



Lake George Aquatic Plant Survey

Anoka County, MN
August 2 – 3, 2006

October 2, 2006

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Introduction

Fortin Consulting, Inc. (FCI) was hired by the Lake George Conservation Club to conduct an aquatic plant survey on Lake George. The Minnesota Department of Natural Resources is requiring aquatic plant surveys for lakes with infestations of Eurasian watermilfoil where funding is requested. A MnDNR grant of \$2655 was received by the Lake George Conservation Club to complete the survey. The survey was conducted on August 2 – 3, 2006 by Carolyn Dindorf and Roman Rowan. Hours spent on the lake completing survey (2 person crew):

August 2: 10.25

August 3: 4.25

Plant identification was completed by Carolyn Dindorf.

Lake Description

Lake George is a 495 acre lake located in Oak Grove, Anoka County, Minnesota (DOW #2-0091). Lake George exhibits very good water clarity with a summer average of 10.5 feet in 2004. About 391 acres or 80% of the lake is classified as littoral (<15' deep). The littoral zone generally defines the area where aquatic plants are likely to be found (Figure 1). However, since Lake George exhibits very clear water, plants grow to a deeper depth in the lake. The maximum and mean depths are 32 feet and 5 feet respectively. Lake George is an oval shaped lake with two dredged channels on the south side. Most of the lake has a sandy bottom, but there are areas of soft muddy sediments. The shoreline length is 4.5 miles (MnDNR Fisheries files). Lake George Regional Park, an Anoka County park, is located on the north side of the lake. The public access is within the park.

Eurasian watermilfoil (hereafter EWM) was first confirmed in Lake George in 1998 and is now forming nuisance mats in large areas of the lake. Previous aquatic plant surveys have been conducted by MnDNR staff using transects or spot checking for milfoil (MnDNR files, personal communication Wendy Crowell).

In addition to Eurasian watermilfoil, curly-leaf pondweed, another non-native species is also in Lake George.

Purpose

The purpose of the survey was to:

- a. identify the location, abundance and extent of Eurasian watermilfoil
- b. identify the location, abundance and extent of curly-leaf pondweed
- c. identify the location and abundance of native plants in the lake
- d. Use this information to help guide future control efforts

Methods

The survey was conducted using the point-intercept protocol as required by the Minnesota Department of Natural Resources (DNR) (Crowell, 2006) and based on

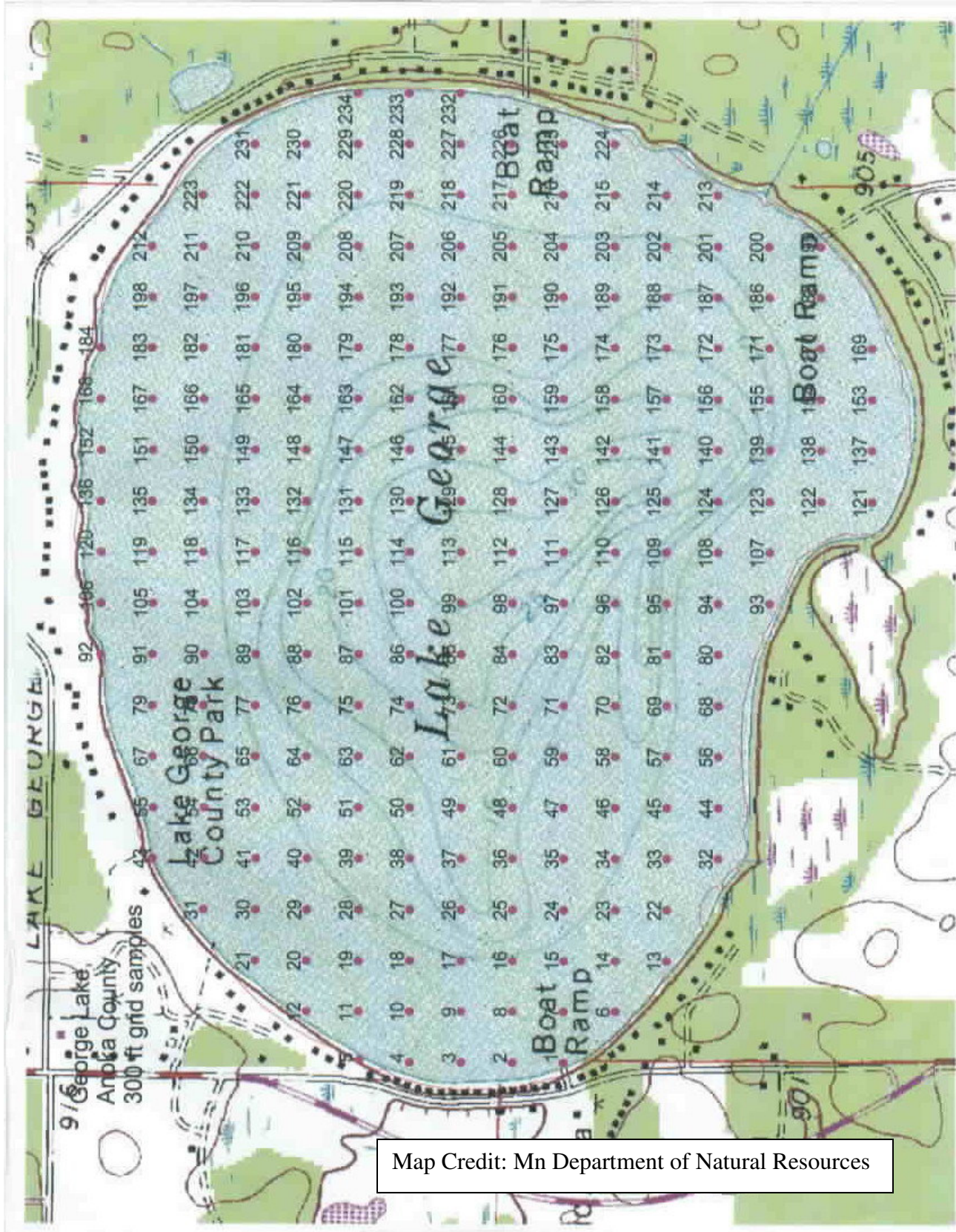


Figure 1: Lake George Depth Map showing 5' contours and survey points

Madsen (1999). An electronic file and map of survey points was provided by the MnDNR (Figure 1). A Garmin Map76Cx was used to locate the survey points. Depths were measured using a rod for up to 12'. Deeper depths were measured using an Eagle and/or Vexilar depth finder. At each survey point a double headed rake sampler on a rope was thrown and retrieved to the boat. All the plant species found on the rake were recorded. Samples were bagged and labeled for further identification and confirmation. Plant abundance was determined for each species based on a scale of 1 – 4, with 4 being the most abundant. Samples were collected for all points out to one survey point beyond where plants were found. A total of 234 survey points were sampled. In addition, the two lagoons/channels on the south side of the lake were surveyed by observation. Plants that were observed were noted on the survey sheets. Submersed, floating and emergent plants were recorded. For Eurasian watermilfoil, occurrence of EWM to the surface of the water, or surface matting was recorded. A specimen of each species was herbarium mounted.

Results

Aquatic plants were found in 206 of the survey points on the lake (Figure 2). Twenty-eight different aquatic species were sampled or observed in Lake George. Site 168, a near-shore site, had 14 different species. Native plants were found throughout the lake in water up to 19.7 feet deep (survey point 156) in Lake George. The attached spreadsheet lists the aquatic plant species found in Lake George at each survey point (Table 1). Dominant species are shown in Table 2. All others were found in less than 10% of the survey points. Chara, a common algae specie, was a dominant in the lake. Percent occurrence and relative abundance, on a scale of 1 – 4, are shown in Table 3.

Table 2. Lake George Dominant Submersed Species

Latin Name	Common Name	Relative Abundance	% occurrence
<i>Potamogeton robbinsii</i>	Robbins pondweed	1.9	42.7
<i>Potamogeton illinoensis</i>	Illinois pondweed	1.3	40.8
<i>Chara</i>	Musk grass	1.8	28.6
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	1.6	26.2
<i>Ceratophyllum demersum</i>	Coontail	1.9	26.2
<i>Najas flexilis</i>	Bushy pondweed	1.4	22.8
<i>Myriophyllum sibiricum</i>	Northern milfoil	1.1	13.1
<i>Potamogeton zosteriformis</i>	Flat stem pondweed	1.3	12.6

The floating-leaved species, Watershield (*Bidens beckii*), and were found at five sites and observed near another and in both lagoons. White Water Lily (*Nymphaea*) was found at one site with coverage of about 50% and observed near another site. It was also observed in both lagoons. Emergent species were found at eight survey points and included Three Square (*Scirpus americanus*), Softstem Bulrush (*Scirpus validus*) and Arrowhead (*Sagittaria rigida*). Abundance was approximately 10% coverage. Cattails (*Typha*) species occur along several areas of the shoreline. There are dense stands in some areas, especially in the channels. Sago pondweed (*Potamogeton pectinatus*)

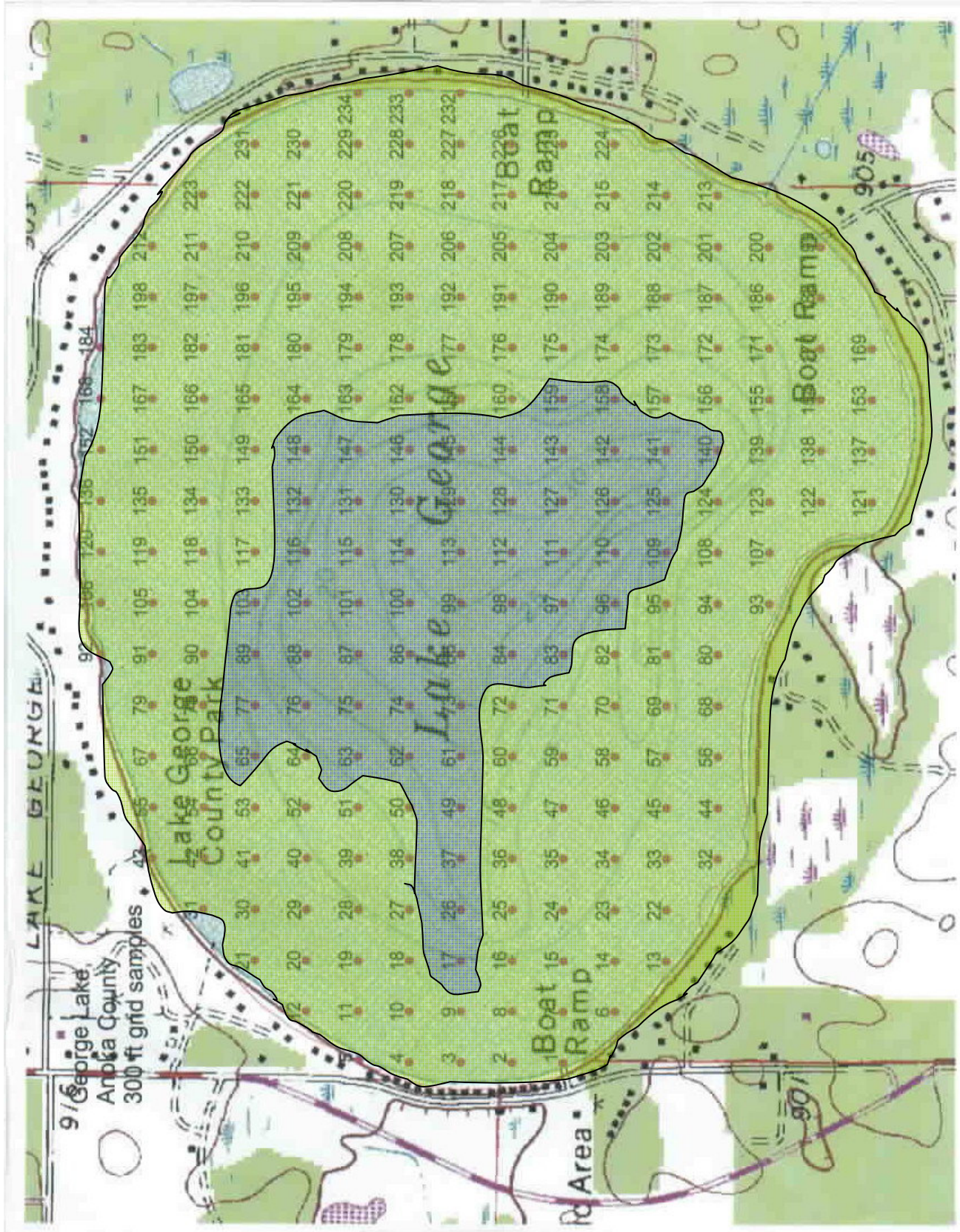


Figure 2. Lake George Aquatic Vegetation Coverage

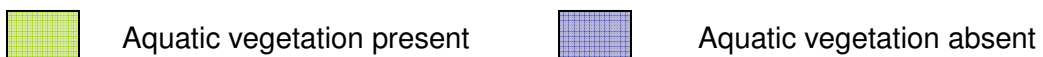


Table 3. Lake George Plant Species Occurrence and Relative Abundance

Latin	Common	% Occurrence	Relative Abundance
<i>Bidens beckii</i>	Water Marigold	9.2	1.1
<i>Brasenia schreberi</i>	Watershield	2.4	1.2
<i>Ceratophyllum demersum</i>	Coontail	26.2	1.9
<i>Chara sp.</i>	Muskgrass	28.6	1.8
<i>Eleocharis acicularis</i>	Needle spike-rush	4.4	1.0
<i>Elodea canadensis</i>	Canada waterweed	2.4	1.0
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	13.1	1.1
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	26.2	1.6
<i>Myriophyllum tenellum</i>	Dwarf Milfoil	8.7	1.0
<i>Najas flexilis</i>	Bushy Pondweed	22.8	1.4
<i>Nymphaea sp.</i>	White Water Lily	0.5	50 % coverage
<i>Potamogeton crispus</i>	Curly-leaf Pondweed	3.9	1.0
<i>P. pusillus (foliosus?)</i>	Leafy Pondweed	4.4	1.0
<i>P. fresia (?)</i>	Pondweed, narrow leaf	3.4	1.0
<i>P. gramineus</i>	Variable Pondweed	9.7	1.1
<i>P. illinoensis</i>	Illinois Pondweed	40.8	1.3
<i>P. natans?</i>	Floating-leaf Pondweed	Observed in lagoon/channel	
<i>P. pectinatus</i>	Sago Pondweed	Observed near access	
<i>P. praelongus</i>	White-stem Pondweed	5.3	1.3
<i>P. richardsonii</i>	Clasping-leaf Pondweed	10.2	1.3
<i>P. robbinsii</i>	Robin's Pondweed	42.7	1.9
<i>P. zosteriformis</i>	Flat-stem Pondweed	12.6	1.3
<i>Ranunculus longirustris</i>	Stiff-water Crowfoot	0.5	1.0
<i>Sagittaria rigida</i>	Arrowhead	1.0	1.0
<i>Scirpus americanus</i>	Threesquare	1.0	0.5
<i>Scirpus validus</i>	Softstem Bulrush	1.9	0.3
<i>Typha latifolia</i>	Common Cattail	Observed along several areas of shoreline	
<i>Utricularia vulgaris</i>	Common Bladderwort	Observed in lagoon/channel	
<i>Vallisneria americana</i>	Wild Celery	6.8	1.0

Species not found during the survey, but observed in the lagoon or in the lake are noted.

was not found during the survey, but was observed near the access and possibly in one channel. Dwarf milfoil (*Myriophyllum tenellem*), an uncommon small aquatic submersed plant, was found at 18 sites. The pondweeds are difficult to distinguish to species level, especially without the flower or fruit. Question marks are shown in the table above where the identification is not certain. The native plant community was very diverse in most of the lake.

Eurasian watermilfoil

Eurasian watermilfoil (*Myriophyllum spicatum*) was found at 54 of the 206 survey points (26.2%)(See Figure 3). EWM was found in water up to 18.6 feet deep (survey point 173). The relative abundance was 1.6. EWM is present around the majority of the lake

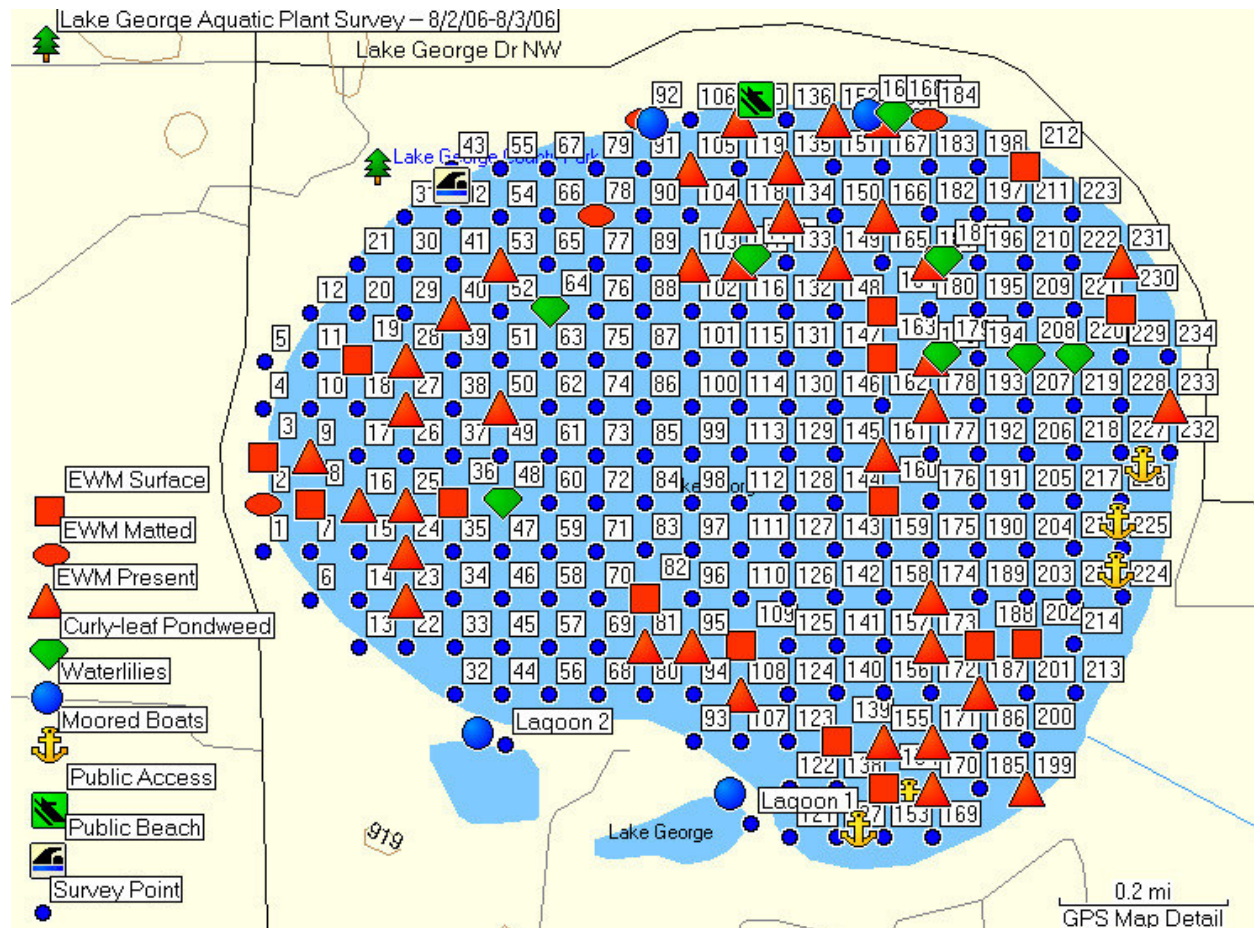


Figure 3. Lake George Survey Points, Invasive Species and Other Features

perimeter (Figures 3 and 4), but most was not right near the shore. EWM was also observed near two survey sites and in the western lagoon/channel (labeled lagoon 2). EWM was found at the surface in 15 survey points ranging from 2 to 13.5 feet deep, with surface matting at four additional points ranging from 1.0 to 5.4 feet deep. Matting was also observed between survey sites 154 and 170.

Estimates of the EWM infested areas were made using a dot counting grid. There were four larger areas and four small areas. There were a few surface mats within these areas, but the delineated area includes all EWM found, indicating areas of potential future nuisance conditions.

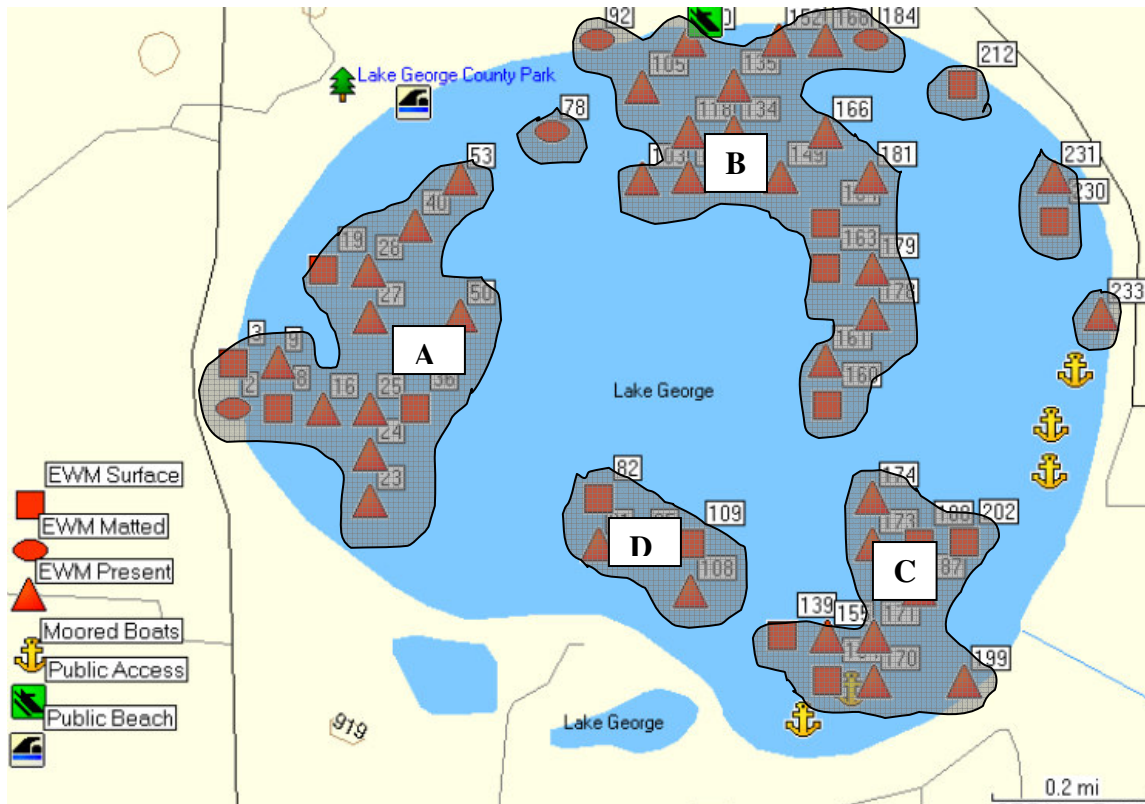


Figure 4. Lake George Eurasian watermilfoil Coverage
(Areas where Eurasian watermilfoil was found)

Acreeage estimates

Area A: 55 – 60 acres

Area C: 35 – 40 acres

Area B: 70 – 80 acres

Area D: 15 – 20 acres

Smaller areas shown: <1 – 5 acres

TOTAL: 175 – 205 acres

Curly-leaf pondweed

Curly-leaf pondweed (*Potamogeton crispus*) was not widespread in the lake (Figure 3). It was found in only 8 of the 206 survey points (3.9%) and at a low average abundance (1.0). However, the survey occurred in August, after most of the Curly-leaf may have senesced. Turions (hardened stem tips that break off and can germinate in the spring) were found at two sites. No surface matting of Curly-leaf pondweed was observed. It was found in waters 1.5 to 15.8 feet deep.

Most plant species, including the invasive species, were found in water 12 feet deep or less (Figure 5.)

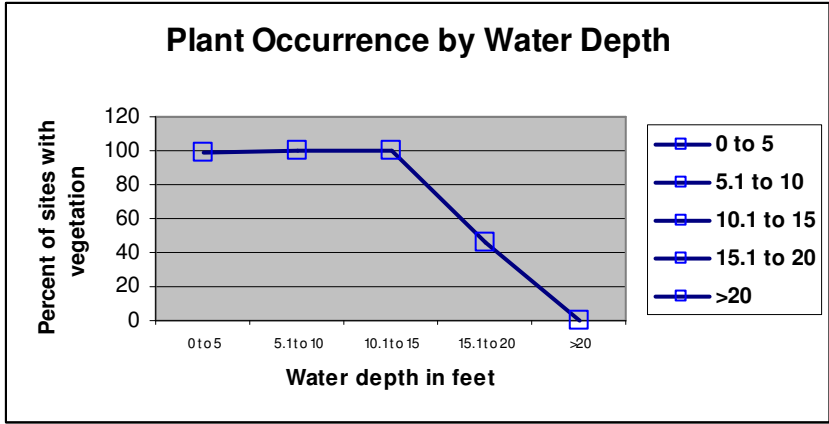


Figure 5. Plant Occurrence by Water Depth

Emergent Species

Some larger stands of Softstem Bulrush and Cattail were record and are noted on Figure 5. This map does not show smaller stands of emergent species. Both lagoon channels were lined with cattails. Floating-leaved water lily stands are shown in Figures 3 and 6.

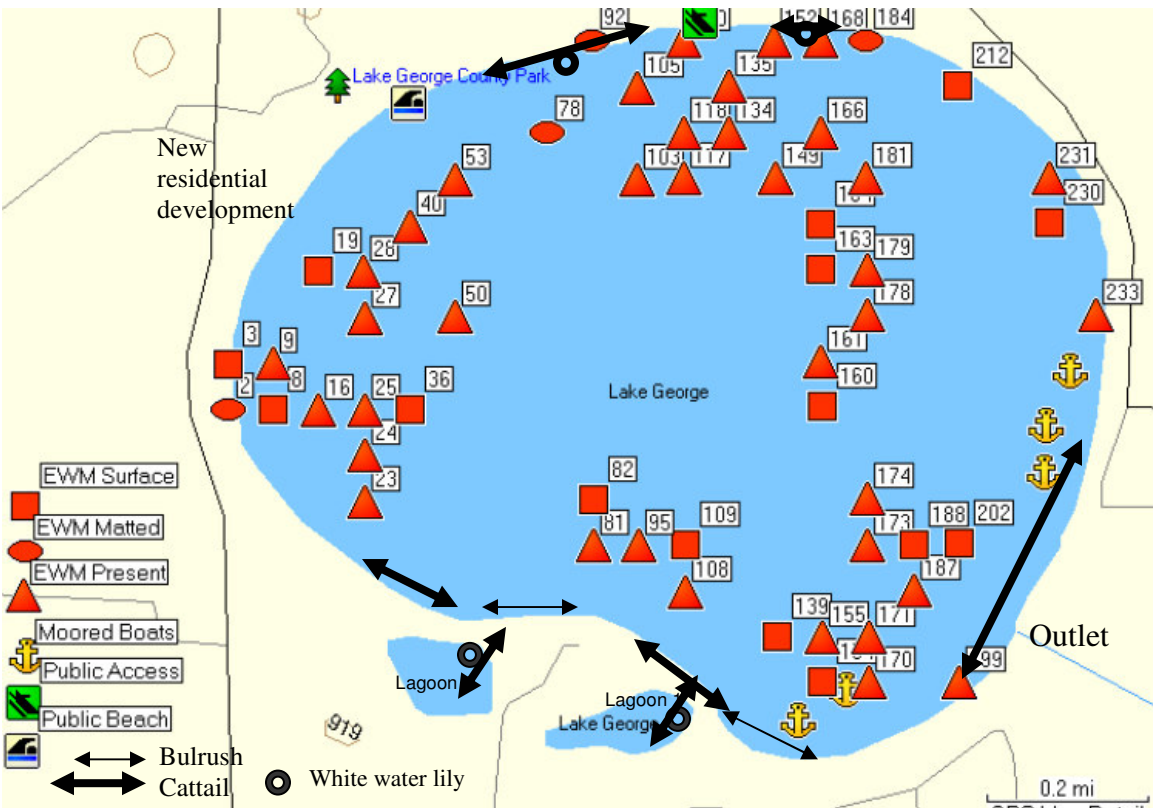


Figure 6. Lake George Emergent Species Stands

Shoreline Features and Lake Use

There is one public water access located in the Anoka County Park on the northwest end of the lake. A large roped-off swimming beach is located within the park. Survey points 42 and 43 were not sampled because they were within the roped area and the swimming area was being used. There are large shallow areas along the shoreline on the east and southeast of the lake. Several boats are moored out in deeper waters (see Figure 6). With the exception of a few vacant lots, a wetland area in the southeast corner at the lake outlet, a new development on the west end, and the County property, there are homes located along the entire lake.

The lake receives intense use on summer weekends (Schurbon, 2006). When surface matting occurs, this can be a source of cutting and spreading of the milfoil plants.

Discussion

In general, Lake George has a very diverse aquatic plant community. Twenty-eight (28) different species were found in the lake. EWM was first found near the County Park Access in Lake George in May of 1998 by a DNR biologist. Since that time, Eurasian watermilfoil appears to be spreading in the lake and may be at its worst conditions this year (personal communications, Dan Burke). The native plant community and recreational use of the lake is threatened by the spread of this invasive exotic species. In addition to EWM, curly-leaf pondweed was found at 8 locations in the lake. It was not found in large colonies. However, August is not the best time to conduct a survey for curly-leaf pondweed. It should be surveyed earlier in the season.

Because Lake George exhibits very clear conditions, it may be more prone to the spread of milfoil to deeper water. The average Secchi disk transparency from 2000 - 2005 ranged from 9.0 – 11.5 feet (CLMP data). With the clear water, light can penetrate into deeper waters and promote plant growth beyond the 15' depth. EWM was recorded on the data sheets only if it was found at the survey point. See the notes below the data for additional information about EWM observed between survey points.

Several, less intense, surveys have been conducted on the lake. In June of 2005 DNR staff conducted a visual survey of the lake for EWM for the purpose of evaluating the need for funding treatments. It was observed scattered around the perimeter of the lake with heavier amounts on the west end, the northeast corner and a mat on the southeast corner (Crowell, 2005).

Since the survey was completed, many more areas of surface matting have become evident. In a survey conducted by Chip Welling of the MnDNR on September 15, 2006, several areas of surface mats were documented (see attached report). The large mat marked between waypoints 3 – 7 is in an area where milfoil was found to the surface during the August 2-3 survey. Some matting was observed on August 2-3 near waypoint 15 an area of dense matting found in the September 15 survey.

Additional mapping of the surface mats was completed by Dan Burke of the Lake George Conservation Club (Burke, 2006). Fifteen acres were mapped. Anoka County

also mapped the area by the public access and in front of their property. That information was not available for this report.

This survey will provide good baseline data for the native plant community. Along with previous less-intensive surveys, the data from this survey will provide information on the extent and spread of EWM. The information can be used to help develop a strategy for EWM and curly-leaf pondweed control. Surveys like this, along with follow-up surveys, are also helpful in determining the success of control methods such as herbicide treatments.

Literature Cited

Burke, Dan. 2006 Personal Communication. Lake George Conservation Club.

Crowell, W. 2004. Field notes from July 20, 2004 survey of Green Lake, Isanti County (30-0136-00). MnDNR Ecological Services Division, Invasive Species Program, St. Paul, MN.

Crowell, W., 2005. Eurasian watermilfoil density survey, June 27, 2005. MnDNR Ecological Services Division.

Crowell, W. 2006. Protocols for aquatic plant surveys accepted by the Minnesota Department of Natural Resources for the collection of pre-treatment data for the MN DNR grant program "Pilot projects to control curly-leaf pondweed or Eurasian watermilfoil on a lake-wide basis for ecological benefits". April 13, 2006.

Minnesota Department of Natural Resources. Ecological Services Division, Invasive Species Program files. 500 Lafayette Rd., St. Paul, MN 55155.

Minnesota Department of Natural Resources. Fisheries Division. Lake Survey Reports. 500 Lafayette Rd., St. Paul, MN 55155.

Minnesota Department of Natural Resources Lake George Map, 1956. 500 Lafayette Rd., St. Paul, MN 55155.

Madsen, J. D. (1999). "Point intercept and line intercept methods for aquatic plant management." *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/aqua.

Jamie Schurbon, July 2006. Personal Communication. Water Resources Specialist, Anoka Soil and Water Conservation District. Ham Lake, MN.

Welling, C. 2006. Inspection of Eurasian watermilfoil. September 15, 2006. MnDNR Ecological Services Division.