-Control Project. Later in spring you will need to put net sleeve cages over your pots and plants to keep predators out. Winter is a good time to sew these cages so they are ready to go when you get your roots.

Dig roots as soon as wetlands thaw sufficiently in the spring, typically by early April in the South and mid-April in the North. Pot and cage them as quickly as possible to keep predators off of them. Four to six weeks later, usually between early and late May, your plants need to be around two feet tall so you can receive beetles.

By mid summer, six to eight weeks after adding beetles, transport your pots with the new generation of adults into local purple loosestrife patches. Record and send to the Wisconsin DNR your release site and date information. In late summer, when the plants are in fullest bloom, photograph your release site and send in a copy of the picture.

In years after the first release--beyond the scope and timeline of this appendix--monitoring the success of your beetles will tell you whether or not further work is required to have the effect you want on the loosestrife. It will also give you satisfaction as you see native plants begin to control your wetland again. Instructions for this will be issued as a future Appendix.

**Collecting Roots**

Purple loosestrife is a state-listed noxious weed and to legally cultivate the plant to produce beetles you must return a signed copy of the permission form to the Wisconsin DNR.

Purple loosestrife is a perennial, with only the aboveground parts dying each fall. The aim in collecting and growing the roots is to quickly produce large plants with the most foliage possible in order to maximize beetle production on them later in the spring when beetles emerge from over-wintering. Harvesting purple loosestrife roots very early in spring ensures that shoots have not started to grow, which protects them against mechanical damage during transplanting. (Some bud growth may have occurred the previous fall.) Also, shoot growth is dependent upon temperatures and competition and moving plants early to a warmer, upland setting will maximize growth. Immediate caging will also reduce the likelihood of predators.

If roots are still frozen late in spring in northern Wisconsin, you may want to travel south to collect them. The PLBCP can advise you on suitable sites or consult glifwc-maps.org for loosestrife locations. If you dig roots in fall to avoid this problem you must store them wetted, in either a cold room at about 40$^{o}$F (such as a root cellar) or outside under a tarp in a shady place to stay cool, moist and out of the light. Always dig more roots than you need because many will not survive until spring.

Choose a wetland that has good vehicle access since roots are heavy. Plants in standing water, friable soil or drier, loose, sandy soil are usually the easiest to dig. Clip the old stems of a clump, leaving a "handle" of 8 inches or so. Treat the clump as a single plant, though it is just as likely to be several. Use a shovel to cut, or a fork to loosen, around the outer base of the multi-stemmed clump before pulling up the root mass. A large clump can be cut or pulled apart if it is too heavy to carry or too big for a pot, especially if it is more than one plant. A clump with 6 to 8 stems is probably large enough for beetle rearing in a ten-inch pot; choose the largest roots that will fit into your pots to produce the most foliage possible and avoid premature plant death from larval feeding. Trim as much soil, other plant roots, and dead loosestrife roots (black and brittle) as possible and leave this material in the wetland. Haul roots out of the wetland in garbage bags or tubs. Wear appropriate boots and clothes, including protective eyewear! Transport the roots to your potting area for further work, being careful not to spread soil contaminated with loosestrife seed or root fragments anywhere along the way.

**Potting Roots and Growing Plants**

Transplant 12 to 15 roots for each 10 growing plants desired. Extra plants will be useful if some do not grow well; for feeding beetles if a plant must be kept after larvae have completely consumed its foliage; catching stray beetles, and over-wintering beetles. In a pool, mix water with your potting soil until it is thoroughly moist. Fill each 3 to 5-gallon pot with enough soil to allow a root crown to be two inches below the top. Sprinkle in the correct amount of slow-release fertilizer (if not already in the mix, usually a teaspoon) and mix it with the top inch of soil. In another pool or container, spray-wash each root with a garden hose to remove most of the mud and organic material or pull it off by hand, especially from the top of the crown, to get rid of eggs of plant or insect predators. Dispose of any waste material from this process in a capped landfill or back in the original wetland to avoid spreading loosestrife. Place the largest roots possible, with root tips trimmed if necessary, in your pots. They should just fit. Several small roots can be combined to produce at least 6-8 stems and sufficient foliage. Pack the remainder of each

pot with soil to within 2 inches of the top, but not too firmly, so that larvae can penetrate the soil surface later. Also, be careful to push soil into all air pockets around the plants' roots and try to get soil heights the same in all pots. You don't have to do any watering now if the soil was saturated at the start, but it can help to settle the soil surface. Hereafter always water by filling the pool into which the pots are placed.

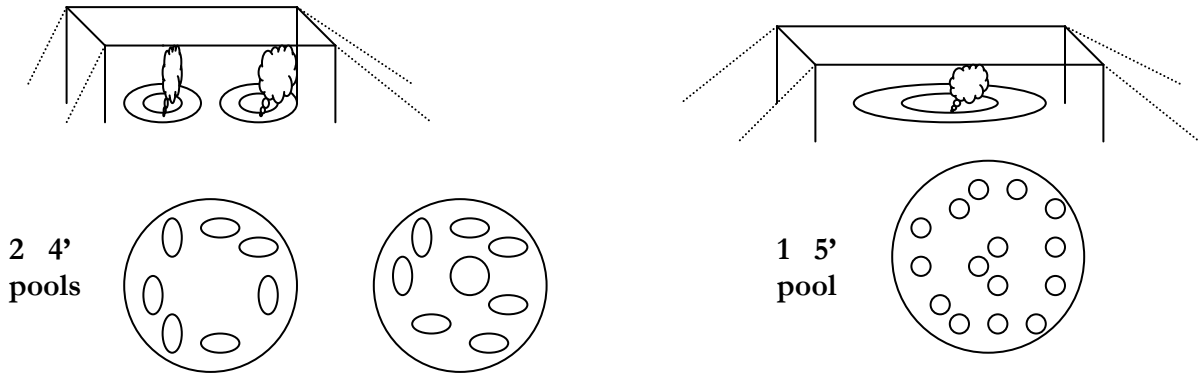
Place a net sleeve cage over each pot as soon as possible. The cage must be securely closed at both ends or beetles will escape. Duct tape one end of the cage to the pot or use a draw cord or large rubber band over the net in a groove at the top of the pot to secure the net. (You may have to add tape if wind tends to blow your nets off.) The tape should be high enough to be out of the water in the pool or it may loosen. Also, try to leave as much fabric above the tape as possible to give the plant the maximum amount of room for growth. Close the top of the cage with a draw cord or wire, place the pot into a pool and suspend the top from a support. The net sleeves must be supported to allow plants to grow unhindered to maintain a healthy environment for the beetles. Many kinds of support systems work, ranging from simple suspended lines to posts supporting rigid cross pieces or even a thin post in each pot inside its cage. Guy lines can give added stability.

Place pools in full sunlight, but out of both strong winds and stagnant, easily heated air. Arrange pots around the outside of a wading pool to give each plant maximum sunlight. Ten pots should fit around a 5-foot pool, but two 4-foot pools would be better. Extra plants can go into the pool center. At least one of these plants can be cage-less to “catch” escaped beetles. Other extra plants may have cages to keep predators off for future use or as control plants. Always keep some water in pools with potted plants. Check pools daily, even on weekends if the weather is hot and sunny. Drill several drain holes in each pool’s sides to ensure that the maximum water level stays 2-3 inches below soil heights since pupating beetles do poorly in fully-saturated soils.

Mosquito larvae may live in your open-topped pools, an increasing concern because of West Nile Virus. Eliminate them by putting in a few goldfish or mud minnows, both of which can survive in low oxygen environments. You may have to replenish them if you let water levels drop too low or if local predators such as raccoons eat them! Weekly draining or over-flowing your pools may also destroy or flush out mosquito larvae.

Plants need about 4-6 weeks, depending on weather conditions, to grow large enough for beetle introduction. Crowns take a week or two after potting to begin to grow, but then grow quickly. When stems are 12 to 15 inches tall, carefully pinch off the tip of each with a tweezers by spreading the small leaves and removing the growing point. This stimulates the growth of more lateral stem tips and foliage and helps keep plants from growing into the cage tops. Placing beetles on plants that are too small, have too few stems, or are too old can result in reduced beetle production and even premature death of the plant and require early beetle release.

**Figure A.2.2.** *View of pools and possible structure.*




**Adding and Raising Your Beetles**

When plants are around two feet tall they are ready for beetles. Let the Wisconsin Purple Loosestrife Bio-Control Program know ahead of time when you expect this to be the case and they will try to time sending your beetles to that date, or plan to get your own then. There is a small program donation required to cover the cost of shipping beetles. They will come to you either shipped overnight or delivered in-person by program personnel. Once you receive them, put the beetles into your cages as soon as possible. If you must delay, do not subject them to extreme temperatures. Keep them cool and out of direct sunlight, especially if in the shipping container. If the delay is overnight, open the shipping container and, if airtight, open the bag briefly and carefully to give them fresh air and lessen humidity. Be careful in doing this since the beetles are strong fliers. Keep the shipping container, unless instructed to return it.

When you are ready to transfer beetles to your cages use an aspirator (see equipment list) or similar device to move 10 healthy beetles to each plant. If there is any reason to suspect spiders or other predators might be on your plants (e.g., your plants were not netted immediately after transplanting), check them over carefully right before adding the beetles. If you have leftover beetles at the end put more beetles on any larger plants and fewer on smaller ones. Open the top of each rearing sleeve and drop the beetles in, making sure none fly back out. Tightly cinch the top closed and re-suspend the sleeve. Do not use fingers or tweezers to handle the insects as this can crush them.

You will see your beetles go through four life stages if you watch carefully over the following 6-8 weeks. Many web sites listed in the resource file have color photos and will aid you to identifying these stages. Note that temperature and weather conditions will be important factors in the amount of activity that you see and the number of days that each life stage takes to develop.

***Old Adults*** **–**from the previous year are dark brown, often with a black stripe along the edge of each wing cover. They are 4-6 mm in length, and about half as wide. They have

over-wintered in the surface soil layers either in a wetland or surrounding uplands and have emerged to feed and mate. They will live about 40 days and each female will lay about 10 eggs a day for 30 days. They feed between the veins by chewing small, fairly round holes in leaf tissue, called "skeletonization" as many small holes begin to leave just the veins. If it seems like no adult beetles are present (indicated by a lack of leaf damage) after the first week, look around the sleeve, in the lower parts of the plant and along the soil for live adults. If there are no adults present, then check the cage for holes or other possible means of escape. If no escape was possible, check for insect predators that may have eaten your beetles, resulting in the loss of the beetles. Check your sleeveless plant for escapees and return them, once any means of escape has been fixed.

***Eggs –*** are tiny (less than 1 mm) and cream colored with an uneven black line of frass (black insect excrement) deposited on them. They are usually laid in bunches, often along the edge of adult feeding damage on both stems and leaves. Humidity is important for egg hatching so make sure pools remain half full with water so the humidity remains high. Eggs hatch 2-3 weeks after they are laid.

***Larvae –***are very small and hard to see when newly hatched. Larval damage in the shoot tips, called "tip-feeding, ' is quite obvious, especially as it is often accompanied by frass. Larvae are yellow with a dark head capsule and molt five times, each time increasing in size. Over 80% of the larval growth occurs in the $4^{th}$ and $5^{th}$ larval instars. Their feeding damage is described as "window paning" because the leaf issue is left brown, thin, and translucent, unlike the holes left by adults.

P***upae –*** Larvae become pupae after 2-3 weeks of feeding when large $5^{th}$ instar larvae move to the soil after intensive feeding. When most larvae seem to have disappeared, they are in the top ½ in. of soil as pupae. Do not allow the upper layers of soil in the pots to be saturated at this time or many pupae will not survive. Fish out any you see floating in the pool and drop in a cage.

***New Adults –*** will emerge up to 100 times more numerous than the number of old adults started with 6-8 weeks earlier. They emerge after 2-3 weeks as pupae and are light tan with no dark coloration on their wing covers. They tend to collect at the top of each cage, apparently trying to disperse. Numbers are low at first, but hundreds may appear in days, so the pot must be placed in the field as soon as possible. Newly emerging adults will <u>not survive</u> if larvae have completely defoliated the plant, especially if the days are hot. Place fresh loosestrife stems, put into florist clips with water into cages to feed them for a brief time, but release them as soon as possible.

**Releasing Beetles and Follow-up**

Decide on suitable release sites well before your beetles are ready to release. You will probably produce enough beetles to set up an insectory or two. These are small, high quality sites with at least 50 healthy, mature loosestrife plants and well separated from larger loosestrife infestations. Beetle numbers can build up quickly and stay concentrated on such sites, making it easy to see results and even collect local breeding stock within one to several years. These sites should have landowner assurance of site security, have good access and footing, receive no insecticide spraying (such as for mosquito control),

have little spring flooding, no summer flooding and be places from which the loosestrife is unlikely to infest new wetlands.

Unless you have reasons for choosing otherwise, put half of your first year's beetle production on each of two such sites. Always place a minimum of 2,000 beetles (usually 2-4 pots) wherever they are placed to start a viable population. More on a site is always better. Once local propagation stock is assured or if no further rearing will take place, you can place beetles on very large loosestrife sites where little other control is practical. Refer to Wisconsin DNR's "Purple Loosestrife Control Recommendations" or consult other publications, such as the brochure "Purple Loosestrife: What You Should Know, What You Can Do" or WDNR and UW Extension personnel for further advice on selecting sites.

When the first new adult beetles begin to appear in your net cages 4-6 weeks after adding them to plants it is time to take the pots to your wetland. Newly emerged beetles are rather delicate and handling them at this stage is not recommended. Transport the potted plants and cages together, making sure your beetles arrive in good condition by avoiding jarring (such as in high wind in an uncovered pick-up) and high temperatures. Transport the pots in tubs to catch muddy drippings and in an air-conditioned vehicle if it is hot. Fold plants and cages over gently if space is small.

Cluster 2-5 pots within a 10 x 10-m area with each pot adjacent to a large, healthy purple loosestrife plant. Remove the cages and shake out any adults onto nearby foliage. Bend the nearby loosestrife plant stems into the spent potted plant stems to allow new beetles and any remaining larvae to walk onto fresh foliage for immediate feeding. Mark either the corners of the site or the individual pots with PVC pole(s) so you can find them again. Wait at least 4 weeks after the release before recovering your pots to allow the remaining beetles to emerge and disperse or leave them until the next spring.

If your beetle release is late and hundreds of beetles are bunched in the cage tops, first look to see if any green plant tissue remains. If not, you must immediately release them or feed them or risk causing many to die, either then or later from the stress of starvation and warm temperatures. A different release procedure is also recommended to encourage the beetles to stay on the site after release. At the field site loosen the sleeve from a pot, lift the pot and spread one side of the sleeve, inserting several healthy field stems into it as you lower it to the ground. Snug the bottom of the sleeve around the pot and new stems as well as possible. This gives the new adults additional “field” food, getting them used to the site, before they are actually released when the sleeves are completely removed 2-3 days later. It's OK if some beetles escape early. On the day of every release, fill out and mail in a copy of the Site Location Information form for each release site.

Return to each release site to photograph it in late summer when the loosestrife flowering there is its most spectacular. This visual record of flowering in year 1 can be used to contrast with photographs of the same site taken in ensuing years to see how much the beetles are affecting the loosestrife. Larvae demolish flower buds and as their numbers build there should be less and less purple on the site at this time. Put a marker on the spot

where you take the picture so later shots will be comparable. This is the surest way for you to gauge your success with biological control! Send in a copy of site photos when they are available.

New adults feed on leaves for a few weeks, but disappear around mid-August to over-winter in the leaf litter near host plants or in surrounding uplands. They and their feeding damage are often difficult to find then, but look carefully and you may see them when you return to collect pots or take photos. The best time to see beetles is in early spring.

If you have any questions, comments or suggestions about this process, want to send site or release information or would like information on how to join the program, please write or call the Purple Loosestrife Bio-control Project, Wisconsin DNR, 1350 Femrite Dr., Monona, WI 53716; woodsb@dnr.state.wi.us; 608-221-6349.

# Materials for Rearing 100 *Galerucella* Beetles

Note: This is an exhaustive list and you may not need, or need to purchase, all items. Some can often be gotten for free, such as pots from landscape businesses or school lunch programs (need holes drilled).

**Collecting Roots**

1. Plant ID book--**if** you need one to be sure of which species you have. A great reference book with many photos is *Wetland Plants and Plant Communities of Minnesota and Wisconsin* by Eggers and Reed (1997). Cost is $15. Most wildflower books will have at least some wetland species.
2. Map(s) to location of source of loosestrife roots and beetle release sites--Use a good local map. The best written resource for finding sites is free on the web where GLIFWC has put up all the Wisconsin DNR and their own information on loosestrife locations: ***www.glifwc-maps.org***.
3. Colored flagging--to mark plants for later root excavations
4. Filled out, signed, copied and mailed Wisconsin DNR permit letter
5. Shovel and/or fork--for digging roots and modifying their sizes and shapes for potting
6. Plastic tubs (Rubbermaid type) or other carrying containers--for hauling roots and waste
7. Pruning shears--to cut off old dead stem tops and root tips, if necessary
8. Gloves and eye protection, rubber boots and old clothes--old loosestrife stems are nasty and wetlands are wet, muddy places and very cold in early spring

**Potting Roots and Growing Plants**

9. *25 yards of no-see-um insect netting, thread and sewing machine to make 11 net sleeve cages (about 80 inches long and 26 inches wide). Fold each piece of fabric along the short side (~54 inches) and sew up the open long seam, tapering your cage to the diameter of your pots. Easy.
10. *Duct tape and/or elastic cords (bungee) to attach cages firmly to pots
11. Wire or string--tie cage tops shut and to supports, tie cage bottoms to pots and guy support posts
12. 12 BIG purple loosestrife roots from the wet end of a local wetland
13. *12 plastic pots, 10 to 14 inches in diameter
14. *About 2.5 cubic feet (less if roots are bigger!) of high peat content potting soil (Fafard mix or something similar)
15. *1 pound of fertilizer, slow release type like Osmocote 18-6-12
16. Hose and water source--for rinsing roots, wetting soil and filling pools
17. 7 foot high cage support system for suspending tops of net cages--Simple clotheslines, or posts from conduit, wood, pipe, etc. that support lines or rigid cross members. Lots of possibilities.
18. *2 4-foot or 1 5-foot foot child's pool (or other suitable containers-tubs from above?)
19. About 6' by 8' of space in full sun or behind south facing windows
20. Dependable watering system--students, friends, the dog, etc.

**Adding and Growing Beetles**

21. *100+ over-wintered beetles--from Wisconsin DNR or field collected or from other supplier --see reverse. Possible field collection sites may soon be put on GLIFWC's web site.
22. *Aspirator--for catching and moving beetles. Simple to make it or a short-term facsimile, such as a cloth over the end of a straw large enough to take in a beetle. Or order--see reverse, with picture.
23. Heavy duty transportation-- for taking potted plants into the field. Try to get field hands along with it by teaming up with a community partner, such as a lake association!
24. Site release form filled out and mailed to WISCONSIN DNR on the day of release
25. 2-11 PVC posts--for marking release site(s) and photo point (camera)
26. Camera and film

***Critical higher cost item Wisconsin DNR may be able to supply free or at low cost**

**Where to Get Some Hard to Find Materials for Starting a Bio-Control Program**

***Beetles for rearing (or field release in July-August)****: (Call or write for details)*

- Cornell University, 607-275-3786. (from New York State - minimum # to order)
- Beetles Unlimited, 608-831-5601.
  13 Winterset Circle, Madison, WI 53717 (from Wisconsin - no minimums)

***Insect Netting: (need~80 in. of fabric/cage) (Wisconsin DNR supplies free w/3 year rearing)***

| | |
|---|---|
| Venture Textiles<br>115 Messina Drive<br>Baintree, MA 02185<br>(781) 794-1400 | White or slate; 500 yd. bolt is $1.10/yd.; lesser yardage is $1.10/yard plus $10 cut chg |
| Seattle Fabrics, Inc.<br>Attn: Karen Christianson<br>8702 Aurora Avenue North<br>Seattle, WA 98103<br>(206) 525-0670<br>fax: (206) 525-0779 | White, 54 inches wide, $2.25 /yard for 500+ yds; $2.50 for 100+; $2.75 for 1-99 |

***Madison Area Seamstress****:* (in case you can't sew sleeves yourself*)*

Sleeves made with **your** fabric -- $6 (no drawstrings), $10 (with 1 drawstring), $12 (with 2 drawstrings). Prices may change without notice.

Sew What? Attn: Lynn Messinger
213 S. 5th Street
Mt. Horeb, WI 53572
(608) 437-4171

***Various Other Supplies: (most from local greenhouse or discount market)***

*Aspirators (a small jar with hoses for collecting/moving beetles)*

BioQuip
17803 La Salle Avenue
Gardena, CA 90248
(310) 324-0620
fax: (310) 324-7931

***Videos:***

- "Restoring the Balance: Biological Control of Purple Loosestrife" – a summary of the problem, traditional and biological solutions.

- "Rearing of Biological Control Agents for Purple Loosestrife" – more rearing detail.

$25 each (volume discounts apply).
(**Your local and school libraries can also get these on inter-library loan from Wisconsin DNR library in Madison for free!**)

Resource Center
7 Business & Technology Park
Cornell University
Ithaca, NY 14850
(607) 255-7660, ext. 2090
Fax: (607) 255-9946

# Appendix M

Red Cedar Lakes EWM Rapid Response Plan

# EWM Rapid Response Plan for the Red Cedar Lakes, Barron and Washburn Counties, Wisconsin

## Monitoring

Continuous monitoring of the lake and the public access points for the presence of EWM will be completed by trained Red Cedar Lakes Association (RCLA) volunteers, Citizen Lake Monitoring Network (CLMN) volunteers, watercraft inspectors, and others. RCLA volunteers will patrol the shorelines of Balsam, Mud, Red Cedar, and Hemlock Lakes at least three times annually from May through October. In-lake inspection at all boat access sites will be completed at least once a month from May through October by RCLA, CLMN, and other lake volunteers. Volunteers completing any monitoring will collect suspicious plants and document where they were found. Suspicious plants will be submitted to designated RCLA personnel, this consultant, Barron or Washburn County AIS representatives, or the WDNR for vouchering.

## Specimen Vouchering

Volunteers are asked to collect at least two samples of the suspicious plant including roots if possible and place them in a zip-lock bag marked with the date, time, and location in the lake where it was found. The samples should be kept refrigerated until they can be submitted to one of the following appropriate personnel:

| | |
|---|---|
| Red Cedar Lakes Association | |
| Larry Johnson | 715.205.5144 |
| Gerry Johnson | 715.354.7061 |
| Mark Kuula | 715.986.2484 |
| RCLA AIS Coordinator | |
| | |
| SEH | |
| Dave Blumer, Lake Scientist | 715.861.4925 |
| Jake Macholl, Lake Scientist | 715.861.1944 |
| | |
| Barron County Soil and Water Conservation Department | |
| Tyler Gruetzmacher, County Conservationist | 715.537.6315 |
| | |
| Washburn County Soil and Water Conservation Department | |
| Lisa Burns, County AIS Coordinator | 715.468.4654 |
| | |
| Wisconsin Department of Natural Resources | |
| Jim Cahow, Water Resources Biologist - Barron | 715.637.6863 |
| Kris Larsen, AIS Specialist - Spooner | 715.635.4072 |
| Pamela Toshner, Lakes Coordinator - Spooner | 715.635.4073 |
| Alex Smith, Critical Habitat Coordinator - Spooner | 715.635.4124 |
| Jim Kreitlow, Lakes Coordinator – Rhinelander | 715.365.8947 |

## Positive Identification

If EWM is positively identified in the Red Cedar Lakes, the WDNR and RCLA volunteers will install EWM warning signs at all private and public access points. Aquatic plant management, if any is occurring in the area where EWM was identified, will immediately cease until arrangements can be made for the completion of an intensive search for EWM in the immediate and nearby area in which it was found. If a sizable area of EWM is identified, EWM buoy markers will be placed in the lake to keep boaters out of the infested area until management can be undertaken.

## APM Plan Modification

If EWM is identified in the lakes, the existing plant management plan will need to be modified to include the treatment of EWM. An evaluation will be completed to determine and implement the most effective short-term management option. If necessary, a WDNR AIS Early Detection and Response grant will be applied for to help implement recommendations made in the modified plan. Either in the same year or the year immediately following the new identification, a whole-lake plant survey will be completed to again look for EWM. A complete EWM control plan will be added to the next revision of the existing APM Plan.

## AIS Activity Funding

The RCLA collects annual dues from its members. If these monies are not enough to cover the cost of an EWM treatment program, the RCLA will seek donations from its constituency and benefactors, undertake fundraisers and apply for an AIS Rapid Response and Early Detection grant to obtain appropriate funds. AIS Rapid Response and Early Detection grants can be applied for at any time as they are not subject to pre-determined application dates. Up to $20,000.00 is available for management implementation and planning activities.

# Appendix N

Excerpts from 2009 Beaver Creek Reserve AIS Study

Written by Anna Mares
November 23, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

# Hemlock Lake (Waterbody Identification Code # 2109800)

Barron County (T36N R10W S27 SE ¼ SE ¼)

## Dates of Survey

Hemlock Lake was surveyed on June 15, July 14, and August 6, 2009

## Boat Launch

There is one public boat launch on the south side of Hemlock Lake (1), and is accessible from 28 ½ Street. It is maintained by Barron County and requires no fees. The launch is paved to sand/gravel. There is a wooden dock, parking for six vehicles with trailers and there are no restrooms. “Stop and remove” and “Help prevent” signs were present.

## Native Plant List*

| Common Name | Scientific Name |
|---|---|
| Water marigold | *Bidens beckii* |
| Marsh calla | *Calla palustris* |
| Coontail | *Ceratophyllum demersum* |
| Needle spikerush | *Eleocharis acicularis* |
| Creeping spikerush | *Eleocharis palustris* |
| Common waterweed | *Elodea canadensis* |
| Pipewort | *Eriocaulon aquaticum* |
| Northern St. John's wort | *Hypericum boreale* |
| Northern blue flag | *Iris versicolor* |
| Lesser duckweed | *Lemna minor* |
| Forked duckweed | *Lemna trisulca* |
| Various-leaved water milfoil | *Myriophyllum heterophyllum* |
| Nitellas | *Nitella sp.* |
| Bullhead pond lily | *Nuphar variegata* |
| White water lily | *Nymphea odorata* |
| Large-leaf pondweed | *Potamogeton amplifolius* |
| Ribbon-leaf pondweed | *Potamogeton epihydrus* |
| Floating leaf pondweed | *Potamogeton natans* |
| White-stem pondweed | *Potamogeton praelongus* |
| Small pondweed | *Potamogeton pusillus* |
| Clasping-leaf pondweed | *Potamogeton richardsonii* |
| Fern pondweed | *Potamogeton robbinsii* |
| Narrowleaf pondweed | *Potamogeton sp.* |
| Flat-stem pondweed | *Potamogeton zosteriformis* |

Written by Anna Mares
November 23, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

| Common Name | Scientific Name |
|---|---|
| Stiff water crowfoot | *Ranunculus longirostris* |
| Slender riccia | *Riccia fluvitans* |
| Stiff arrowhead | *Sagittaria rigida* |
| Common bur-reed | *Sparganium eurycarpum* |
| Great duckweed | *Spirodela polyrhiza* |
| Broad-leaved cattail | *Typha latifolia* |
| Bladderwort sp. | *Utricularia sp.* |
| Common bladderwort | *Utricularia vulgaris* |
| Wild celery | *Vallisneria americana* |
| Common watermeal | *Wolffia columbiana* |

*Plant list is not comprehensive and contains only those species observed on 06/15/2009

The plants present in a lake can reflect the water quality and level of disturbance in a lake which can be measured using the Floristic Quality Index (FQI) of Wisconsin. The state average FQI is 22.2, but it can range from 3.0 to 44.6, with higher FQI values correlating to greater lake quality (UWEX, 2009). Hemlock Lake was found to have an approximate (two plants were not keyed to species and two were not listed in the FQI) FQI value of 33.77, higher than the state average.

**Invasive Species**

One invasive plant, *Potamogeton crispus*, was found in Hemlock Lake during the 2009 field season. *P. crispus* had not been documented in Hemlock Lake until this survey. A voucher specimen was collected. *P. crispus* was found in 16 of 21 transects used for sampling aquatic plants placed at 1,500 ft intervals around the perimeter of the lake.

No spiny waterflea or zebra mussel veligers were detected during the three summer samplings. Rusty crayfish were detected from the August 6, 2009 sampling. Rusty crayfish have not been documented for Hemlock Lake and a voucher specimen has been sent in. One invasive species of snail, the Chinese mystery snail, was found in Hemlock Lake.

Written by Anna Mares
November 23, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

## Secchi Disk Readings

Readings stayed relatively steady through out the summer. All GPS points were collected in the NAD 83 Central Datum.

| | GPS (UTMs) | June 15, 2009 | July 14, 2009 | August 6, 2009 |
|---|---|---|---|---|
| Site #1 | 15T 0612536 5047301 | 8.5 ft | 3.25 ft | 3.0 ft |
| Site #2 | 15T 0611370 5046812 | 8.75 ft | 4.75 ft | 3.25 ft |
| Site #3 | 15T 0612055 5047231 | 8.75 ft | 4.0 ft | 3.0 ft |

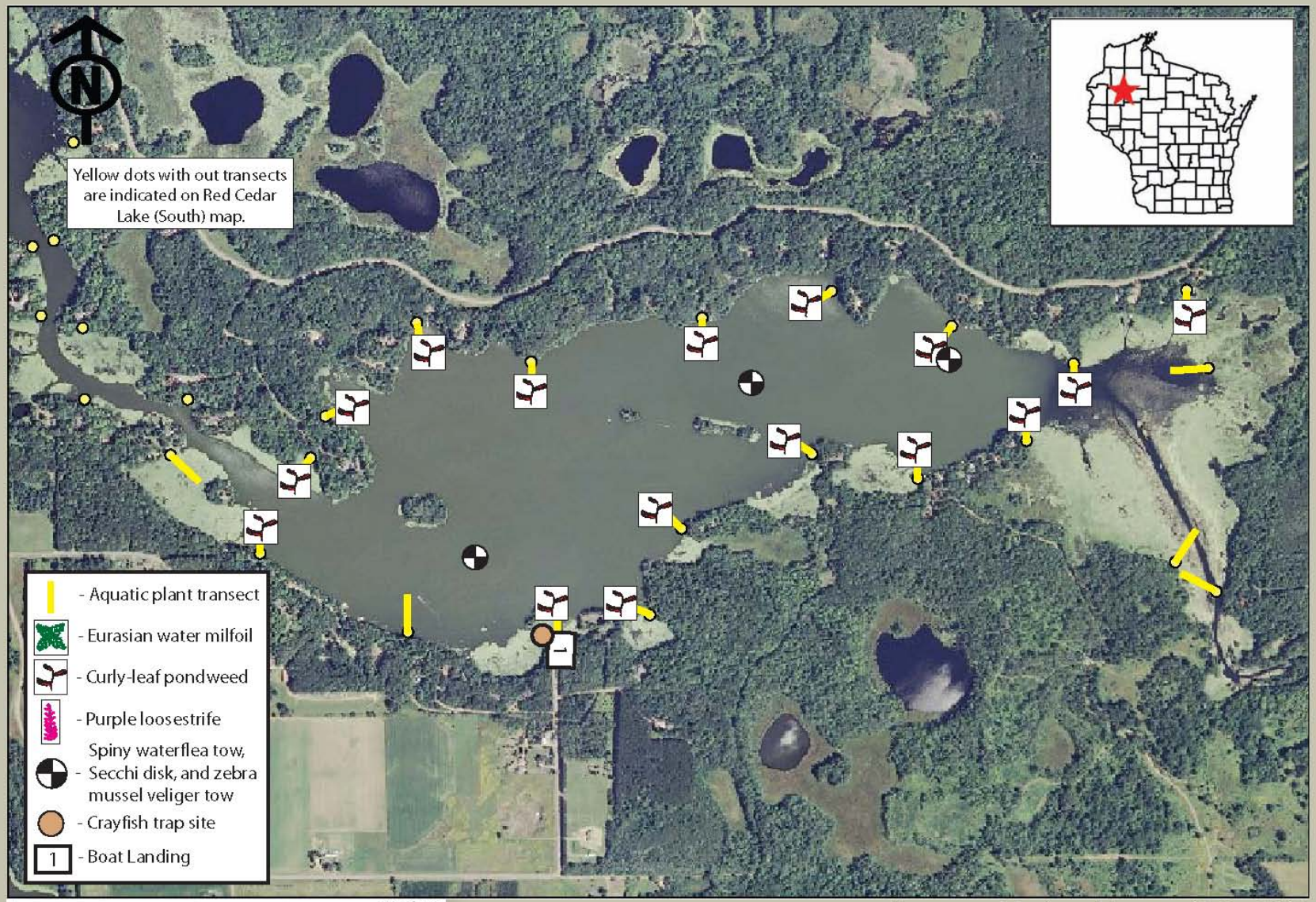
## Lake and Shoreline Conditions

There were no apparent water level fluctuations from the normal water level. Roughly 40% of the shoreline is developed. Homes on Hemlock Lake tend to be set further back in the woods than those on Red Cedar Lake. Most of the homes have excellent buffers. Hemlock Lake has one of the largest plant lists out of all of the lakes surveyed under this project with 34 native plants. It may be important to monitor the aquatic plant community to watch for changes due to the presence and possible spread of *P. crispus*, which could out-compete native species, possibly lowering the FQI of Hemlock Lake.

Aquatic Invasive Species Survey of

# Hemlock Lake, Barron County

Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson on June 15, July 14, and August 6, 2009




Map created by Anna Mares on 05-Oct-2009
Beaver Creek Reserve

Written by Anna Mares
November 17, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

# Red Cedar Lake (Waterbody Identification Code # 2109600)

Barron County (T36N R10W S21 SE ¼ NE ¼)

## Dates of Survey

Red Cedar Lake was surveyed on June 11, July 14, and August 6, 2009

## Boat Launch

Red Cedar Lake has three boat launches, corresponding to those on the map by number. The first boat launch (1) is at the Barron County Park on the northwest side of the lake. It has a paved turnaround, pit toilets, and parking along the roadside. The launch is a cement pad with two wooden docks. No fee is required for launching there. There are "Help Prevent" and "Stop and Remove" signs. Video surveillance is being used at this landing to ensure that boaters are removing aquatic plants from their trailers before and after entering the water. The second boat launch (2) is in the middle section of the lake on the east side. It is an unimproved launch with a sand/gravel pad and a dock. There is one parking stall. No fee is required. Pit toilets for men and women are available. Signs for "VHS Alert" (viral hemorrhagic septicemia) and Barron County Ordinances were present. The third launch (3) is also in the middle section of the lake but on the west side, accessible from State Hwy 48. It is adjacent to the Stout Island drop off and pick-up lot. It is an unimproved launch of sand/gravel with no dock. There are no fees or restrooms. Space is available for two vehicles with trailers along the side of the launch. VHS Alert, "Stop and Remove," "Help Prevent," and Barron County Ordinances signs were present at the launch. Overflow parking in the Stout Island parking lot is prohibited.

## Native Plant List*

| Common Name | Scientific Name |
|---|---|
| Water Marigold | *Bidens beckii* |
| Marsh Calla | *Calla palustris* |
| Coontail | *Ceratophyllum demersum* |
| Three-way Sedge | *Dulichium arundinaceum* |
| Common Waterweed | *Elodea canadensis* |
| Pipewort | *Eriocaulon aquaticum* |
| Quillworts | *Isoetes sp.* |
| Northern Blue Flag | *Iris versicolor* |
| Lesser Duckweed | *Lemna minor* |
| Forked Duckweed | *Lemna trisulca* |
| Northern Water Milfoil | *Myriophyllum sibiricum* |

Written by Anna Mares
November 17, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

| **Common Name** | **Scientific Name** |
|---|---|
| Bullhead Pond Lily | *Nuphar variegata* |
| White Water Lily | *Nymphea odorata* |
| Large-leaf Pondweed | *Potamogeton amplifolius* |
| White-stem pondweed | *Potamogeton praelongus* |
| Fern Pondweed | *Potamogeton robbinsii* |
| Flat-stem Pondweed | *Potamogeton zosteriformis* |
| White water crowfoot | *Ranunculus trichophyllus* |
| Arrowhead | *Sagittaria sp.* |
| Hardstem bulrush | *Scirpus acutus* |
| Great duckweed | *Spirodela polyrhiza* |
| Broad-leaved Cattail | *Typha latifolia* |
| Common Bladderwort | *Utricularia vulgaris* |
| Bladderwort | *Utricularia sp.* |
| Wild Celery | *Vallisneria americana* |
| Common Watermeal | *Wolffia columbiana* |

*Plant list is not comprehensive and contains only those species observed on 6/11/2009

The plants present in a lake can reflect the water quality and level of disturbance in a lake which can be measured using the Floristic Quality Index (FQI) of Wisconsin. The state average FQI is 22.2, but it can range from 3.0 to 44.6, with higher FQI values correlating to greater lake quality (UWEX, 2009). Red Cedar Lake was found to have an approximate (as a full plant survey was not conducted) FQI value of 30.82, higher than the state average.

## Invasive Species

One invasive plant, *Potamogeton crispus*, was found in Red Cedar Lake during the 2009 field season. *P. crispus* has already been documented for Red Cedar Lake. It was found at 22 of 56 transects used for plant sampling set at 1,500 ft intervals around the perimeter of the lake. *P. crispus* was heavy in the northern bay near Bass Lake.

No spiny water flea or zebra mussel veligers were detected during the three summer samplings. Rusty crayfish were detected from the August 6, 2009 sampling. They have already been documented in Red Cedar Lake. One species of invasive snail, the Chinese mystery snail, was found in Red Cedar Lake. This is a new invasive species for Red Cedar Lake.

Written by Anna Mares
November 17, 2009
Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson

**Secchi Disk Readings**

Readings stayed relatively steady through out the summer. All GPS points were collected in the NAD 83 Central Datum.

| | GPS (UTMs) | June 11, 2009 | July 14, 2009 | August 6, 2009 |
|---|---|---|---|---|
| Site #1 | 15T 0609902 5049258 | 9.25 ft | 9.5 ft | 11.5 ft |
| Site #2 | 15T 0609680 5051359 | 8.5 ft | 13.75 ft | 11.0 ft |
| Site #3 | 15T 0609519 5052911 | 9.5 ft | 13.75 ft | 12.25 ft |

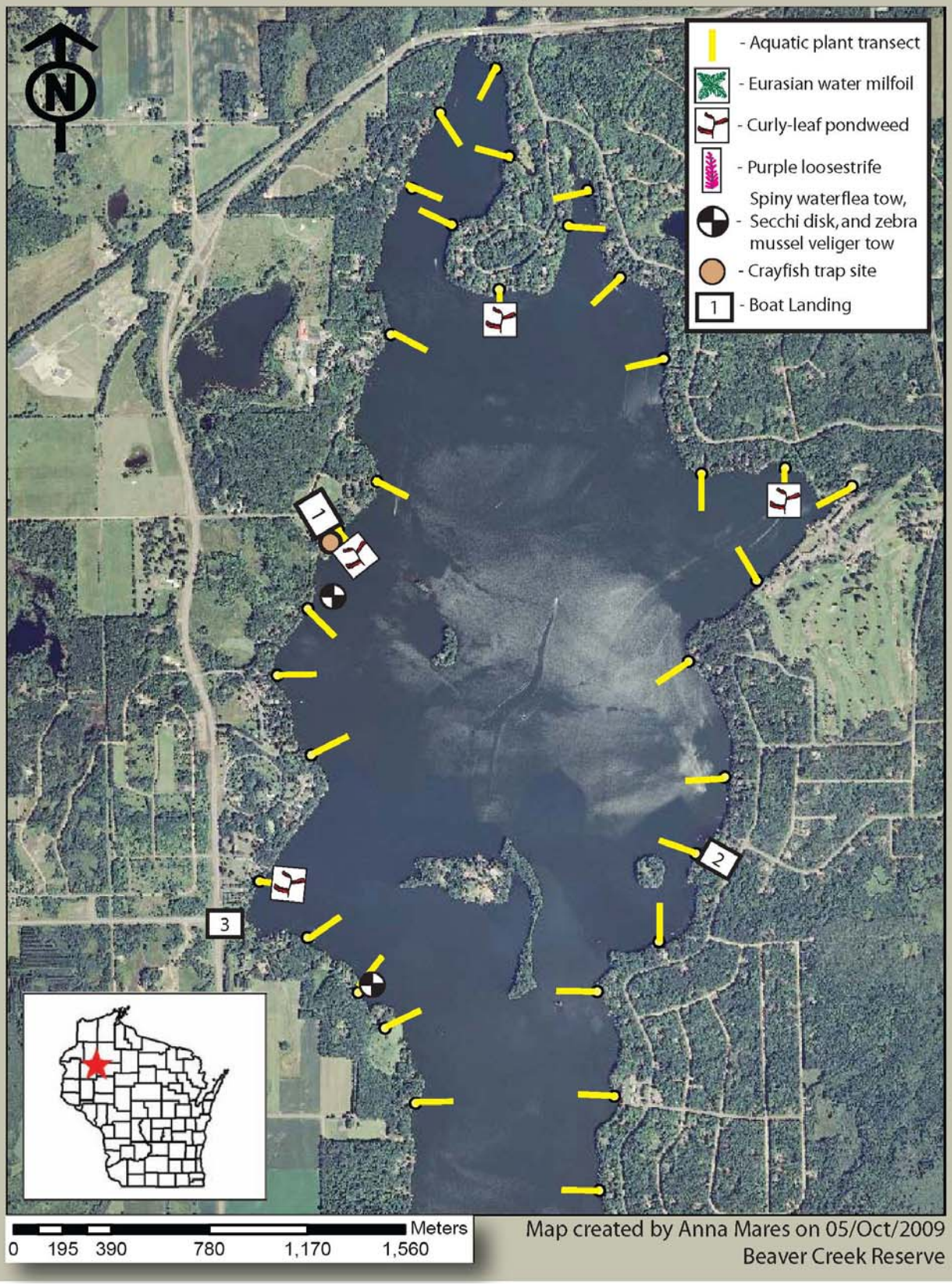
**Lake and Shoreline Conditions**

The water level appeared to be 3-4 inches lower than normal. The shoreline vegetation is approximately 90% deciduous and 10% coniferous. Around 80% of the lake is developed with homes. In general the lake homes have good buffers. It is encouraged to have 30 ft of buffer before the water's edge. The shoreline is mostly rocky with some sandy spots

Aquatic Invasive Species Survey of

# Red Cedar Lake (North), Barron County

Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson on June 11, July 14, and August 6, 2009

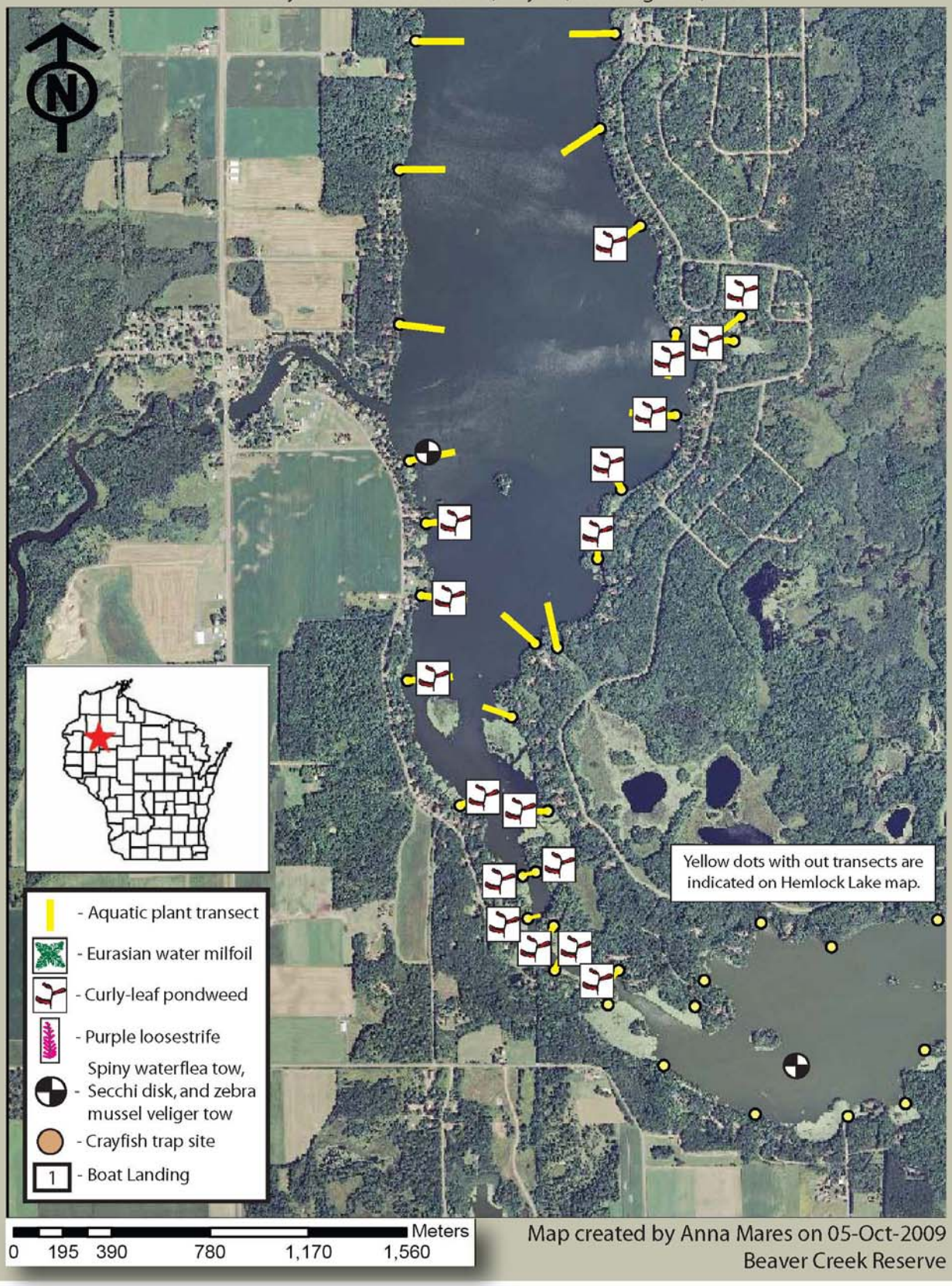



Map created by Anna Mares on 05/Oct/2009
Beaver Creek Reserve

Aquatic Invasive Species Survey of

# Red Cedar Lake (South), Barron County

Data collected by Anna Mares, Zoe Hastings, Ted Ludwig, Jenny Pomeroy, Larry Johnson, and Gerry Johnson on June 11, July 14, and August 6, 2009




Map created by Anna Mares on 05-Oct-2009
Beaver Creek Reserve