

# Delavan Lake

Aquatic Plant Survey, 2013

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## **DELAVAN LAKE AQUATIC PLANT SURVEY – 2013**

### **SUMMARY**

In 2013, early season rainfalls and the resulting poor water clarity throughout the summer was probably a factor that reduced the amount of plant growth in Delavan Lake. Although the maximum rooting depth in Delavan Lake was 15 feet, the same as in 2012, plant densities were significantly reduced from previous years. Eurasian watermilfoil and coontail continue to dominate the plant community. Eurasian watermilfoil growth is lower this year while coontail growth is up significantly. Filamentous algae covered plants weighing them down; and also covered much of the lake bottom. Chara was notably absent and may have been affected by the filamentous algae growth. The near-shore zone between the piers is dominated by milfoil, coontail and wild celery.

Wild celery continues to increase its coverage in the lake, although the percent frequency is only slightly changed from 2012. As wild celery continues to expand its range in the lake, the District's plant management efforts may have to include collection of floating wild celery plants in late July, August and September. This plant, including its roots, lifts from the lake bed in July and August and can create floating, dense mats. The mats collect on the shorelines, further spreading the range of the plant.

Zebra mussels are found on plants in large numbers throughout Delavan Lake, however, mussels continue to be small, with most mussels being less than ½-inch in size.

Eurasian watermilfoil and curly-leaf pondweed were the only aquatic invasive plant species located in the transect plant survey in 2013. However, two other exotic species, pennywort and sacred lotus, have been found. Removal efforts include chemical treatment and hand removal. Regular inspections should continue to be conducted at launch areas and any questionable plants should be forwarded on for a positive identification. Swift response should continue to follow any newly-identified species. Local vigilance is critical in the control of exotic species.

Star duckweed continues to increase significantly and is often found resting within Eurasian watermilfoil plants.

The area just off the point on the NW end of the lake that is usually dominated by Eurasian watermilfoil was clear.

The outlet contained only occasional vegetation along the near shore areas, and consisted of coontail, Eurasian watermilfoil, sago pondweed, duckweed and water stargrass.

There are two shallow bays on the south end of the lake which require regular plant management. Vegetation in the Southeastern-most bay was light, and included

Eurasian watermilfoil, coontail, duckweed, star duckweed, wild celery and sago. The wetland fringe on the West side of the bay was dominated by coontail, sago, elodea and Eurasian watermilfoil, along with water lilies.

The Southwestern-most bay was dominated by Eurasian watermilfoil. Some of the highest densities of Eurasian watermilfoil in the lake were found in this bay. Sago pondweed, water stargrass, coontail and water lilies were also present. The near-shore zone along the wetland fringe on the East side of bay was similar to other years, with high densities of Eurasian watermilfoil and coontail.

Wild celery continues to increase its range in the near-shore areas of Delavan Lake, especially the areas between the piers, however it declined in the deep water zone. Eurasian watermilfoil declined in all depths of the lake. Sago pondweed declined slightly throughout the lake. Chara has declined over recent years and was not found in the 2013 survey. It was found in one sample point in 2012.

The wide channel from the Hwy 50 bridge/town boat launch out to the main lake was clear of vegetation in the main, harvested channel. The shoreline fringe areas along the main channel out to the lake were heavily vegetated with coontail, water stargrass, star duckweed, small duckweed, and Eurasian watermilfoil. The inlet channel north of the bridge was clear of vegetation. The edges were dominated by Eurasian watermilfoil, with coontail, water stargrass, sago and duckweed also present.

The "golf-course bay", just east of the bridge, was dominated by Eurasian watermilfoil, coontail, sago pondweed, and water stargrass. This bay is not harvested or chemically treated so the changes in plant dominance are not influenced by the management activities on the lake. Some of the highest densities of Eurasian watermilfoil was found in this area.

The Sanitary District should consider the use of chemical treatments in the pier zone areas to target Eurasian watermilfoil and to protect the native plant diversity in these areas. Early season treatment (as soon as the plants are showing signs of active growth, around May 1 to May 15) using a selective herbicide, would knock back the Eurasian watermilfoil without impacting the native species.

## **INTRODUCTION**

In July 2013, Aron & Associates conducted an aquatic plant survey on Delavan Lake. This survey is part of an ongoing study to document changes in the aquatic plant community of Delavan Lake that began in September 1992. The information can be used to refine aquatic plant management activities. The information may also be used by future investigators to further document changes in the aquatic plant community and evaluate the impact of plant management and lake management techniques upon the plant communities

Delavan Lake is located in Walworth County, Wisconsin. Hydrographic and morphological information are presented in Table 1 and Map 1.

Table 1. Hydrographic and Morphologic Data of Delavan Lake.

Surface Area	1790 acres
Total Drainage Area	38.6 sq. miles
Volume	44,800 acre feet
Length	3.9 miles
Width	1.0 mile
Shoreline Length	13.0 miles
Shoreline Development Factor*	2.19
Maximum Depth	54 feet
Mean Depth	25 feet

\* The ratio of the shoreline length to that of a circular lake of the same area.  
Source: USGS

## METHODOLOGY

### General Survey

A preliminary survey of the lake was made by boat. No plants were collected and preserved since all species located had been collected during earlier surveys. Nomenclature follows Fassett (1956) and Helquist and Crow (1980). The 2013 maximum rooting depth in Delavan Lake was determined to be fifteen feet. Map 2 illustrates the area of the lake that was available for aquatic plant growth.

### Transect Survey

The methodology for the transect survey follows the methods utilized by the Wisconsin Department of Natural Resources (WDNR) in their Long Term Trend Monitoring Program and modified in recent years by WDNR Bureau of Research. Twenty-five transects were sampled along the lake perimeter. The transects are duplications of those used since a September 1992 survey. Each transect was identified by a landmark, compass bearing, and way point and gps coordinate. Transects extended from shore to the maximum rooting depth or to a point approximately half way to the opposite shore (way point). Identification of transect locations were confirmed using photographs taken of each transect shore location in 1992. Map 3 shows the transect locations.

Four sampling locations along each transect were established at water depths of 1.5, 3.0-4.0, 6.0-8.0, and 9.0-13.0 feet. Because the level of Delavan Lake remains relatively constant, the sampling depths were the same as previous years. A rake with a telescoping handle was used to collect plant samples. Each plant species retrieved was recorded and given a density rating on a scale of 1 to 3 in accordance with the criteria established by WDNR.

The data collected were then used to calculate frequency of occurrence, and density ratings for each species along each transect at each sample depth.

The abundance of each species was determined using four estimates:

- 1) The **frequency** is an estimate of how often a species occurs in the sample points.
- 2) The **average density** rating, or the average density of a species in the sample point where it occurred.
- 3) The **relative density** rating, or the average density of a species averaged over all sample points whether or not any species were present.
- 4) The **relative density** rating averaged over all sample points in which any species occurred.

### Launch Surveys

Launch areas around the lake were inspected for signs of Hydrilla (*Hydrilla verticillata*), or waterweed (*Elodea canadensis*), a native but similar-looking plant. None was found in these areas. Invasive species monitoring is especially important since early control is the only effective way to conduct early eradication and to prevent the spread of the plants.

## RESULTS

During the July 2013 survey, a total of thirteen aquatic plant species were observed. one of those species, slender naiad, was observed only during the general survey, and twelve species were observed in the transect survey (Table 2). The filamentous algae may have prevented locating additional fine-leaved plants.

In addition, two emergent species were observed, and include bulrush (*Scirpus* sp.) and cattails (*Typha* sp.). These two species were associated with wetland complexes located along the southwestern bay. Cattails were found within the wetland complex along the inlet channel located at the northern tip of the lake.

Table 2. Aquatic Plant Species Observed in Delavan Lake, July 2013.

<u>Scientific Name</u>	<u>Common Name</u>	<u>% Frequency</u>
<i>Ceratophyllum demersum</i>	Coontail	52
<i>Lemna minor</i>	Duckweed	4
<i>Lemna trisulca</i>	Star Duckweed	29
<i>Myriophyllum spicatum</i>	Eurasian Watermilfoil	51
<i>Najas flexilis</i> *	Slender Naiad	-
<i>Nuphar</i> sp.	Yellow Water Lily	1
<i>Nymphaea</i> sp.	White Water Lily	2
<i>Potamogeton crispus</i>	Curly-leaf Pondweed	1
<i>P. natans</i>	Floating-leaf Pondweed	4
<i>P. zosterformis</i>	Flat-stem Pondweed	3
<i>Stuckenia pectinata</i>	Sago Pondweed	25
<i>Vallisneria americana</i>	Wild Celery	24
<i>Zosterella dubia</i>	Water Star Grass	6

\* found only in the general survey.

The distribution of plants by water depth is summarized in Table 3. Of those species found during the transect survey, three were found at all sample depths and include coontail, Eurasian watermilfoil, and star duckweed. The greatest plant diversity was found in the 1.5 foot depths (10 species).

Table 3. Delavan Lake Aquatic Plant Species Distribution by Depth, July 2013.

Plant Species	Depth			
	1.5	3.0	6.0	9.0
<i>Ceratophyllum demersum</i>	x	x	x	x
<i>Lemna minor</i>	x	x		
<i>Lemna trisulca</i>	x	x	x	x
<i>Myriophyllum spicatum</i>	x	x	x	x
<i>Nuphar sp.</i>	x			
<i>Nymphaea sp.</i>	x			
<i>Potamogeton zosterformis</i>	x	x		x
<i>Stuckenia pectinata</i>	x	x	x	
<i>Vallisneria americana</i>	x	x	x	
<i>Zosterella dubia</i>	x	x		x

Using the total mean density ratings for each species (Appendix), the most abundant species were Eurasian watermilfoil, coontail, and star duckweed respectively. Table 4 shows the Total Mean Density of the aquatic plant species in Delavan Lake for the years 2002 through 2013.

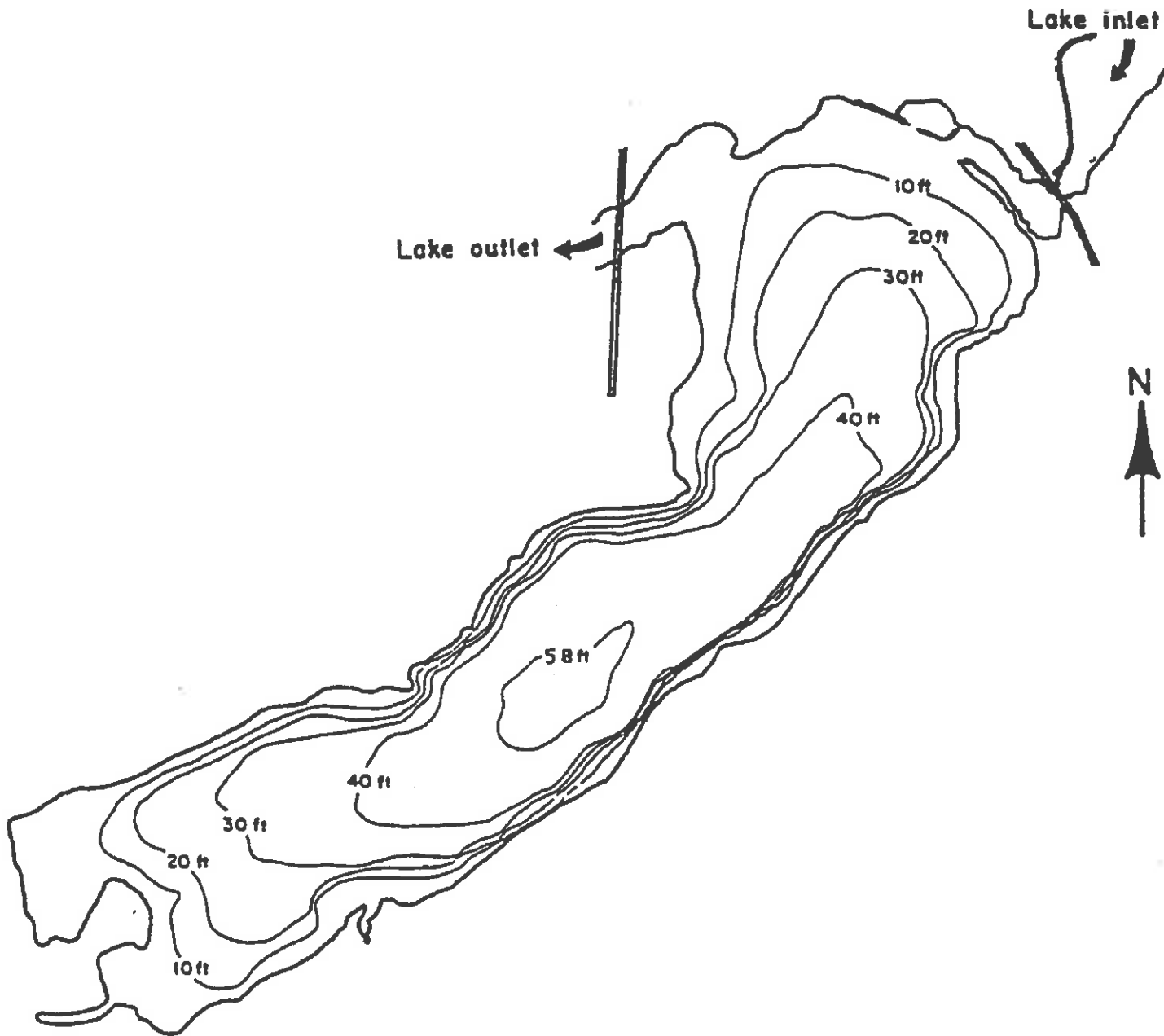
Table 4. Total Mean Density for Aquatic Plant Species in Delavan Lake, 2002 - 2013

Scientific Name	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Ceratophyllum demersum</i>	0.69	2.03	2.16	1.89	2.69	2.16	1.24	1.25	1.11	0.99	0.49	0.81
<i>Chara sp.</i>	0.25	0.53	0.02	0.03	0.01	0.07	0	0.04	0.07	0.01	0.01	0
<i>Elodea canadensis</i>	0.06	0.16	0.06	0	0.02	0.05	0	0.04	0.02	0.03	0.02	0
<i>Lemna minor</i>	0.05	0	0	0	0.13	0.05	0	0	0.02	0.10	0	0.02
<i>Lemna trisulca</i>	0	0	0	0.02	0.04	0.17	0.22	0.44	0.15	0.40	0.21	0.34
<i>Myriophyllum spicatum</i>	2.31	2.98	1.78	2.44	1.71	1.45	0.34	0.40	0.54	0.65	1.33	0.62
<i>Nuphar sp.</i>	-	-	-	-	-	-	-	-	-	0.04	0	0
<i>Nymphae sp.</i>	-	-	-	-	-	-	-	-	-	0.01	0	0
<i>Potamogeton crispus</i>	0.44	0.57	0.04	0.21	0	0.08	0.10	0.07	0.02	0.05	0	0.01
<i>P. foliosus</i>	0.04	0.02	0	0	0.01	0	0	0.01	-	-	-	0
<i>P. Illinoensis</i>	-	-	-	-	-	-	-	-	-	0.01	-	-
<i>P. natans</i>	-	-	-	-	-	-	-	-	0.01	-	0	0
<i>P. zosterformis</i>	0.74	0.88	0.66	0	0.03	0	0.01	0.02	-	-	0.02	0.01
<i>Stuckenia pectinata</i>	0.74	0.88	0.66	0.58	0.34	0.51	0.19	0.17	0.23	0.33	0.30	0.19
<i>Vallisneria americana</i>	0.01	0.11	0.12	0.12	0.12	0.20	0.09	0.16	0.33	0.36	0.23	0.26
<i>Zannichellia palustris</i>	0.05	0.01	0.01	0.01	0.01	0.02	0	0.02	-	-	-	-
<i>Zosterella dubia</i>	0.10	0.08	0.09	0.08	0.27	0.16	0.14	0.10	0.14	0.10	0.04	0.07

## REFERENCES

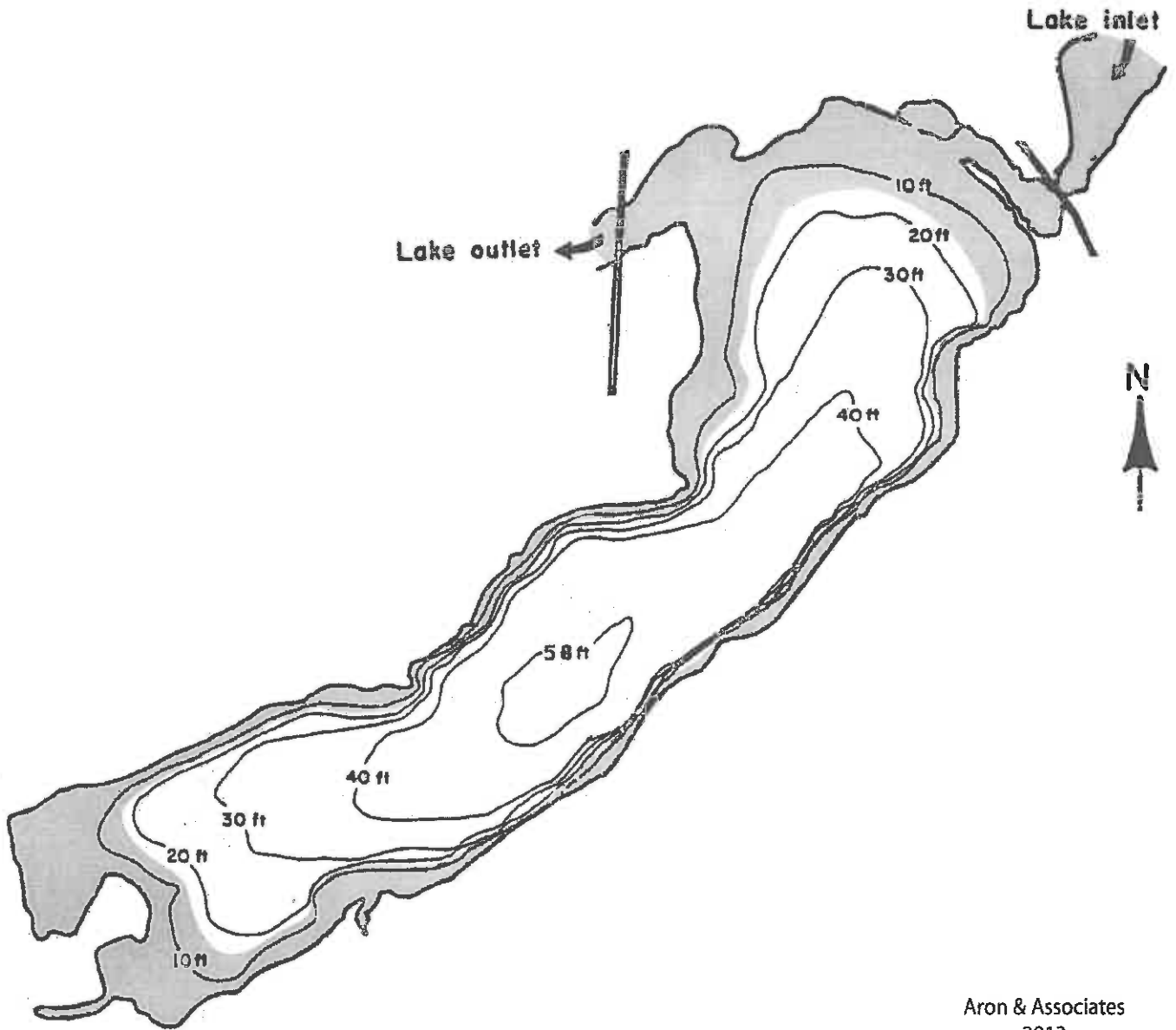
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# Map 1 - DELAVAN LAKE





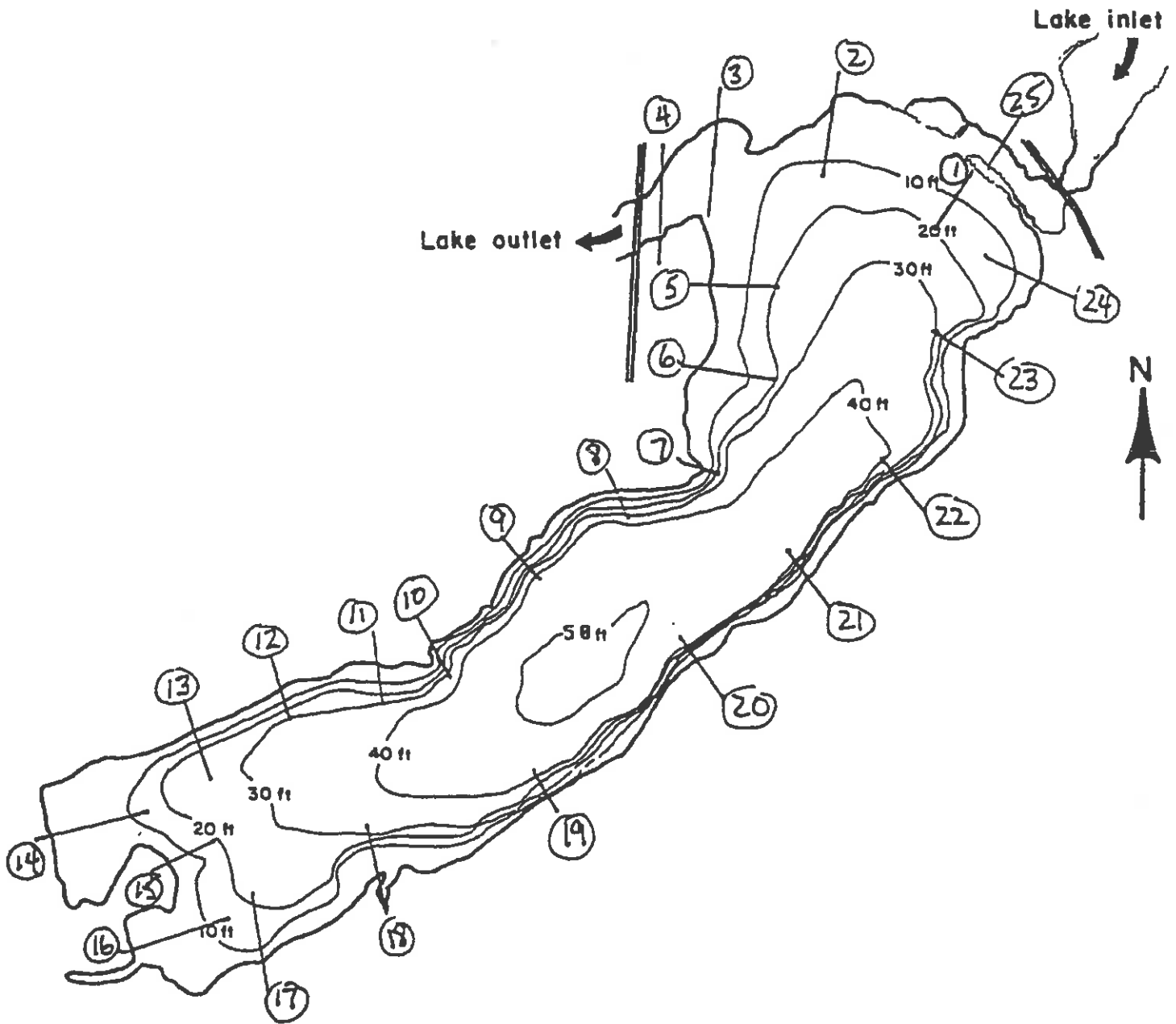
**Delavan Map 2**  
**Area Available for Aquatic Plant Growth, 2013**



Aron & Associates  
2013

**Delavan Lake**

**Map 3 -Transect Locations**



DELAVAN LAKE AQUATIC PLANT SURVEY, JULY 2013

LAKE TRAN	DEPTH	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	RANLO	LEMTR	WOLCO	POTNA	POTIL	NYMSP
DELA\ 1	1.5	V			1										1				
DELA\ 2	1.5	V			1	V	1												
DELA\ 3	1.5		2		2		2												
DELA\ 3.1	1.5		1		1	V	1								1				
DELA\ 4	1.5	V			V		2												
DELA\ 4.1	1.5		3		1	V	V												
DELA\ 5	1.5				1														
DELA\ 6	1.5																		
DELA\ 7	1.5						1												
DELA\ 8	1.5						1												
DELA\ 9	1.5				1														
DELA\ 10	1.5		1		1														
DELA\ 11	1.5		2																
DELA\ 12	1.5						1												
DELA\ 13	1.5																		
DELA\ 14	1.5		1				1												
DELA\ 15	1.5																		
DELA\ 16	1.5		1		2			1			2				3				
DELA\ 17	1.5																		
DELA\ 18	1.5							1			1								
DELA\ 19	1.5																		
DELA\ 20	1.5																		
DELA\ 21	1.5																		
DELA\ 22	1.5										V								
DELA\ 23	1.5																		
DELA\ 24	1.5	V			1														V
DELA\ 25	1.5		3		3								1						
DELA\ 25.1	1.5				3		2												

28 points

FREQUENCY	% FREQUENCY	SUM DENSITY	SPEC MEAN DENSITY	TOT MEAN DENSITY	TMD W/PLANTS	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	RANLO	LEMTR	WOLCO	POTNA	POTIL	NYMSP
12	0	0	0	0	0	13	0	0	13	0	10	2	0	4	14	0	1	0	7	0	0	0	1
43	0	0	0	0	0	46	0	0	46	0	36	7	0	14	50	0	4	0	25	0	0	0	4
14	0	0	0	0	0	18	0	0	18	0	9	1	0	5	14	0	1	0	9	0	0	0	0
1.17	#DIV/OI	#DIV/OI	#DIV/OI	1.38	#DIV/OI	0.90	0.50	#DIV/OI	1.25	1.00	#DIV/OI	1.00	#DIV/OI	1.29	#DIV/OI	#DIV/OI	1.00	#DIV/OI	1.29	#DIV/OI	#DIV/OI	#DIV/OI	0.00
0.50	0.00	0.00	0.00	0.64	0.00	0.32	0.04	0.00	0.18	0.50	0.00	0.00	0.00	0.00	0.64	0.00	0.04	0.32	0.32	0.00	0.00	0.00	0.00
0.64	0.00	0.00	0.00	0.82	0.00	0.41	0.05	0.00	0.23	0.64	0.00	0.00	0.00	0.00	0.64	0.00	0.05	0.41	0.41	0.00	0.00	0.00	0.00

DEHAVAN LAKE AQUATIC PLANT SURVEY, JULY 2013

LAKE	TRAN	DEPTH	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	LEMTR	NAJMA	WOLCO	POTNA	NYMPSP	NIJPS
DELA1	1	3	1			1									2					
DELA1	2	3	1			1					1				1					
DELA1	3	3	1		1										1					
DELA1	3.1	3	2			1									1					
DELA1	4	3	2			2									1					
DELA1	4.1	3	3			2									1					
DELA1	5	3	V			2									1					
DELA1	6	3	2																	
DELA1	7	3	1			1														
DELA1	8	3	2			1														
DELA1	9	3	1			1														
DELA1	10	3	1			1														
DELA1	11	3	1			1														
DELA1	12	3	1			1														
DELA1	13	3	1			1														
DELA1	14	3	V			1														
DELA1	15	3	1			1														
DELA1	16	3	1			1														
DELA1	17	3	1			1														
DELA1	18	3	1			1														
DELA1	19	3	2			1														
DELA1	20	3	1			1														
DELA1	21	3	1			1														
DELA1	22	3	1			1														
DELA1	23	3	1			1														
DELA1	24	3	1			1														
DELA1	25	3	1			3														
DELA1	25.1	3	1			1														
28 points																				
FREQUENCY			MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	LEMTR	NAJMA	WOLCO	POTNA	NYMPSP	NIJPS
% FREQUENCY			22	0	1	19	0	12	1	1	10	1	1	3	16	0	0	1	1	0
SUM DENSITY			79	0	4	68	0	43	4	0	36	4	4	11	57	0	0	4	4	0
SPEC MEAN DENSITY			26	0	1	24	0	9	0	0	12	0	0	1	17	0	0	0	0	0
TOT MEAN DENSITY			1.18	#DIV/0!	1.00	1.26	#DIV/0!	0.75	0.00	#DIV/0!	1.00	1.20	0.00	0.33	1.06	#DIV/0!	#DIV/0!	0.00	0.00	#DIV/0!
TMD W/PLANTS			0.93	0.00	0.04	0.86	0.00	0.32	0.00	0.00	0.04	0.43	0.00	0.04	0.61	0.00	0.00	0.00	0.00	0.00
			0.96	0.00	0.04	0.89	0.00	0.33	0.00	0.00	0.04	0.44	0.00	0.04	0.63	0.00	0.00	0.00	0.00	0.00



DELVAN LAKE AQUATIC PLANT SURVEY, JULY 2013

LAKE	TRAN	DEPTH	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	LEMTRI
DELA\	1	9				2									
DELA\	2	9				3									
DELA\	5	9				3									
DELA\	6	9													
DELA\	7	9													
DELA\	8	9				2									
DELA\	9	9				3									
DELA\	10	9	1												
DELA\	11	9													
DELA\	12	9													
DELA\	13	9													
DELA\	14	9	2			2									
DELA\	15	9	2												
DELA\	16	9	2												
DELA\	17	9				1									
DELA\	18	9	1												
DELA\	19	9													
DELA\	20	9													
DELA\	21	9													
DELA\	22	9													
DELA\	23	9													
DELA\	24	9													

22 points

	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	ZANPU	HETDU	VALAM	POTFO	LEMMI	LEMTRI
FREQUENCY	5	0	0	7	0	0	0	0	1	0	0	0	0
% FREQUENCY	23	0	0	32	0	0	0	0	5	0	0	0	0
SUM DENSITY	8	0	0	16	0	0	0	0	1	0	0	0	0
SPEC MEAN DENSITY	1.60	#DIV/0!	#DIV/0!	2.29	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
TOT MEAN DENSITY	0.36	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
TMD W/PLANTS	0.73	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00

COMBINED VALUES FOR ALL DEPTHS

	MYRSPS	CHARA	POTCR	CERDE	ELOCA	STUPE	POTZO	HETDU	VALAM	LEMMI	LEMTR
FREQUENCY	MAX=10	51	0	1	52	0	25	6	24	4	29
% FREQUENCY		51	0	1	52	0	25	6	24	4	29
SUM DENSITY	MAX=50	62	0	1	81	0	19	7	26	2	34
SPEC MEAN DENSITY		1.22	#DIV/0!	1.00	1.56	#DIV/0!	0.76	1.17	1.08	0.50	1.17
TOT MEAN DENSITY		0.62	0.00	0.01	0.81	0.00	0.19	0.07	0.26	0.02	0.34

	POTIL	NUPSP	NYMSP	POTFO
FREQUENCY	MAX=100	0	1	2
% FREQUENCY		0	1	2
SUM DENSITY	MAX=500	0	0	0
SPEC MEAN DENSITY		#DIV/0!	0	0.00
TOT MEAN DENSITY		0	0.00	0.00