

**Aquatic Vegetation of Murphy Lake
Scott County, Minnesota
(DOW 70-0010-00)
June 21, 2004**



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Summary

Murphy Lake is an example of a shallow lake with relatively high water clarity and abundant native vegetation. Unlike most lakes within the Twin Cities metropolitan area, Murphy Lake shoreline is primarily forested and is undeveloped. An un-interrupted stand of floating-leaf plants rings the lake and submerged plants grow to a depth of 16 feet. Although the exotic plant, curly-leaf pondweed (*Potamogeton crispus*) has been identified in this lake, it remains a minor part of the plant community. The extensive stands of native vegetation may help prevent curly-leaf pondweed from dominating this lake.

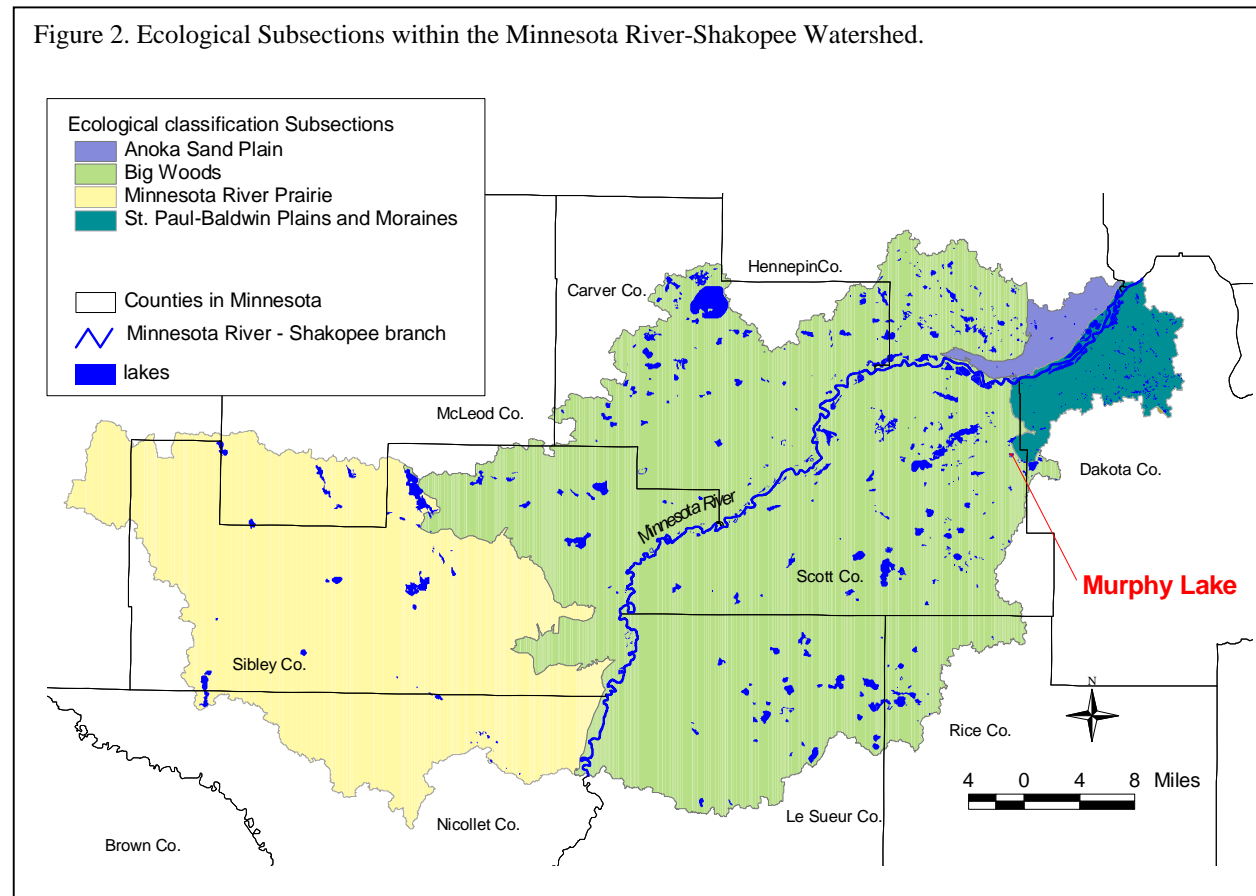
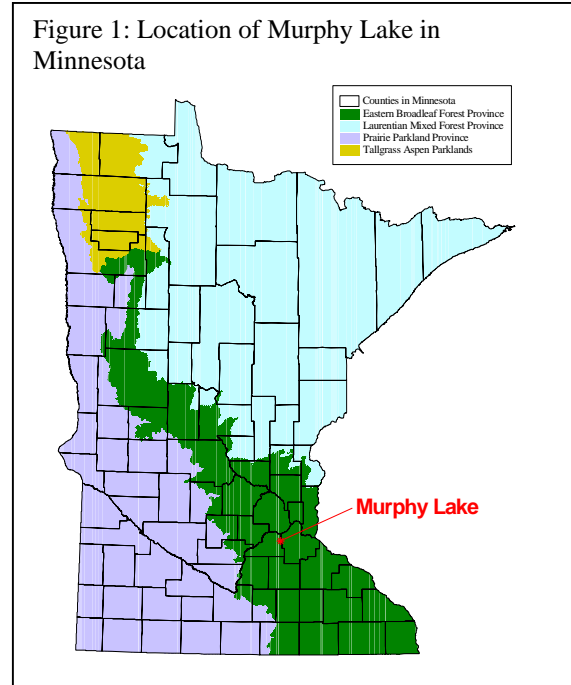
Introduction

Survey Lake Description

Murphy Lake (DOW 40-0051-00) is located about six miles southwest of the city of Shakopee in Scott County, Minnesota. It occurs within the ecological region known as the [Eastern Broadleaf Forest Province](#) (Fig. 1).

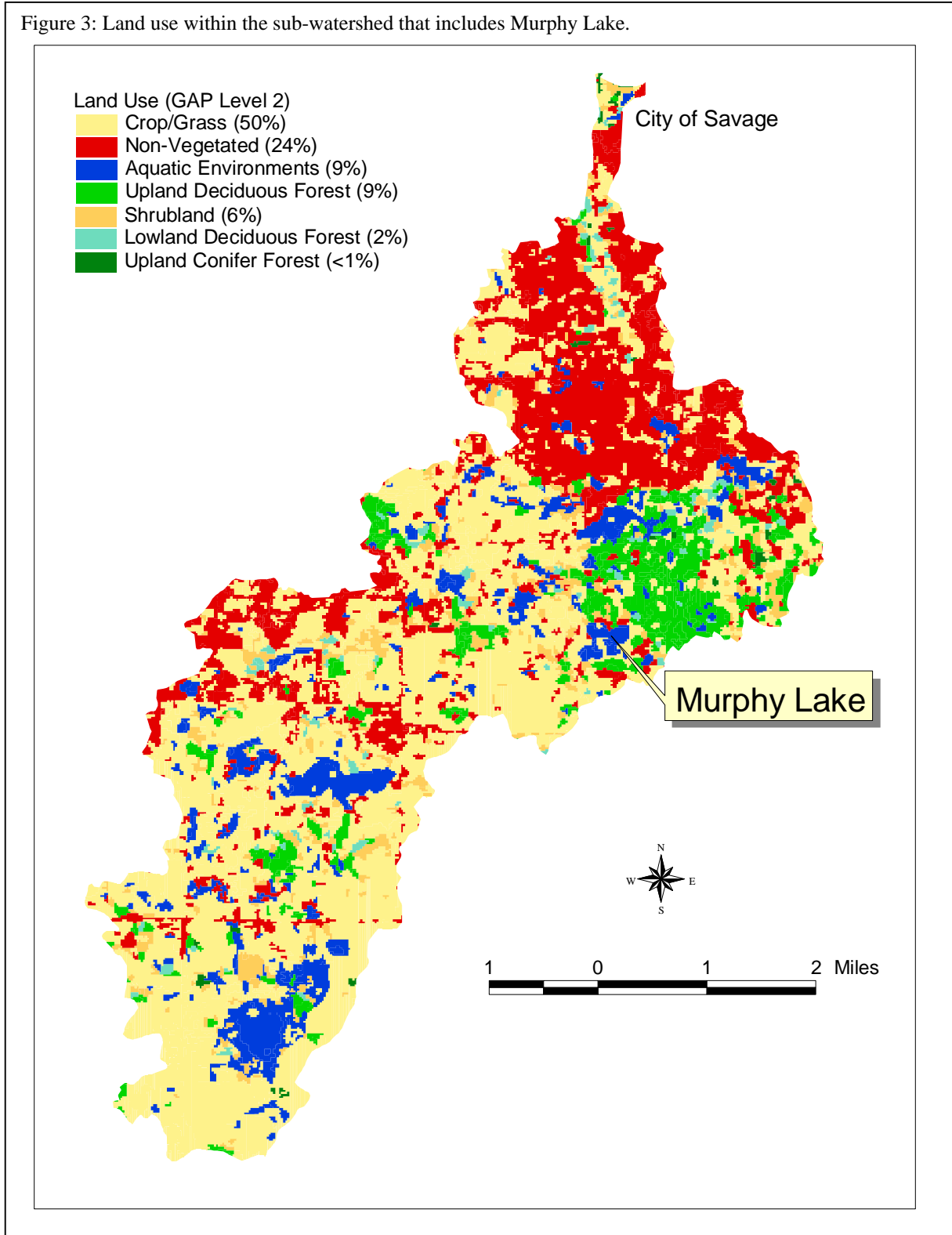
The lake lies within the Minnesota River – Shakopee Watershed. Murphy Lake is primarily land-locked and is located to the southeast of the Minnesota River, which drains the watershed to the south (Fig. 2).

This watershed includes four different ecological subsections and Murphy Lake occurs at the eastern edge of the [Big Woods](#) subsection (Fig. 2). The Big Woods was once dominated by oak woodland and maple-basswood forest, but today most of the land has been converted for urban

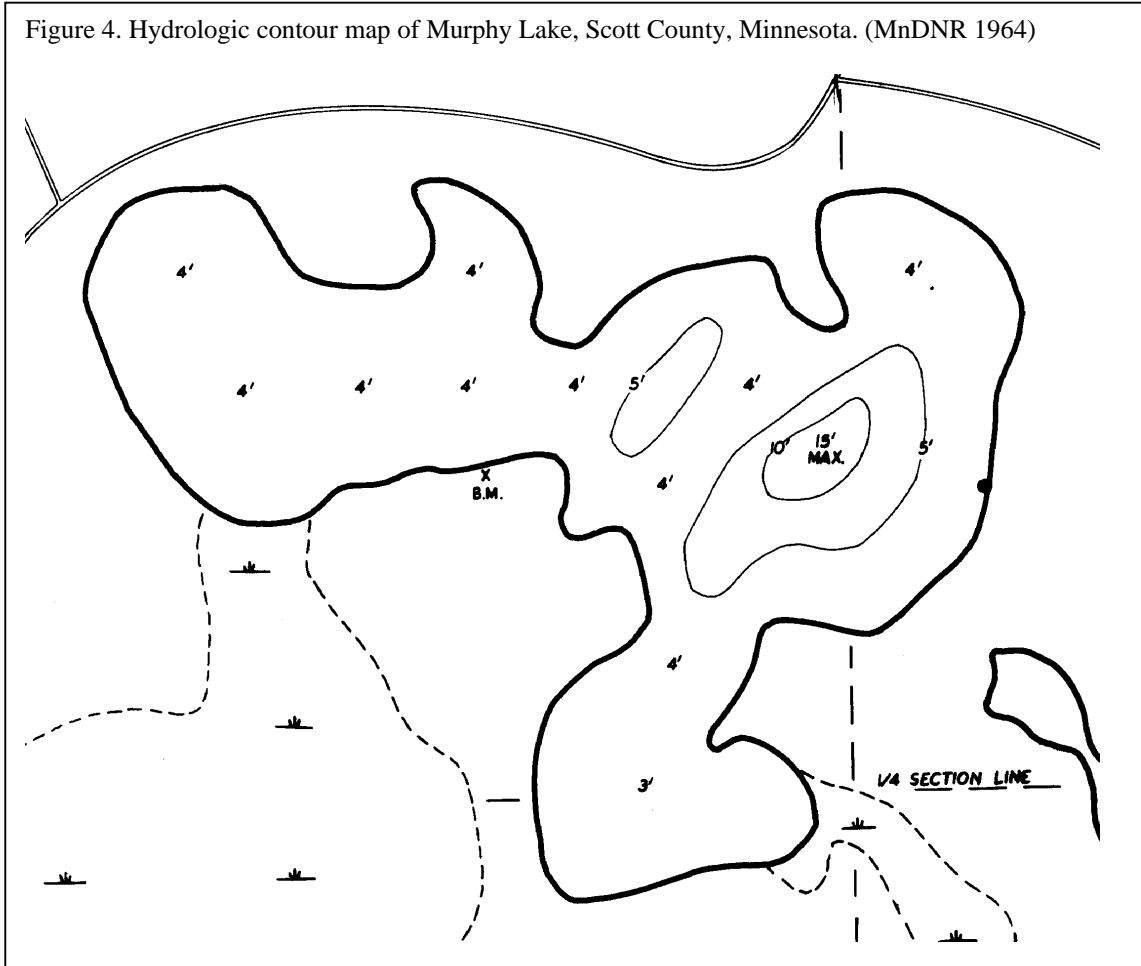


development or agricultural land. Within the sub-watershed that includes Murphy Lake, nearly two-thirds is no longer covered by native vegetation. However, there are several tracts of upland deciduous forest that border Murphy Lake (Fig. 3).

Figure 3: Land use within the sub-watershed that includes Murphy Lake.



Murphy Lake is a relatively small (70 acres) lake with a maximum depth of 21 feet (recorded in 2004) but at least 90 percent of the lake less than 15 feet deep (Fig. 4). The lake is described as mesotrophic (moderate nutrients) with high water clarity as indicated by the 1996 mean summer Secchi depth of 10 feet (MPCA 2003).



Murphy Lake is located within the Murphy-Hanrehan Park Reserve of Scott County. The lakeshore is primarily undeveloped and forested. A road runs along the north end of the lake and a public access is located on the northwest bay.

Vegetation Survey Objectives

The purpose of the 2004 survey of Murphy Lake is to describe the current aquatic plant community including:

- 1) Estimate the maximum depth of rooted vegetation
- 2) Estimate the percent of the lake occupied by rooted vegetation
- 3) Record the aquatic plant species that occur in the lake
- 4) Estimate frequencies of occurrence of individual species
- 5) Develop maps of the distribution of the common species

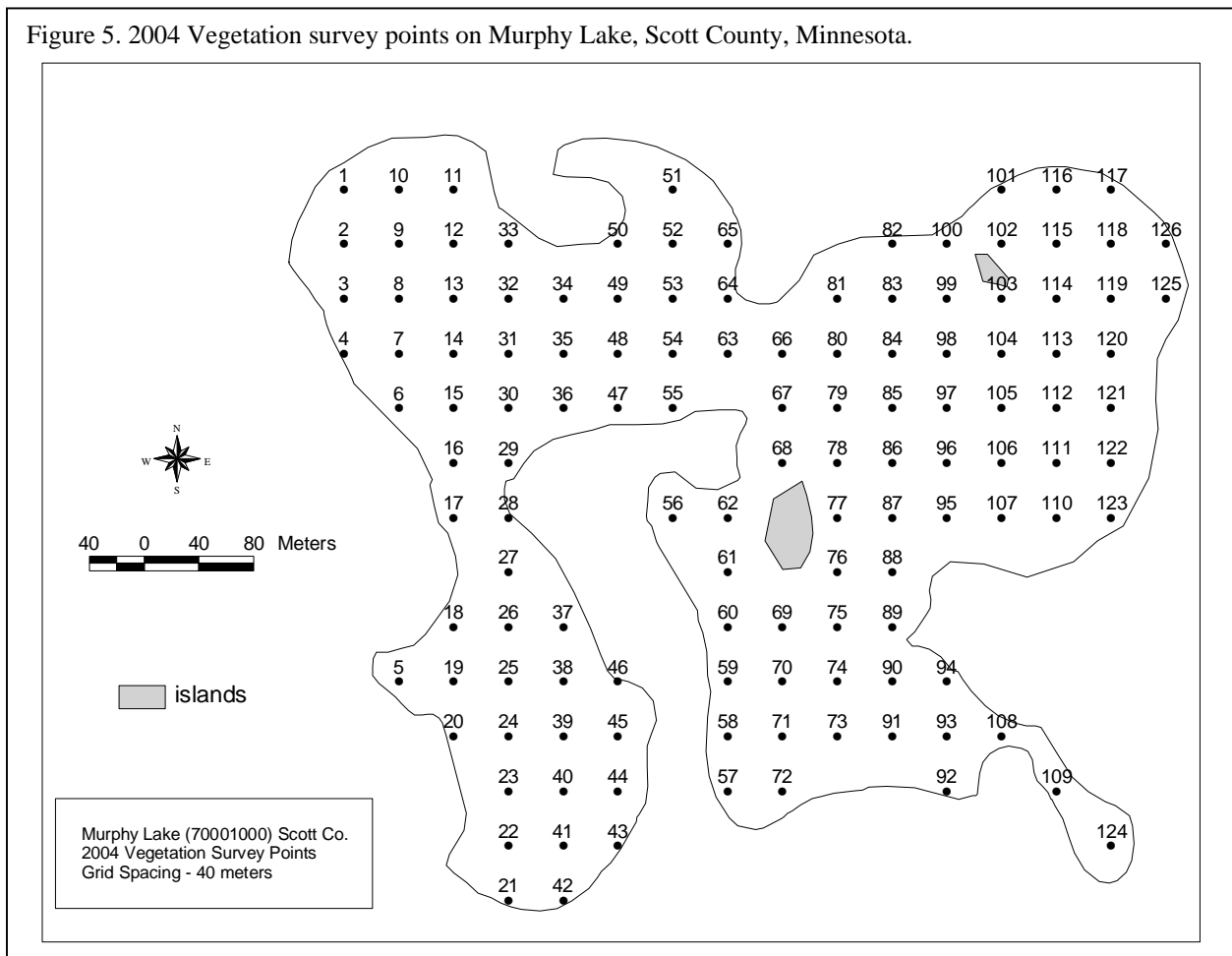
Data from the 2004 vegetation surveys can be used to monitor annual changes in the native and exotic plant species composition and may also be used to guide vegetation management decisions.

Methods

Point-Intercept Survey

A Point-Intercept vegetation survey of Murphy Lake was conducted on June 21, 2004 following the methodology described by Madsen (1999). At a minimum, we wanted to sample 100 points within the vegetated zone and place sample point no further than 100 meters apart for mapping purposes. Sample points were established in using ArcView GIS program using a 40 meter by 40 meter grid across the lake surface (Fig. 5). A total of 122 points were sampled.

Figure 5. 2004 Vegetation survey points on Murphy Lake, Scott County, Minnesota.



Survey waypoints were created and downloaded into a Garmin GPS. The GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded in one foot increments using a measured stick in water depths less than eight feet and an electronic depth finder in water depths greater than eight feet. The surveyors recorded all plant species found within a one meter squared sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface. If curly-leaf pondweed (*Potamogeton crispus*) was present at a site, surveyors recorded whether or not it formed surface mats at that site.

Figure 6. Rake used to sample vegetation.



Nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for most plant species.

Data were entered into a Microsoft Access database and frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites.

$$\text{Frequency} = \frac{\text{number of sites in which species occurred}}{\text{Total number of sample sites}}$$

Example:

There were 121 sample sites within the shore to 16 feet zone.

Coontail occurred in 84 of those sample sites.

Frequency of coontail = $84 / 121 = 69$ percent

Frequency was calculated for the entire vegetated zone (0 to 16 feet) and sampling points were also grouped by water depth and separated into five depth zones for analysis: 0 to 5 feet, and 6 to 10 feet, 11 to 15 feet, 16 to 20 feet, and 21 feet.

Plant Bed Delineation

The boundaries of major plant beds were estimated using the results of the point-intercept survey and from review of 2003 aerial photographs. This provides a general estimation of plant bed location and size but detailed mapping of plant beds using GPS was not conducted. A cursory

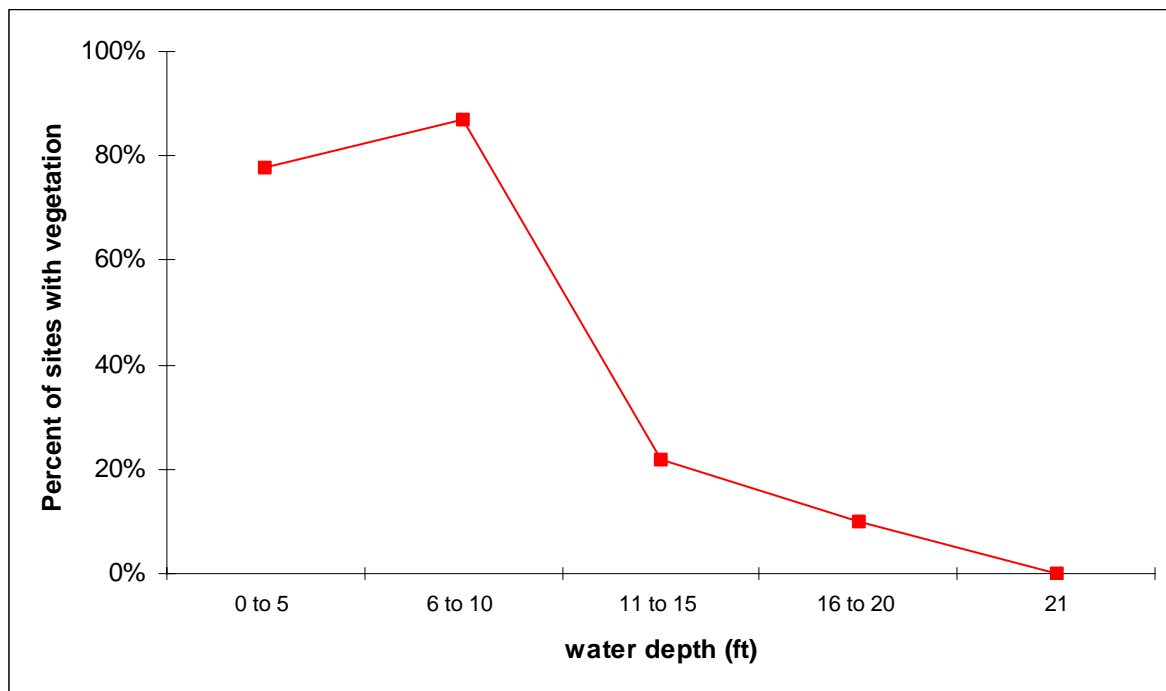
survey of the shoreline was made to record common shoreline emergent plants but a thorough survey for wetland plant species was not conducted.

Results / Discussion

Maximum depth of vegetation and percent of lake with vegetation

Lakewide, 72 percent of the sample sites contained vegetation. Plants were most commonly found to a depth of ten feet, and 85 percent of the sample sites in this zone contained vegetation (Fig. 7). In the depth zone from 11 to 15 feet, 22 percent of the sites were vegetated. (Only two points occurred in depths greater than fifteen feet.)

Figure 7. Plant abundance vs. water depth, Murphy Lake, Scott County, (70001000), June 21, 2004.

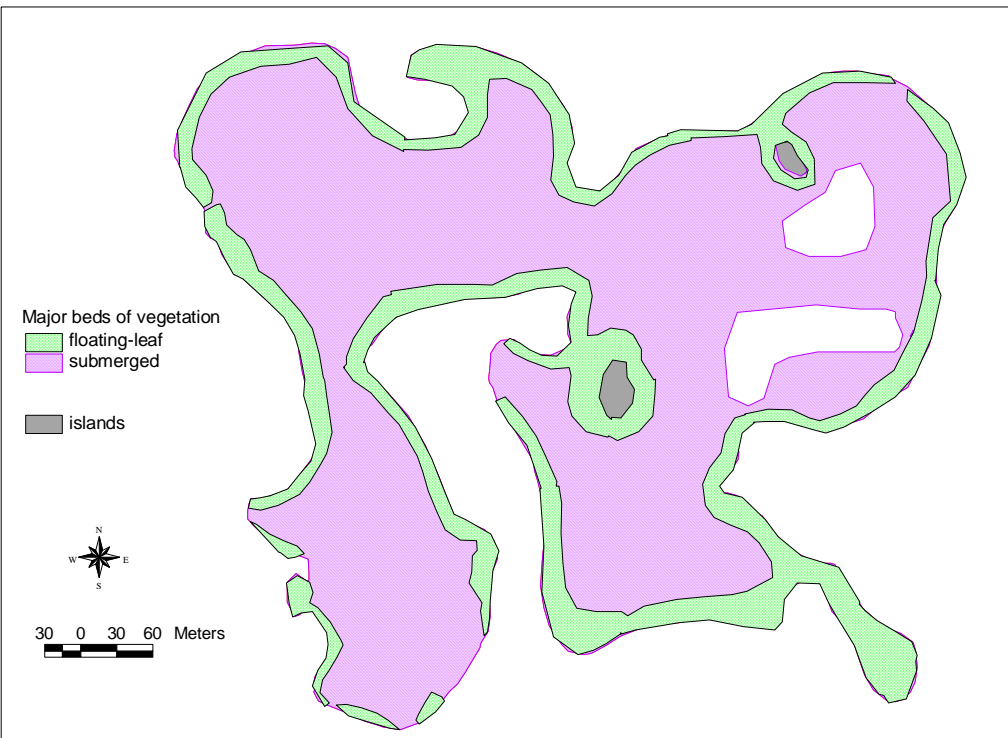


An extensive bed of floating-leaf and submerged plants ringed the entire lake to a depth of about 6 feet and submerged vegetation continued to a depth of 16 feet (Figs. 8 and 9).

Figure 8. Aerial photograph of Murphy Lake (70-0100-00) Scott Co., 2003.



Figure 9. Major plant beds in Murphy Lake (70-0100-00) Scott Co., 2004.



Types of plants found

Ten native species of aquatic plants were recorded including emergent, floating-leaved and submerged (Table 1). The non-native plant, [curly-leaf pondweed](#) (*Potamogeton crispus*) was found at one sample site. Several additional shoreland species were recorded but a thorough survey of wetlands was not conducted.

Table 1. Aquatic Plants of Murphy Lake, Scott County (70-0010-00), June 21, 2004
 Frequency calculated for vegetated zone (shore to 16 feet depth)
 Frequency = percent of sites in which species occurred
 121 sample sites

Life Forms	Common Name	Scientific Name	Frequency
	Coontail	<i>Ceratophyllum demersum</i> (v)	69
SUBMERGED - ANCHORED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are rooted or anchored to the lake bottom.	Robbin's pondweed	<i>Potamogeton robbinsii</i>	42
	Large-leaf pondweed	<i>Potamogeton amplifolius</i>	31
	Flat-stem pondweed	<i>Potamogeton zosteriformis</i> (v)	21
	Canada waterweed	<i>Elodea canadensis</i> (v)	5
	Curly-leaf pondweed	<i>Potamogeton crispus</i> (v)	1
	Stonewort	<i>Nitella sp.</i> (v)	1
FLOATING These plants are rooted in the lake bottom and have leaves that float on the water surface. Many have colorful flowers that extend above the water	Watershield	<i>Brasenia schreberi</i>	14
	White waterlily	<i>Nymphaea odorata</i>	5
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.	Arrowhead	<i>Sagittaria sp.</i>	present
	Bulrush	<i>Scirpus sp.</i>	present
SHORELAND PLANTS	Cattail	<i>Typha sp.</i>	present
	Blue flag iris	<i>Iris versicolor</i>	present*
	Reed canary grass	<i>Phalaris arundinaceae</i>	present

* present indicates plant was found during survey but did not occur within a specific sample site.
 V = voucher specimen collected

Common species their distribution

[Coontail](#) (*Ceratophyllum demersum*) was the most abundant plant found, occurring in 69 percent of the sites within the vegetated zone (Table 1). It occurred to a maximum depth of 15 feet, was the most frequent species at each depth interval (Fig 10) and was evenly distributed around the lake (Fig. 11).

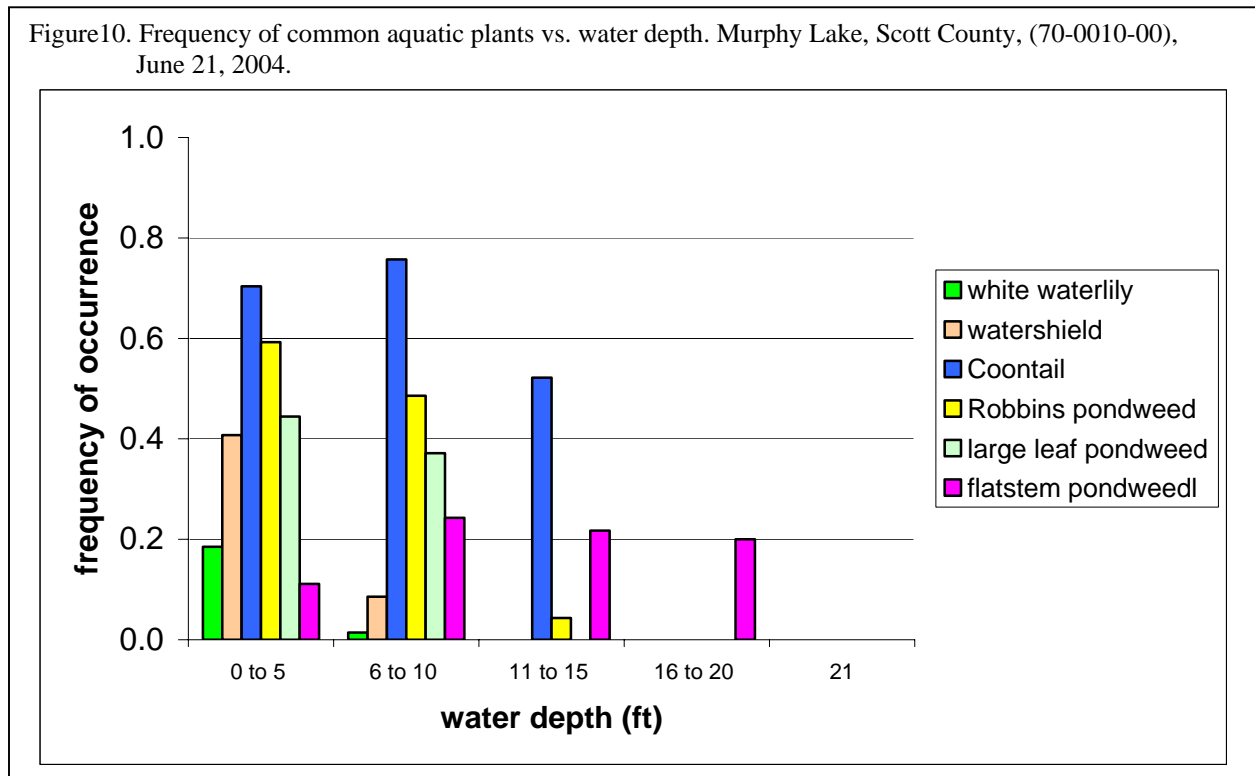
Robbin’s pondweed (*Potamogeton robbinsii*) was found in 42 percent of the sites within the vegetated zone (Table 1). It was also evenly distributed around the lake (Fig. 11) but occurred to a depth of 12 feet and was most common in depths of ten feet and less (Fig. 10).

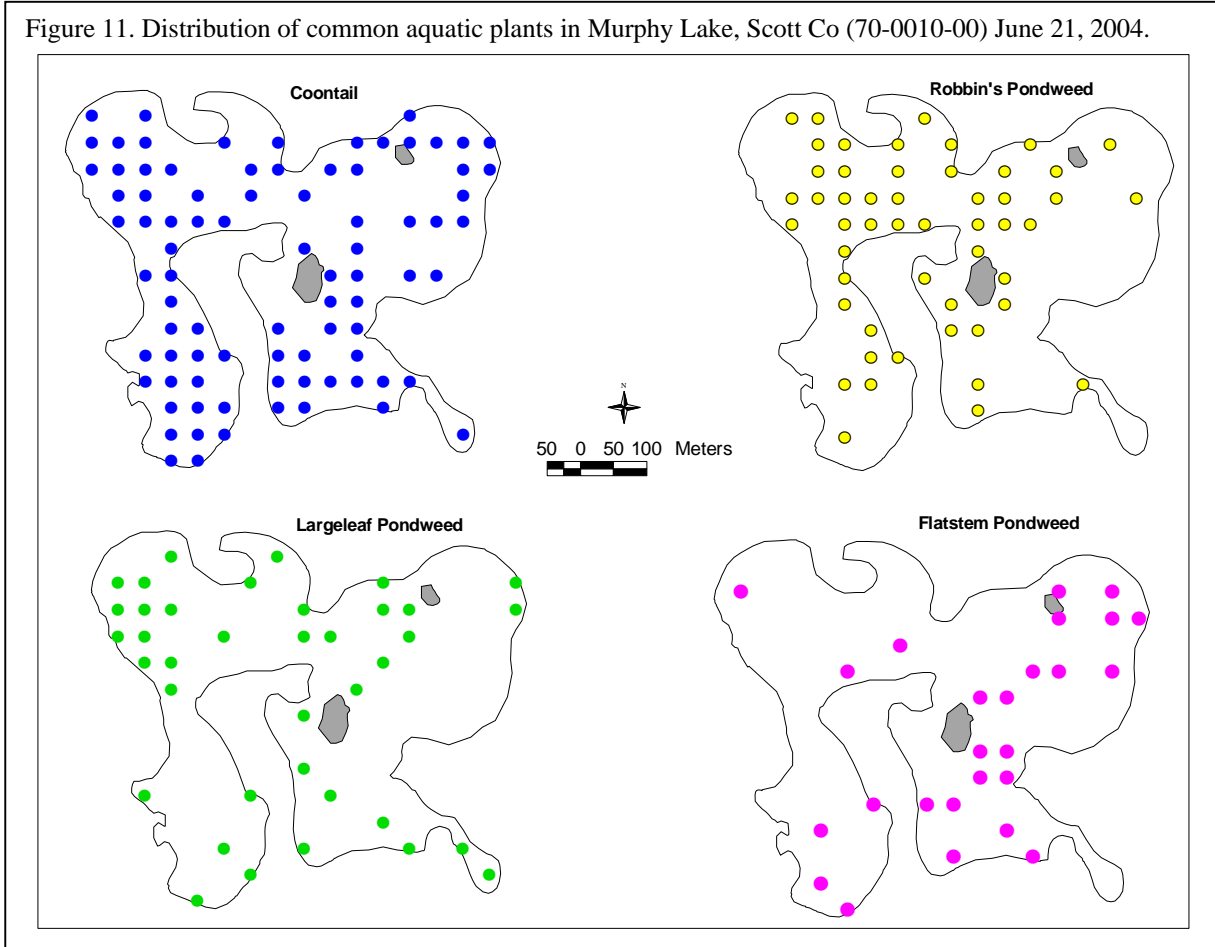
Large-leaf pondweed, (*Potamogeton amplifolius*) was present in 31 percent of the sites within the vegetated zone and was restricted to depth of eight feet and less (Fig. 10). It was most often found in the northwest half of the lake (Fig. 11). This plant frequently formed both submerged and floating leaves in depths less than seven feet (Fig. 12).

Flat-stem pondweed (*Potamogeton zosteriformis*) occurred in 21 percent of the sites within the vegetated zone, was the only species found in depths greater than 15 feet and reached a maximum depth of 16 feet (Fig. 10). This plant was most often found in the southeast half of the lake (Fig. 11).

The other two common species were floating-leaved plants: watershield (*Brasenia schreberi*) and white waterlily (*Nymphaea odorata*) which occurred in 14 percent and five percent of the sites, respectively but were restricted to depths less than seven feet (Fig. 10).

All other species were found in five percent or less of the sample sites (Table 1).





Factors influencing aquatic plant community of Murphy Lake

Murphy Lake is unique because it occurs within the seven county metropolitan area of Minneapolis and St. Paul, yet remains undeveloped with an intact vegetated shoreline, relatively high water clarity, and an abundant native aquatic plant community. As lakeshore development increases throughout Minnesota, more people are choosing to live on small, shallow, heavily vegetated lakes, similar to Murphy. Several issues that are seen on many metropolitan lakes that are not found in Murphy Lake include: 1) destruction and loss of the emergent and floating-leaf vegetation as a result of development (Radomski and Goeman 2001), 2) invasion by, and subsequent domination by, exotic species such as curly-leaf pondweed, and 3) decline in water clarity and a switch from a plant dominated system to an algal dominated lake. Murphy Lake provides an example of how a relatively undisturbed native plant community can help buffer against these potential problems. It also shows that abundant native aquatic plants serve a valuable role in a healthy lake system. (Click here for more information on: [value of aquatic plants](#)).

Change in Murphy Lake plant community over time

Historical information on the aquatic plant community of Murphy Lake is patchy, but we do know that the lake has not experienced dramatic changes in lakeshore development. Murphy Lake may be among the best representatives of how shallow, vegetated lakes in the metropolitan area appeared prior to European settlement. Between 1925 and 1930, the aquatic plant communities of 26 lakes in Scott, Carver and Hennepin Counties were surveyed (Hotchkiss 1932).

Although these surveys did not include Murphy Lake, we can get a general impression of lake plant communities in this area before many lakes were heavily developed. The early surveyors describe a variety of lakes including many with broad to narrow marsh margins, abundant submerged vegetation and a diversity of native species including wild rice (*Zizania aquatica*), cattail, bulrush, arrowhead and white waterlily. By contrast, many metropolitan lakes today lack emergent and floating-leaf vegetation and the submerged plant community is often sparse, due to low water clarity, or is dominated by exotic species.

The 2004 vegetation survey of Murphy Lake gives a “snapshot” of the aquatic plant community. Comparison of the 2004 results with data collected during a 1999 survey (MnDNR Fisheries Lake Files) suggests that the general composition of Murphy Lake’s plant community has not changed in the last five years. Native species that were common in 1999 were still common in 2004. Curly-leaf pondweed was recorded as present, but not abundant, during both surveys, and it does not dominate the plant community as it does in many other Minnesota lakes. (The 1999 survey was conducted in early June and if curly-leaf pondweed was abundant, it would have been detected during that survey). Data collected during the 2004 survey can be compared to future quantitative surveys of Murphy Lake to better estimate how the plant community may be changing. Monitoring changes in aquatic plant communities can help reflect changes in the overall water quality of the lake and watershed.

Figure 12. Large-leaf pondweed (*Potamogeton amplifolius*) with floating leaves in Murphy Lake, Scott Co., June 21, 2004.



Figure 13. Aquatic plant bed in Murphy Lake (70-0010-00), Scott Co. June 21, 2004.



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