2005 SUMMARY REPORT
of
Slocum Lake

Lake County, Illinois

Prepared by the

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

LAKE FACTS 2

SUMMARY OF WATER QUALITY.....3

SUMMARY OF AQUATIC MACROPHYTES.....11

SUMMARY OF SHORELINE CONDITION 23

SUMMARY OF WILDLIFE AND HABITAT.....23

LAKE MANAGEMENT RECOMMENDATIONS 24

TABLES

Table 1. Water quality data for Slocum Lake, 2001 and 2005 5
Table 2. Comparison of water quality parameters on lakes within the Slocum Lake watershed 9
Table 3. Lake County average TSI phosphorus (TSIp) rankings 2000-2005.....12
Table 4. Aquatic plant species found in Slocum Lake in 2005 17
Table 5. Aquatic plant species found at the 9 sampling sites on Slocum Lake, 2005 The maximum depth that plants were found was 6.5 feet 17
Table 5b. Distribution of rake density across all sampling sites.....17
Table 6. Floristic Quality Index (FQI) of lakes in Lake County, calculated with exotic species (w/Adventives) and with native species only (native) 19

FIGURES

Figure 1. Water quality sampling site on Slocum Lake, 2005.....4
Figure 2. Area (66 acres) of Slocum Lake topped out in aquatic plants in 2005.....7
Figure 3. Secchi depth vs. total suspended solid (TSS) concentrations in Slocum Lake, 2005.....8
Figure 4. Approximate watershed delineation of Slocum Lake, 2005 10
Figure 5. Approximate land use within the Slocum Lake watershed, 2005 16

APPENDICES

Appendix A. Methods for field data collection and laboratory analyses.
Appendix B. Multi-parameter data for Slocum Lake in 2005.
Appendix C. Interpreting your lake's water quality data.
Appendix D. Lake management options.
D1. Options for Watershed Nutrient Reduction
D2. Options for Nuisance Algae Management
D3. Option for Lakes with a High Carp Population
D4. Options to Eliminate or Control Exotic Species

D5. Options to Reduce or Eliminate User Conflicts
D6. Option for Lakes with a High Carp Population
Appendix E. Water quality statistics for all Lake County lakes.
Appendix F. Grant program opportunities.
Appendix G. Common native, emergent, floating, and submersed plants available from selected nurseries.

EXECUTIVE SUMMARY

Slocum Lake, located in unincorporated Wauconda Township, near the border of Lake and McHenry Counties, is a natural pothole slough of glacial origin. It is a shallow, oval shaped lake with a surface area of 225.4 acres and mean depth of 4.1 feet. The lake receives water via the Bangs Lake Drain, which enters from the east. Water leaves the lake over a dam on the south shore, eventually emptying into the Fox River. The Wauconda Wastewater Treatment Plant, built in the early 1900's, discharged effluent into the Bangs Lake Drain for most of the century but was diverted to Fiddle Creek in 1997. However, the many years of effluent emptying into Slocum Lake has likely contributed to the severely degraded water quality.

Total phosphorus (TP) concentrations in Slocum Lake averaged 0.150 mg/L, which is three times higher than the county median (0.063 mg/L) and may be a result of resuspension by carp activity and wind and wave action. This carp activity and wind and wave action are also responsible for a TSS concentration almost seven times higher (53.6 mg/L) than the county median (7.9 mg/L). This is quite a bit higher than in 2001 where the average TP was 0.182 mg/L and TSS was 39.2 mg/L. These high TSS concentrations decreased water clarity with a Secchi depth average of 1.03 feet. An analysis of TKN concentrations revealed a large amount of nitrogen present however, it is being utilized by the millions of algal cells living in Slocum Lake. The TN:TP ratio was 19:1, meaning the lake was phosphorus limited. Because of the high amounts of phosphorus and other nutrients in Slocum Lake it was considered hypereutrophic, with a TSIp value of 76.4. This ranks Slocum Lake at 132nd out of 162 lakes in the county based on phosphorus.

The maximum aquatic macrophyte area was mapped in July, 2005 and covered 66 acres (30%) of the lake. There were only three aquatic plant species found in Slocum Lake. Coontail was the dominant species found in 64% of the sites and Eurasian Watermilfoil was the second most abundant occurring at 34% of the sites. Sago Pondweed was present at only one sampling location. In 2005, Slocum Lake had a Floristic Quality Index (FQI) of 5.8. The median FQI of lakes that we have studied from 2000-2005 was 13.1.

Based on the LMU 2001 report, approximately 66.7% of Slocum Lake's shoreline was developed. The undeveloped portions of the lake were comprised of wetland (63%), woodland (4.2%), and prairie (1.3%), which are desirable shoreline types. They provide wildlife habitat and typically protect the shore from excessive erosion. As a result of the dominance of wetland shoreline, 64.1% of Slocum Lake's shoreline exhibited no erosion. In 2005 the LMU reevaluated the shoreline and found some improvement. Areas previously exhibiting moderate erosion now have little to no erosion due to human-made control mechanisms (e.g. rip-rap).

Wetland and woodland areas around the lake are abundant and provide good habitat for many species. For the first time, *Euhrychiopsis leconte* (an aquatic weevil), was observed in the lake and can be used as a biocontrol for Eurasian Watermilfoil. A fish survey was performed by the IDNR in 2003. They found a good diversity fish with a large number of Common Carp present in the lake.

LAKE FACTS

Lake Name:	Slocum Lake
Historical Name:	None
Nearest Municipality:	Island Lake
Location:	T44N, R9E, Section 28
Elevation:	734 feet
Major Tributaries:	None
Watershed:	Fox River
Sub-watershed:	Slocum Lake Drain
Receiving Waterbody:	None
Surface Area:	214.6 acres
Shoreline Length:	3.9 miles
Maximum Depth:	7.3 feet
Average Depth:	5.1 feet
Lake Volume:	1141.9 acre-feet
Lake Type:	Pothole slough of glacial origin
Watershed Area:	5520 acres
Major Watershed Land Uses:	Single family, public and private open space, agriculture, forest and grassland
Bottom Ownership:	Private
Management Entities:	Private
Current and Historical Uses:	Historically and currently the lake is used for fishing and boating.
Description of Access:	No public access

SUMMARY OF WATER QUALITY

Water samples collected from Slocum Lake were analyzed for a variety of water quality parameters (Appendix A). Due to the shallow nature of the lake, water samples were taken at a depth of 3 feet, near the center of the lake (Figure 1). Multiparameter data was collected during each sampling period (Appendix B). Water level was recorded monthly from a staff gage on Slocum Lake, located at the dam on the south shore. The 2005 season was unusually dry and therefore a loss of 1.01 feet was recorded from May through September. However, there was not a large fluctuation in depth from month to month. Due to an average depth of 5.1 feet, Slocum Lake does not thermally stratify (divide into an upper, warm water layer and a lower, cold water layer). Therefore, the lake remained well oxygenated throughout the season. When the dissolved oxygen (DO) concentration drops below 5.0 mg/L, aquatic organisms can become stressed. This did not occur in Slocum Lake where the average DO concentration was 11.90 mg/L.

The Wauconda Wastewater Treatment Plant (WTP) was built in the early part of the 20th century and discharged treated effluent into the Bangs Lake Drain, which empties into Slocum Lake. Since 1997 however, effluent has been diverted to Fiddle Creek, which flows away from Slocum Lake and into the Fox River. The 2001 Lakes Management Unit (LMU) report on Slocum Lake gives more information on the history of the treatment plant. Regardless of the improvements, many years of the effluent emptying into Slocum Lake likely severely degraded its water quality (Appendix C; Interpreting your lake's water quality data).

Phosphorus is a nutrient that limits plant and algal growth, therefore any addition of phosphorus to the lake could produce algal blooms. Total phosphorus (TP) concentrations in Slocum Lake averaged 0.150 mg/L, which is three times higher than the county median (0.063 mg/L) (Table 1). However, although TP is high for the county it has been decreasing in the lake since 1995 (1990=0.190 mg/L; 2003=0.180 mg/L). This could be a result of an increasing plant community. Due to high carp activity and wind and wave action, resuspension of the phosophorus may be the reason for these high levels of TP. Common Carp stir up the sediment with their active spawning and foraging behaviors. According to a 2001 survey done by the Illinois Department of Natural Resources (IDNR), carp were too numerous to count and they suggest all carp be removed. The depth of Slocum Lake is very shallow relative to its surface area and the lake has a relatively long (one mile) fetch. Fetch is the farthest distance across the water in which wind blows, unobstructed by land. A long fetch across a shallow lake typically leads to high sediment resuspension (such as in Slocum), as wind blows and waves move across Slocum Lake, sediment is pulled into the water column, where phosphorus may be released from the sediment particles and made available to algae and plants.

Large amounts of algae and sediment in the lake have also led to a high total suspended solid (TSS) concentrations and low Secchi disk readings. High TSS values are typically correlated with poor water clarity and can be detrimental to many aspects of the lake ecosystem, such as plant and fish communities. A large amount of material in the water column can inhibit successful predation by sight-feeding fish, such as bass and pike, or settle out and smother fish eggs. High turbidity caused by sediment or algae can shade out native aquatic plants, resulting in their reduction or disappearance from the littoral zone (shallow area of the lake). The IDNR

Figure 1. Water quality sampling site on Slocum Lake, 2005.

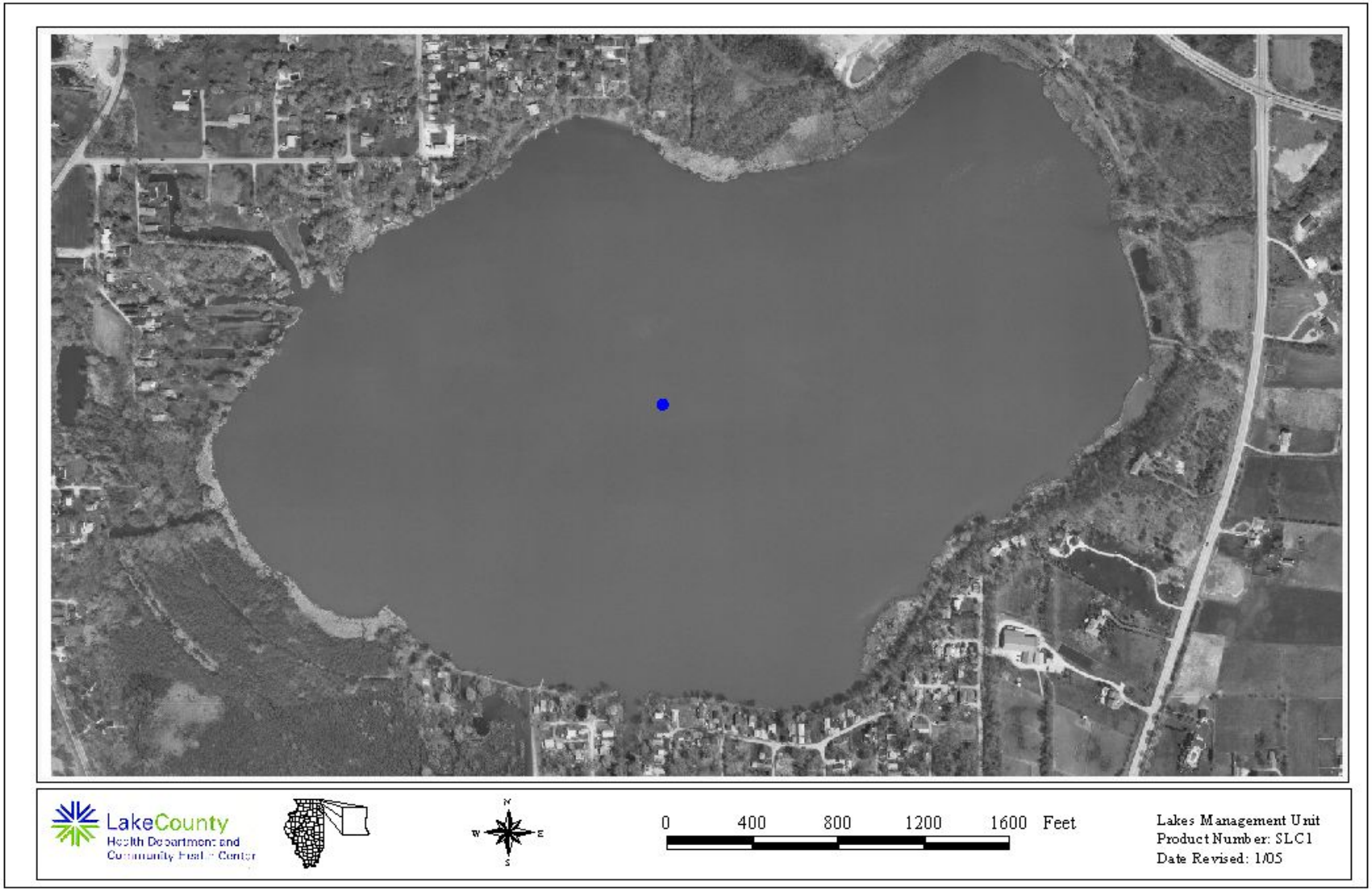


Table 1. Summary of water quality data for Slocum Lake, 2005 and 2001.

2005	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	TSS	TS	TVS	SECCHI	COND	pH	DO	Cl^-
18-May	3	169	1.71	<0.1	<0.05	0.107	<0.005	NA	24.0	660	127	1.640	1.109	8.46	11.67	240
22-Jun	3	130	2.57	<0.1	<0.05	0.135	<0.005	NA	57.0	660	173	0.689	1.068	9.04	12.11	243
20-Jul	3	110	3.46	<0.1	<0.05	0.192	<0.005	NA	77.0	738	215	0.850	1.122	9.37	10.72	259
17-Aug	3	108	3.38	<0.1	<0.05	0.160	<0.005	NA	49.0	728	209	0.980	1.135	9.46	11.97	267
21-Sep	3	108	3.36	<0.1	<0.05	0.154	0.015	NA	61.0	728	193	0.980	1.159	9.46	13.03	277
	Average	125	2.90	<0.1[k]	<0.05[k]	0.150	<0.005[k]	NA	53.6	703	183	1.028	1.119	9.16	11.90	257

2001	Epilimnion														
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	TSS	TS	TVS	SECCHI	COND	pH	DO
22-May	3	185	0.94	<0.1	0.08	0.143	<0.005	524	39.0	594	150	1.02	0.9005	8.22	8.44
26-Jun	3	145	1.44	<0.1	<0.05	0.192	0.006	476	48.0	566	197	0.98	0.8091	8.43	9.52
31-Jul	3	128	2.67	<0.1	<0.05	0.140	<0.005	452	38.0	534	175	0.82	0.7891	8.62	10.78
28-Aug	3	149	3.12	<0.1	<0.05	0.268	<0.005	482	46.6	529	154	0.79	0.8096	8.44	8.30
25-Sep	3	129	3.11	<0.1	<0.05	0.168	0.012	438	24.6	494	155	1.05	0.7500	8.43	9.92
	Average	147	2.26	<0.1	0.08[k]	0.182	0.009[k]	474	39.2	543	166	0.93	0.8117	8.43	9.39

Glossary

ALK = Alkalinity, mg/L $CaCO_3$
TKN = Total Kjeldahl nitrogen, mg/L
NH_3-N = Ammonia nitrogen, mg/L
NO_3-N = Nitrate nitrogen, mg/L
TP = Total phosphorus, mg/L
SRP = Soluble reactive phosphorus, mg/L
TDS = Total dissolved solids, mg/L
Cl^- = Chlorides, mg/L
TSS = Total suspended solids, mg/L
TS = Total solids, mg/L
TVS = Total volatile solids, mg/L
SECCHI = Secchi disk depth, ft.
COND = Conductivity, milliSiemens/cm
DO = Dissolved oxygen, mg/L

k = Denotes that the actual value is known to be less than the value presented.
NA= Not applicable

recommends 30%- 40% coverage to adequately support gamefish. The average TSS was almost seven times higher in Slocum Lake (53.6 mg/L) than the county median (7.9 mg/L) (Appendix E). This may in part be due to low water levels concentrating everything into a smaller volume. However, TSS was also very high in 1995 (29.0 mg/L) and 2001 (39.2 mg/L). As a result of high TSS concentrations, Secchi depth (a measure of water clarity) was low, with an average of 1.03 feet in 2005 (Figure 2). This is below the county median of 3.17 feet. In May, the Secchi depth was at its highest (1.64 feet). This may have been a result of low carp activity, minimal algal growth in the lake, larger water volume. The Volunteer Lake Monitoring Program (VLMP) has been in place in Slocum Lake since 1996, however this year was the first year data was not collected. This data is valuable in recording Secchi depth during the seasons the LMU does not sample the lake. It is also helpful, in conjunction with LMU data, in understanding trends occurring month to month. Continued participation in the program is strongly recommended.

Conductivity readings, which are correlated with chloride concentrations, have been increasing throughout the past few years in the county. It is believed that road salt is probably the reason for the increase because chloride concentrations detect sodium chloride, calcium chloride, potassium chloride, magnesium chloride or ferrocyanide salts, which is what most road salt consists of. The average conductivity of Slocum Lake was 1.1186 mS/cm, which is up from 2001 (0.8117 mS/cm). This is higher than the county median of 0.7748 mS/cm.

Slocum Lake watershed (Figure 3) encompasses 5520 acres and includes Bangs Lake and several small lakes (Banana Pond, Taylor Lake, Heron Pond, and Lakewood Marsh). Although Bangs Lake flows into Slocum Lake, it does not appear to be negatively affecting the lake. Bangs Lake has very good water quality with low phosphorus and TSS levels and high Secchi depths. In 2002 and 2005 the average TP in Bangs Lake was 0.027 mg/L and 0.023 mg/L, respectively. These levels are both far below the county median. Zebra Mussels are very abundant in Bangs Lake and may eventually be carried downstream into Slocum Lake. There have been reports of Zebra Mussels around the inlet at Slocum Lake, however it has not been confirmed. Looking at the watershed as a whole there are general trends that can be seen (Table 2). Conductivity in all lakes has increased since the previous year it was sampled. The landuse (Figure 4) within the watershed is primarily single family housing. Single family housing is often associated with manicured lawns, which use fertilizers. Runoff could be carrying phosphorus from the lawns into the lake and contributing to the algal blooms. TP has increased in lakes within the watershed. Heron Pond went from 0.032 mg/L in 2004 to 0.058 mg/L in 2005 and Lakewood Marsh increased from 0.151 mg/L to 0.562 mg/L. Banana Pond and Taylor Lake have all seen reductions in TP. Residents are encouraged to use no-phosphorus fertilizers on their lawns.

Although ammonia nitrogen (NH_3-N) and nitrate nitrogen (NO_3-N) were below detection limits every month except May, the average Total Kjeldahl Nitrogen (TKN) concentration (2.9 mg/L) of Slocum Lake was over double the county median (1.22 mg/L). This can be explained by understanding what each nitrogen form represents. NH_3-N and NO_3-N are inorganic forms of nitrogen. NH_3-N is usually found under anaerobic conditions (which did not occur in Slocum Lake), and any NO_3-N produced would have been immediately taken up by algae and would not have been detectable in water samples. TKN is a measure of organic nitrogen, which includes nitrogen taken up and stored in algal cells. Concentrations of TKN were high this year because

Figure 2. Secchi depth vs. Total suspended solid (TSS) concentrations in Slocum Lake, 2005.

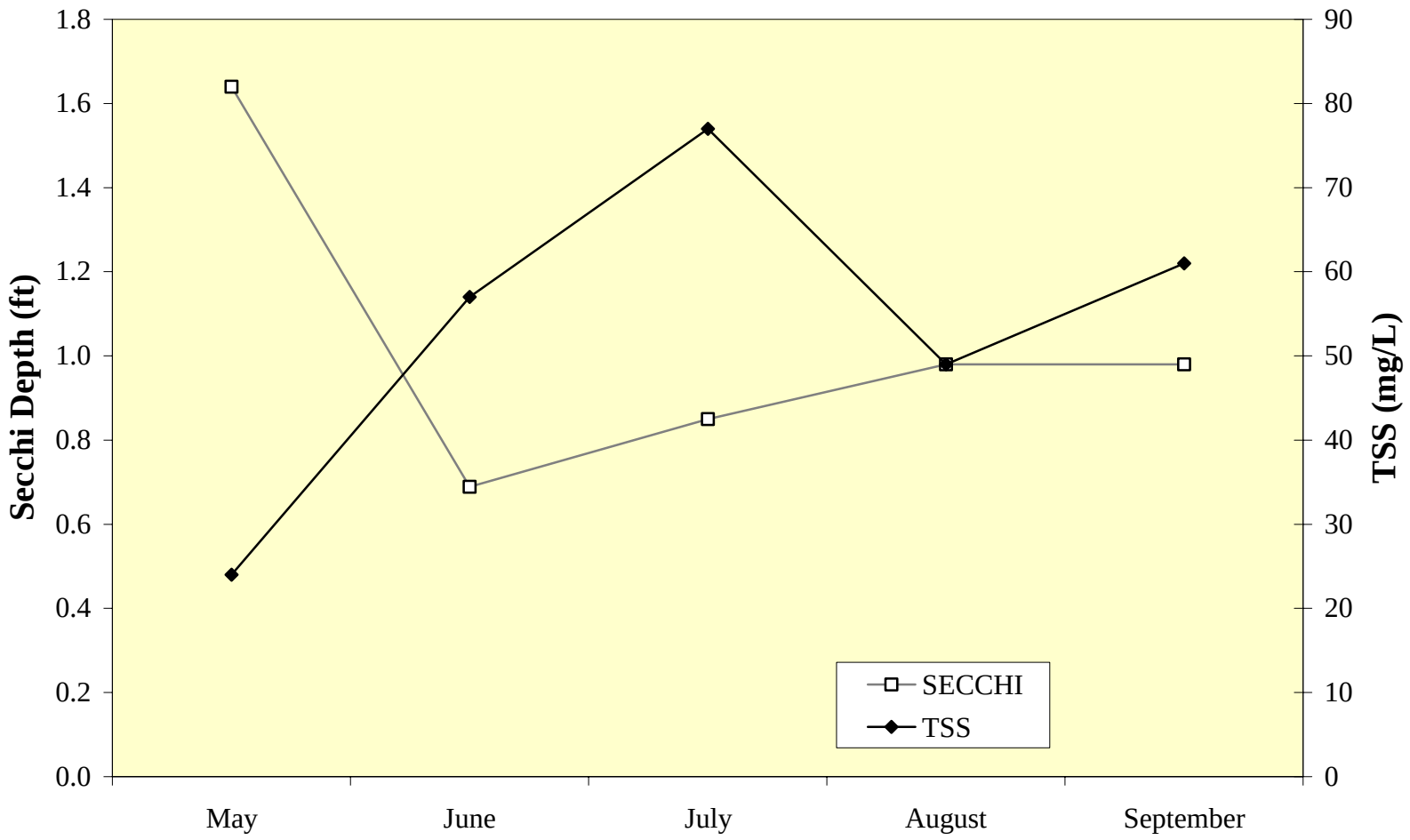


Figure 3. Approximate watershed delineation of Slocum Lake, 2005.

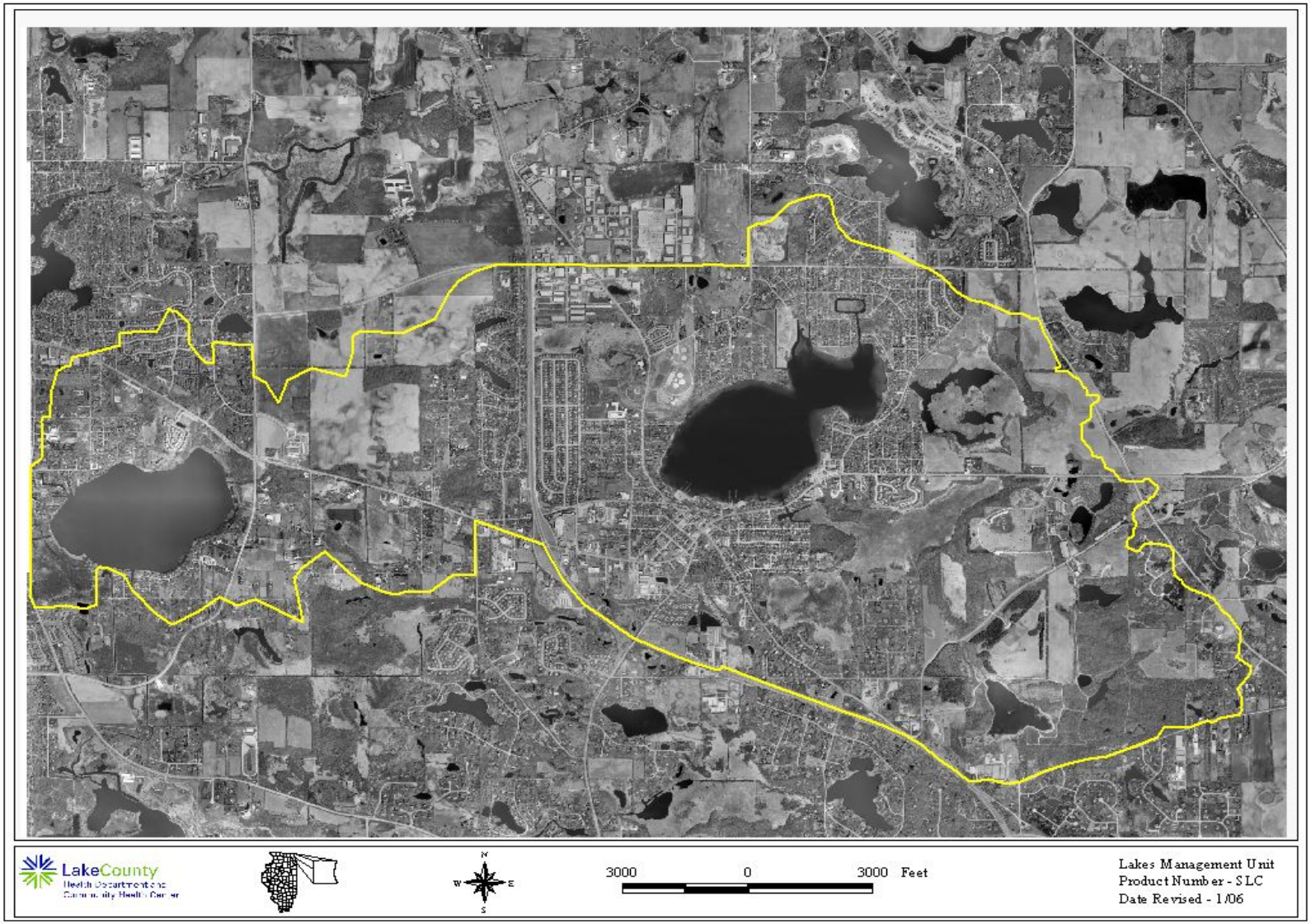
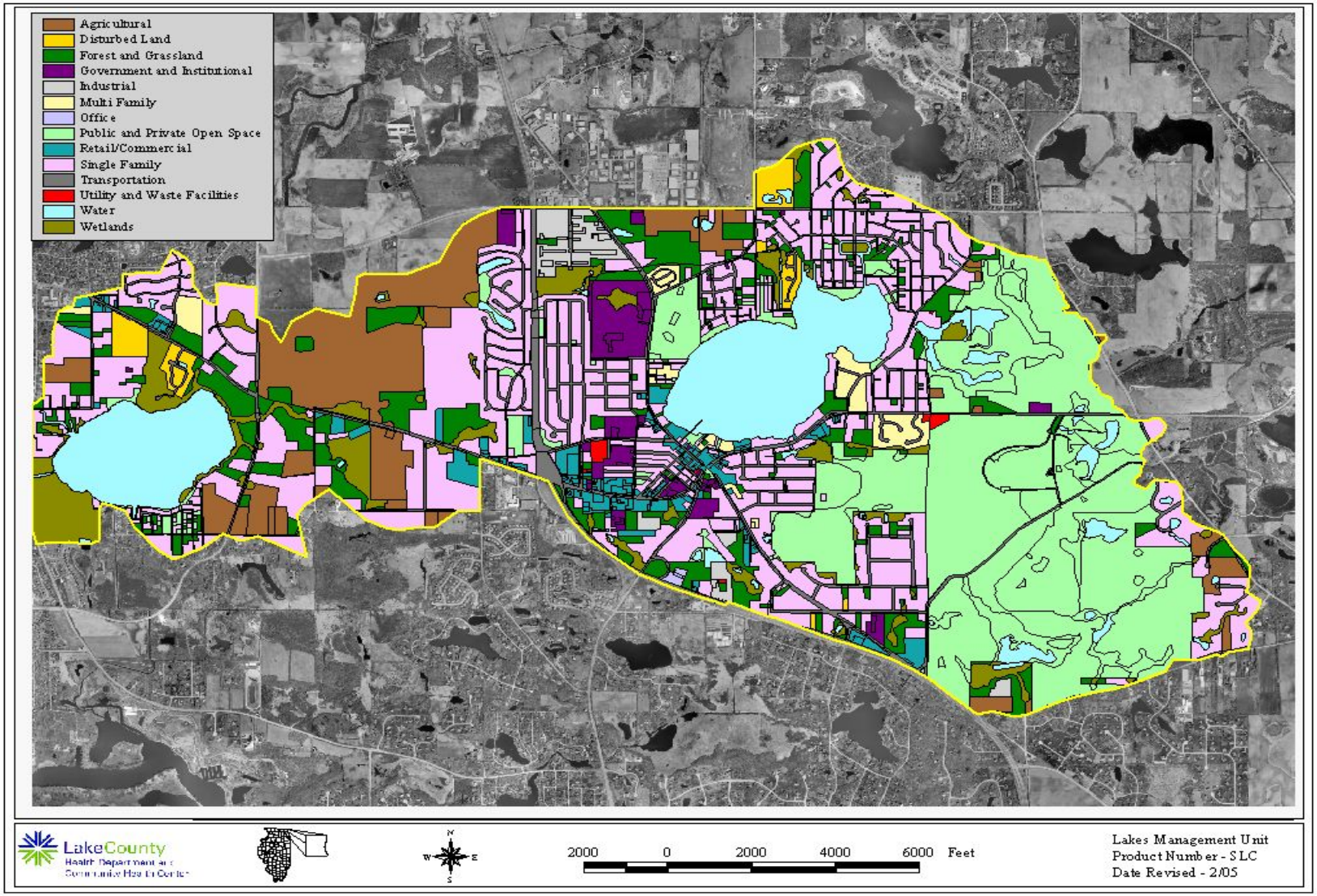


Table 2. Comparison of water quality parameters on lakes within the Slocum Lake watershed.

	Banana Pond	Taylor Lake	Taylor Lake	Heron Pond	Heron Pond	Lakewood Marsh	Lakewood Marsh	Bangs Lake	Bangs Lake	Slocum Lake	Slocum Lake
Year	**2005**	**2005**	**2003**	**2005**	**2004**	**2005**	**2004**	**2005**	**2002**	**2005**	**2001**
Secchi (feet)	8.9	3.5	3.2	7.1	7.1	2.0	3.9	13.8	8.1	1.03	0.93
TSS (mg/L)	2.96	14.08	14.08	3.18	1.84	40.14	4.30	3.43	3.36	53.60	39.24
TP (mg/L)	0.020	0.118	0.118	0.058	0.032	0.562	0.151	0.023	0.027	0.150	0.182
Conductivity (milliSiemens/cm)	0.4468	0.4894	0.4681	0.4292	0.3824	0.712	0.4843	0.6064	0.5538	1.1186	0.8117

Figure 4. Approximate land use within the Slocum Lake watershed, 2005.



of the utilization by the high algal population in the lake. In 2001 the average was slightly lower at 2.26 mg/L, but still double the county median of 1.12 mg/L.

Typically, lakes are either phosphorus (P) or nitrogen (N) limited. This means that one of these nutrients is in short supply relative to the other and any addition of phosphorus or nitrogen to the lake might result in an increase of plant or algal growth. Most lakes in Lake County are phosphorus limited, but to compare the availability of nitrogen and phosphorus, a ratio of total nitrogen to total phosphorus (TN:TP) is used. Ratios less than or equal to 10:1 indicate nitrogen is limiting. Ratios greater than or equal to 15:1 indicate that phosphorus is limiting. Ratios greater than 10:1, but less than 15:1 indicate that there are enough of both nutrients to facilitate excess algal or plant growth. Slocum Lake had TN:TP ratio of 19:1, meaning it was phosphorus limited.

The Illinois EPA has a use indices used for assessing lakes for aquatic life, swimming, and recreational use impairment. The aquatic life index is calculated using the mean trophic state index (TSI), percent macrophyte coverage, and the median nonvolatile suspended solid concentration. The TSI index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive), mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). This index can be calculated using TP values obtained at or near the surface. Because of the high amounts of phosphorus and other nutrients in Slocum Lake it was considered hypereutrophic, with a TSIp value of 76.4 (Table 3). This ranks Slocum Lake at 132nd out of 162 lakes in the county. According to the index, Slocum Lake provides Full support for aquatic life impairment and non-support for swimming and recreational use impairment. The overall use index provides partial support.

SUMMARY OF AQUATIC MACROPHYTES

Plant sampling was performed on Slocum Lake in July. Maximum aquatic macrophyte coverage (i.e. where plants reached the lake surface) was mapped in July using a GPS unit. Plants were topped out over 30% (66 acres) of the lake's surface (Figure 5). Within this 66 acre area, 108 points were sampled based on a grid system with sampling points 60 meters apart (Figure 5) (Appendix A gives a full description of sampling methods). Plant diversity in Slocum Lake was down from 2001, however the surface area covered by plants has increased from 23% to 30%. This falls within the IDNR recommendations of 30%- 40% coverage to adequately support gamefish. There were only three aquatic plant species found in Slocum Lake (Table 4). In 2001, American Elodea and Curlyleaf Pondweed were recorded however, neither were observed this year. Coontail was the dominant species (found in 64% of the sites) and the second most abundant was Eurasian Watermilfoil (EWM), which occurred at 34% of the sites. Sago Pondweed was present at only one sampling location (Table 5). Coontail may be the dominant species because it floats on the waters surface to obtain nutrients from the water column and does not have a root system. This plant's ability to float enables it to compete for much needed light when algal blooms become too dense and block out light to lower waters. EWM is an exotic plant species that begins growing very early in the season and grows to the waters surface

Table 3. Lake County average TSI phosphorous (TSIp) ranking 2000-2005.

RANK	LAKE NAME	TP AVE	TSIp
1	Windward Lake	0.0158	43.9
2	Sterling Lake	0.0162	44.3
3	Lake Minear	0.0165	44.6
4	Pulaski Pond	0.0180	45.8
5	Fourth Lake	0.0182	46.0
6	West Loon Lake	0.0182	46.0
7	Cedar Lake	0.0183	46.1
8	Third Lake	0.0190	46.6
9	Lake Carina	0.0193	46.9
10	Independence Grove	0.0194	46.9
11	Lake Kathyrn	0.0200	47.3
12	Lake of the Hollow	0.0200	47.3
13	Banana Pond	0.0202	47.5
14	Cross Lake	0.0220	48.7
15	Dog Pond	0.0222	48.9
16	Sand Pond	0.0230	49.4
17	Stone Quarry Lake	0.0230	49.4
18	Bangs Lake	0.0233	49.6
19	Cranberry Lake	0.0236	49.7
20	Deep Lake	0.0240	50.0
21	Druce Lake	0.0244	50.2
22	Little Silver Lake	0.0246	50.3
23	Round Lake	0.0254	50.8
24	Lake Leo	0.0256	50.9
25	Timber Lake	0.0270	51.7
26	Dugdale Lake	0.0274	51.9
27	Peterson Pond	0.0274	51.9
28	Lake Miltmore	0.0276	52.0
29	Ames Pit	0.0278	52.1
30	East Loon Lake	0.0280	52.2
31	Lake Zurich	0.0282	52.3
32	Lake Fairfield	0.0296	53.0
33	Gray's Lake	0.0302	53.3
34	Highland Lake	0.0302	53.3
35	Hook Lake	0.0302	53.3
36	Lake Catherine (Site 1)	0.0308	53.6
37	Lambs Farm Lake	0.0312	53.8
38	Old School Lake	0.0312	53.8
39	Sand Lake	0.0316	53.9
40	Waterford Lake	0.0318	54.0
41	Potomac Lake	0.0318	54.0
42	Sullivan Lake	0.0320	54.1

Table 3. Continued.

RANK	LAKE NAME	TP AVE	TSIp
43	Wooster Lake	0.0324	54.3
44	Gages Lake	0.0338	54.9
45	Hendrick Lake	0.0356	55.7
46	Diamond Lake	0.0372	56.3
47	Channel Lake (Site 1)	0.0380	56.6
48	Sun Lake	0.0410	57.7
49	Lake Linden	0.0420	58.0
50	Old Oak Lake	0.0428	58.3
51	Schreiber Lake	0.0434	58.5
52	Nielsen Pond	0.0448	59.0
53	Turner Lake	0.0458	59.3
54	Seven Acre Lake	0.0460	59.4
55	Willow Lake	0.0464	59.5
56	Lucky Lake	0.0476	59.9
57	Davis Lake	0.0476	59.9
58	East Meadow Lake	0.0478	59.9
59	College Trail Lake	0.0496	60.4
60	Countryside Lake	0.0512	60.9
61	Lake Lakeland Estates	0.0524	61.2
62	Butler Lake	0.0528	61.3
63	Lake Christa	0.0530	61.4
64	West Meadow Lake	0.0530	61.4
65	Deer Lake	0.0542	61.7
66	Heron Pond	0.0545	61.8
67	Little Bear Lake	0.0550	61.9
68	Lucy Lake	0.0552	62.0
69	Lake Charles	0.0580	62.7
70	White Lake	0.0588	62.9
71	Lake Naomi	0.0616	63.6
72	Lake Tranquility S1	0.0618	63.6
73	Werhane Lake	0.0630	63.9
74	Liberty Lake	0.0632	63.9
75	Countryside Glen Lake	0.0642	64.2
76	Leisure Lake	0.0648	64.3
77	Hastings Lake	0.0664	64.7
78	St. Mary's Lake	0.0666	64.7
79	Mary Lee Lake	0.0682	65.0
80	Honey Lake	0.0690	65.2
81	Redwing Slough, Site II, Outflow	0.0718	65.8
82	North Tower Lake	0.0718	65.8
83	Lake Fairview	0.0724	65.9
84	Spring Lake	0.0726	65.9
85	ADID 203	0.0730	66.0
86	Bluff Lake	0.0734	66.1

Table 3. Continued.

RANK	LAKE NAME	TP AVE	TSIp
87	Long Lake	0.0761	66.6
88	Harvey Lake	0.0766	66.7
89	Broberg Marsh	0.0782	67.0
90	Echo Lake	0.0792	67.2
91	Sylvan Lake	0.0794	67.2
92	Big Bear Lake	0.0806	67.4
93	Petite Lake	0.0834	67.9
94	Lake Marie (Site 1)	0.0850	68.2
95	North Churchill Lake	0.0872	68.6
96	Grandwood Park, Site II, Outflow	0.0876	68.6
97	South Churchill Lake	0.0896	69.0
98	Rivershire Pond 2	0.0900	69.0
99	McGreal Lake	0.0914	69.3
100	International Mine and Chemical Lake	0.0948	69.8
101	Eagle Lake (Site I)	0.0950	69.8
102	Dunns Lake	0.0952	69.8
103	Lake Barrington	0.0956	69.9
104	Lochanora Lake	0.0960	70.0
105	Owens Lake	0.0978	70.2
106	Woodland Lake	0.0986	70.4
107	Island Lake	0.0990	70.4
108	Duck Lake	0.0996	70.5
109	Tower Lake	0.1000	70.6
110	Crooked Lake	0.1014	70.8
111	Fish Lake	0.1022	70.9
112	Longview Meadow Lake	0.1024	70.9
113	Lake Forest Pond	0.1074	71.6
114	Bittersweet Golf Course #13	0.1096	71.9
115	Fox Lake (Site 1)	0.1098	71.9
116	Bresen Lake	0.1126	72.3
117	Round Lake Marsh North	0.1126	72.3
118	Timber Lake S	0.1128	72.3
119	Deer Lake Meadow Lake	0.1158	72.7
120	Taylor Lake	0.1184	73.0
121	Grand Avenue Marsh	0.1194	73.1
122	Columbus Park Lake	0.1226	73.5
123	Nippersink Lake (Site 1)	0.1240	73.7
124	Grass Lake (Site 1)	0.1288	74.2
125	Lake Holloway	0.1322	74.6
126	Lakewood Marsh	0.1330	74.7
127	Summerhill Estates Lake	0.1384	75.2
128	Redhead Lake	0.1412	75.5

Table 3. Continued.

RANK	LAKE NAME	TP AVE	TSIp
129	Antioch Lake	0.1448	75.9
130	Forest Lake	0.1470	76.1
131	Valley Lake	0.1470	76.1
132	**Slocum Lake**	**0.1496**	**76.4**
133	Drummond Lake	0.1510	76.5
134	Pond-a-Rudy	0.1514	76.5
135	Lake Matthews	0.1516	76.6
136	Buffalo Creek Reservoir	0.1550	76.9
137	Pistakee Lake (Site 1)	0.1592	77.3
138	Salem Lake	0.1650	77.8
139	Half Day Pit	0.1690	78.1
140	McDonald Lake 1	0.1722	78.4
141	Lake Eleanor Site II, Outflow	0.1812	79.1
142	Lake Farmington	0.1848	79.4
143	ADID 127	0.1886	79.7
144	Lake Louise Inlet	0.1938	80.1
145	Grassy Lake	0.1952	80.2
146	Fischer Lake	0.1978	80.4
147	Dog Bone Lake	0.1990	80.5
148	Redwing Marsh	0.2072	81.1
149	Stockholm Lake	0.2082	81.1
150	Bishop Lake	0.2156	81.6
151	Hidden Lake	0.2236	82.2
152	Lake Napa Suwe (Outlet)	0.2304	82.6
153	Patski Pond (outlet)	0.2512	83.8
154	Slough Lake	0.2634	84.5
155	McDonald Lake 2	0.2706	84.9
156	Oak Hills Lake	0.2792	85.4
157	Loch Lomond	0.2954	86.2
158	Fairfield Marsh	0.3264	87.6
159	ADID 182	0.3280	87.7
160	Flint Lake Outlet	0.4996	93.8
161	Rasmussen Lake	0.5025	93.8
162	Albert Lake, Site II, outflow	1.1894	106.3

Figure 5. Area (66 acres) of Slocum Lake topped out in aquatic plants in 2005. Grid used for plant sampling within the area.

Table 4. Aquatic plant species found in Slocum Lake, 2005.

Coontail	*Ceratophyllum demersum*
Sago Pondweed	*Potamogeton pectinatus*
Eurasian Water Milfoil^	*Myriophyllum spicatum*

^ Exotic plant

Table 5. Aquatic plant species found at the 108 sampling sites on Slocum Lake, 2005. The maximum depth that plants were found was 4.1 feet.

July

Plant Density	Coontail	Eurasian Watermilfoil	Sago Pondweed
Present	12	28	1
Common	6	16	0
Abundant	1	10	0
Dominant	0	48	0
% Plant Occurrence	6.4	34.2	0.3

Table 5b. Distribution of rake density across all sampling sites. Sampling sites were within the 30% of the lake that was vegetated.

July

Rake Density (coverage)	# of Sites	% of Sites
No Plants	5	5
>0-10%	29	27
10-40%	11	10
40-60%	11	10
60-90%	13	12
>90%	39	36
Total Sites with Plants	103	95
Total # of Sites	108	100

forming a canopy. This enables it to begin growth before algal blooms become dense in the spring and to compete for light at the waters surface when algae becomes so dense it shades out other plants lower in the water column. These two plants (Coontail and EWM) both may be out competing Sago Pondweed, therefore allowing it to grow in only one small area of the lake.

Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow in a lake. When the light level in the water column falls below 1% of the surface light level, plants can no longer photosynthesize. Plants in Slocum Lake were found at a maximum depth of 4.1 feet. This coincides with the 1% light level in the lake, which was between 4 and 5 feet for the season. Therefore, in order to increase native plant growth to other areas of the lake, turbidity and algal blooms need to be kept under control.

In some lakes, EWM has been periodically controlled by the milfoil weevil, *Euhrychiopsis lecontei*, which is a native weevil that feeds exclusively on milfoil species. They feed on the stem making it difficult for the plants to move nutrients from the roots to new shoots, therefore damaging growth of the plant. Weevils were found in Slocum Lake this season on EWM beds in the northwest portion of the lake. A couple of weevils and pupae chambers were seen. Research has shown that approximately 1-2 weevils per stem are needed in order to see significant damage and decline of an EWM bed. They have not been noted in the lake previously and may just be getting established. The weevil was also observed in Bangs Lake in 1998 and 2002.

Floristic quality index (FQI; Swink and Wilhelm 1994) is an assessment tool designed to evaluate the closeness that the flora of an area is to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term floristic trends, and 4) monitor habitat restoration efforts. Each aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). This is done for every floating and submersed plant species found in the lake. These numbers are averaged and multiplied by the square root of the number of species present to calculate an FQI. A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake. Non-native species were counted in the FQI calculations for Lake County lakes. In 2005, Slocum Lake had a FQI of 5.8 (Table 6). The median FQI of lakes that we have studied from 2000-2005 is 13.1.

It was apparent after sampling the lake, individual bottom owners have treated their own property for plant management. While this is at the owners discretion, it is recommended that all parties on a lake work together to find a solution that is best for the whole lake. While several lake users do not like the aquatic plant abundance, the current coverage is within the recommended percentage. Plants are beneficial to the lake as they use up nutrients, thus increasing water clarity. They also compete with algae for nutrients, therefore keeping algal blooms down. Our recommendation is to identify areas of the lake where the vegetation is deemed unacceptable and treat those areas with an herbicide such as 2,4-D. Since the center of the lake is free of vegetation, lanes from the shore to the center of lake may also be an option. This would limit the area of plants impacted, but allow navigation for boat owners.

Table 6. Floristic quality index (FQI) of lakes in Lake County, calculated with exotic species (w/Adventives) and with native species only (native).

Rank	Lake Name	FQI (w/A)	FQI (native)
1	Cedar Lake	35.6	37.8
2	Deep Lake	33.9	35.4
3	Round Lake Marsh North	29.1	29.9
4	East Loon Lake	28.4	29.9
5	Cranberry Lake	28.3	28.3
6	Sullivan Lake	28.2	29.7
7	Deer Lake	27.9	30.2
8	Little Silver Lake	27.9	30.0
9	Schreiber Lake	26.8	27.6
10	Redwing Slough	26.0	26.9
11	West Loon Lake	26.0	27.6
12	Timber Lake (North)	25.5	27.1
13	Cross Lake	25.2	27.8
14	Wooster Lake	25.2	26.9
15	Butler Lake	25.0	26.6
16	Lake Zurich	24.0	26.0
17	Lake of the Hollow	23.8	26.2
18	Lakewood Marsh	23.8	24.7
19	Round Lake	23.5	25.9
20	Fourth Lake	23.0	24.8
21	Druce Lake	22.8	25.2
22	Sun Lake	22.7	24.5
23	Countryside Glen Lake	21.9	22.8
24	Sterling Lake	21.8	24.1
25	Bangs Lake	21.2	23.7
26	ADID 203	20.5	20.5
27	Broberg Marsh	20.5	21.4
28	Davis Lake	20.5	21.4
29	McGreal Lake	20.2	22.1
30	Lake Kathryn	19.6	20.7
31	Third Lake	19.6	21.7
32	Owens Lake	19.3	20.2
33	Redhead Lake	19.3	21.2
34	Lake Minear	18.8	20.6
35	Turner Lake	18.6	21.2
36	Salem Lake	18.5	20.2
37	Lake Miltmore	18.4	20.3
38	Fish Lake	18.1	20.0
39	McDonald Lake 1	17.7	18.7
40	Potomac Lake	17.3	18.5
41	Hendrick Lake	17.2	19.0

Table 6. Continued

Rank	Lake Name	FQI (w/A)	FQI (native)
42	Duck Lake	17.1	19.1
43	Summerhill Estates Lake	17.1	18.0
44	Ames Pit	17.0	18.0
45	Seven Acre Lake	17.0	15.5
46	Grand Avenue Marsh	16.9	18.7
47	Gray's Lake	16.9	19.8
48	White Lake	16.9	18.7
49	Bresen Lake	16.6	17.8
50	Waterford Lake	16.6	17.8
51	Diamond Lake	16.3	17.4
52	Lake Barrington	16.3	17.4
53	Lake Napa Suwe	16.3	17.4
54	Windward Lake	16.3	17.6
55	Fischer Lake	16.0	18.1
56	Dog Bone Lake	15.7	15.7
57	Independence Grove	15.5	16.7
58	Long Lake	15.5	17.3
59	Tower Lake	15.2	17.6
60	Heron Pond	15.1	15.1
61	Lake Linden	15.1	16.5
62	Lake Tranquility (S1)	15.0	17.0
63	North Churchill Lake	15.0	15.0
64	Dog Training Pond	14.7	15.9
65	Island Lake	14.7	16.6
66	Highland Lake	14.5	16.7
67	Lake Fairview	14.3	16.3
68	Taylor Lake	14.3	16.3
69	Dugdale Lake	14.0	15.1
70	Eagle Lake (S1)	14.0	15.1
71	Longview Meadow Lake	13.9	13.9
72	Bishop Lake	13.4	15.0
73	Hook Lake	13.4	15.5
74	Timber Lake (South)	13.4	15.5
75	Buffalo Creek Reservoir	13.1	14.3
76	Mary Lee Lake	13.1	15.1
77	Old School Lake	13.1	15.1
78	Dunn's Lake	12.7	13.9
79	Old Oak Lake	12.7	14.7
80	Echo Lake	12.5	14.8
81	Sand Lake	12.5	14.8
82	Stone Quarry Lake	12.5	12.5

Table 6. Continued

Rank	Lake Name	FQI (w/A)	FQI (native)
83	Honey Lake	12.1	14.3
84	Lake Leo	12.1	14.3
85	Lambs Farm Lake	12.1	14.3
86	Pond-A-Rudy	12.1	12.1
87	Stockholm Lake	12.1	13.5
88	Lake Matthews	12.0	12.0
89	McDonald Lake 2	12.0	12.0
90	Flint Lake	11.8	13.0
91	Harvey Lake	11.8	13.0
92	Rivershire Pond 2	11.5	13.3
93	Antioch Lake	11.3	13.4
94	Lake Charles	11.3	13.4
95	Lake Naomi	11.2	12.5
96	Pulaski Pond	11.2	12.5
97	Lake Christa	11.0	12.7
98	Redwing Marsh	11.0	11.0
99	West Meadow Lake	11.0	11.0
100	Nielsen Pond	10.7	12.0
101	Lake Holloway	10.6	10.6
102	Lake Carina	10.2	12.5
103	College Trail Lake	10.0	10.0
104	Lake Lakeland Estates	10.0	11.5
105	Crooked Lake	9.8	12.0
106	Hastings Lake	9.8	12.0
107	Werhane Lake	9.8	12.0
108	Big Bear Lake	9.5	11.0
109	Little Bear Lake	9.5	11.0
110	Loch Lomond	9.4	12.1
111	Sand Pond (IDNR)	9.4	12.1
112	Columbus Park Lake	9.2	9.2
113	Sylvan Lake	9.2	9.2
114	Grandwood Park Lake	9.0	11.0
115	Lake Fairfield	9.0	10.4
116	East Meadow Lake	8.5	8.5
117	Lake Farmington	8.5	9.8
118	Lucy Lake	8.5	9.8
119	South Churchill Lake	8.5	8.5
120	Bittersweet Golf Course #13	8.1	8.1
121	Woodland Lake	8.1	9.9
122	Albert Lake	7.5	8.7
123	Banana Pond	7.5	9.2
124	Fairfield Marsh	7.5	8.7
125	Lake Eleanor	7.5	8.7

Table 6. Continued

Rank	Lake Name	FQI (w/A)	FQI (native)
127	Patski Pond	7.1	7.1
128	Rasmussen Lake	7.1	7.1
129	Lucky Lake	7.0	7.0
130	Lake Forest Pond	6.9	8.5
131	Leisure Lake	6.4	9.0
132	Peterson Pond	6.0	8.5
133	Countryside Lake	5.8	7.1
134	Gages Lake	5.8	10.0
135	Grassy Lake	5.8	7.1
136	**Slocum Lake**	**5.8**	**7.1**
137	Deer Lake Meadow Lake	5.2	6.4
138	ADID 127	5.0	5.0
139	Drummond Lake	5.0	7.1
140	IMC	5.0	7.1
141	Liberty Lake	5.0	5.0
142	Oak Hills Lake	5.0	5.0
143	Slough Lake	5.0	5.0
144	North Tower Lake	4.9	7.0
145	Forest Lake	3.5	5.0
146	Half Day Pit	2.9	5.0
147	Lochanora Lake	2.5	5.0
148	Hidden Lake	0.0	0.0
149	St. Mary's Lake	0.0	0.0
150	Valley Lake	0.0	0.0
151	Willow Lake	0.0	0.0
	Mean	**14.0**	**15.4**
	Median	**13.1**	**14.8**

SUMMARY OF SHORELINE CONDITION

In July of 2001 an assessment was conducted to determine the condition of the shoreline at the water/land interface. Approximately 66.7% of Slocum Lake's shoreline was developed. The undeveloped portions of the lake were comprised of wetland (63%), woodland (4.2%), and prairie (1.3%). These are very desirable shoreline types, providing wildlife habitat and, typically, protecting the shore from excessive erosion. As a result of the dominance of wetland shoreline, 64.1% of Slocum Lake's shoreline exhibited no erosion. This year the shoreline was reevaluated and showed some improvement. Areas previously exhibiting moderate erosion now have little to no erosion due to human-made control mechanisms. There were areas where rip-rap and railroad ties had been placed to control the erosion. Although this is a good start, there were still areas that showed no improvement or showed further degradation and need to be attended to.

Invasive plant species were present along 70.9% of the shoreline in 2001, including Reed Canary Grass, Buckthorn, and Purple Loosestrife. These plants are extremely invasive and exclude native plants from the areas they inhabit. Additionally, they do not provide the quality wildlife habitat or shoreline stabilization native plants provide and steps to eliminate them should be carried out before they take over these areas.

SUMMARY OF WILDLIFE AND HABITAT

Wildlife observations were made each month during the season. Wetland and woodland areas around the lake are abundant and provide good habitat for many species. Bird species observed included: Great Blue Heron, Canada Goose, Gold Finch, Red-winged Blackbird, Barn Swallow, Cardinal, Red-headed Woodpecker, and the state threatened Sandhill Crane.

Fish were sampled by the IDNR in October of 2003. Seventeen species were collected which is better than expected for a lake with poor visibility and shallow water. Common Carp were found in such high numbers they were not counted and it was recommended they be removed by fisherman. Other species present in the lake were: Largemouth Bass, Bluegill, Orangespot Sunfish, Green Sunfish, Warmouth, Black Crappie, White Crappie, Yellow Bass, Walleye, Channel Catfish, Yellow Bullhead, Bluntnose Minnow, Golden Shiner, Spottail Shiner, Brook Silverside, and Freshwater Drum.

LAKE MANAGEMENT RECOMMENDATIONS

According to the IDNR, a lake should have 30-40% plant coverage in order to support gamefish, which Slocum Lake reached this year. The lake was also surrounded by good shoreline plant coverage comprised of wetland, woodland, and prairie habitats. All three of these habitat types are desirable for different wildlife species and aid in filtering runoff entering the lake and in shoreline stabilization. Slocum Lake has been a part of the VLMP program since 1996 providing valuable data in years the Lakes Management Unit is not on the lake. There are also many grant opportunities available to lake associations interested in doing improvements around or in the lake (Appendix F).

- **Watershed Nutrient Reduction**

  Although habitat was good in and around the lake, the water quality was poor due to the high levels of nutrients (Appendix D1).

- **Nuisance Algae Management**

  The two key ingredients (nutrients) for plant and algae growth are nitrogen and phosphorus. TP concentrations in the lake were very high which produced excess algal growth (Appendix D2).

- **Lakes with a High Carp Population**

  There were very high levels of carp in the lake. Their foraging and spawning behaviors stir sediment on the lake bottom producing high TSS concentrations (Appendix D3).

- **Eliminate or Control Exotic Species**

  Slocum Lake has a good abundance of aquatic macrophytes, however, it is dominated by Coontail, an invasive species, and Eurasian Waterfmilfoil, an invasive, exotic species. Controlling exotics (Appendix D4) may allow native species to expand in the lake. The milfoil weevil was found this year and may also aid in natural control of the milfoil if they colonize. Invasive shoreline plants such as Buckthorn and Purple Loosestrife were found along 70% of the shoreline. They do not offer good habitat for wildlife and should be removed.

- **Reduce or Eliminate User Conflicts**

  Aquatic macrophytes control seems to be a controversy among many people on the lake. A few bottom owners have treated on their own property, however it is recommended that all bottom owners and other users of the lake work together and decide the best solution for the lake as a whole (Appendix D5). If herbicides are used, it is recommended that spot-treatments be conducted in areas of the lake where aquatic plants are significantly interfering with recreational use. A whole lake herbicide treatment is not recommended at this time.

APPENDIX A. METHODS FOR FIELD DATA COLLECTION AND LABORATORY ANALYSES

Water Sampling and Laboratory Analyses

Two water samples were collected once a month from May through September. Sample locations were at the deepest point in the lake (see sample site map), three feet below the surface, and 3 feet above the bottom. Samples were collected with a horizontal Van Dorn water sampler. Approximately three liters of water were collected for each sample for all lab analyses. After collection, all samples were placed in a cooler with ice until delivered to the Lake County Health Department lab, where they were refrigerated. Analytical methods for the parameters are listed in Table A1. Except nitrate nitrogen, all methods are from the Eighteenth Edition of Standard Methods, (eds. American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 1992). Methodology for nitrate nitrogen was taken from the 14th edition of Standard Methods. Dissolved oxygen, temperature, conductivity and pH were measured at the deep hole with a Hydrolab DataSonde® 4a. Photosynthetic Active Radiation (PAR) was recorded using a LI-COR® 192 Spherical Sensor attached to the Hydrolab DataSonde® 4a. Readings were taken at the surface and then every two feet until reaching the bottom.

Plant Sampling

In order to randomly sample each lake, mapping software (ArcGIS 3.2) overlaid a grid pattern onto a 2004 aerial photo of Lake County and placed points 60 meters apart. Plants were sampled using a garden rake fitted with hardware cloth. The hardware cloth surrounded the rake tines and is tapered two feet up the handle. A rope was tied to the end of the handle for retrieval. At designated sampling sites, the rake was tossed into the water, and using the attached rope, was dragged across the bottom, toward the boat. After pulling the rake into the boat, plant coverage was assessed for overall abundance. Then plants were individually identified and placed in categories based on coverage. Plants that were not found on the rake but were seen in the immediate vicinity of the boat at the time of sampling were also recorded. Plants difficult to identify in the field were placed in plastic bags and identified with plant keys after returning to the office. The depth of each sampling location was measured either by a hand-held depth meter, or by pushing the rake straight down and measuring the depth along the rope or rake handle. One-foot increments were marked along the rope and rake handle to aid in depth estimation.

Plankton Sampling

Plankton was sampled at the same location as water quality samples. Using the Hydrolab DataSonde® 4a 1% light level depth (depth where the water light is 1% of the surface irradiance)
was determined. A plankton net/tow, with 80μm mesh, was then lowered to the pre-determined 1% light level depth and retrieved vertically. On the way up the water column, plankton are collected within a small cup on the bottom of the tow. The collected sample was then emptied into a pre-labeled brown plastic bottle. The net was rinsed with deionized water into the bottle in order to ensure all the plankton were

collected. The sample was then transferred to a graduated cylinder to measure the amount of milliliters (mL) that the sample was. The sample was then returned to the bottle and preserved with Lugol's iodine solution (5 drops/mL). The sample bottle was then closed and stored in a cooler until returning to the lab, where it was transferred to the refrigerator until enumeration. Enumeration was performed within three months, but ideally within one month, under a microscope. Sample bottle was inverted several times to ensure proper homogenization. An automated pipette was used to retrieve 1 mL of sample, which was then placed on a Sedgewick Rafter slide. This is a microscope slide on which a rectangular chamber has been constructed, measuring 50 mm x 20 mm in area and with a depth of 1 mm. The slide was then placed under the microscope and counted at a 20X magnification. Twenty fields of view were randomly counted with all species within each field counted. Through calculations, it was determined how many of each species were in 1 mL of lake water.

Shoreline Assessment

In previous years a complete assessment of the shoreline was done. However, this year we did a visual estimate to determine changes in the shoreline. The degree of shoreline erosion was categorically defined as none, slight, moderate, or severe. Below are brief descriptions of each category.

> None – Includes man-made erosion control such as beach, rip-rap and sea wall.
>
> Slight – Minimal or no observable erosion; generally considered stable; no erosion control practices will be recommended with the possible exception of small problem areas noted within an area otherwise designated as "slight".
>
> Moderate – Recession is characterized by past or recently eroded banks; area may exhibit some exposed roots, fallen vegetation or minor slumping of soil material; erosion control practices may be recommended although the section is not deemed to warrant immediate remedial action.
>
> Severe – Recession is characterized by eroding of exposed soil on nearly vertical banks, exposed roots, fallen vegetation or extensive slumping of bank material, undercutting, washouts or fence posts exhibiting realignment; erosion control practices are recommended and immediate remedial action may be warranted.

Wildlife Assessment

Species of wildlife were noted during visits to each lake. When possible, wildlife was identified to species by sight or sound. However, due to time constraints, collection of quantitative information was not possible. Thus, all data should be considered anecdotal. Some of the species on the list may have only been seen once, or were spotted during their migration through the area.

Table A1. Analytical methods used for water quality parameters.

Parameter	***Method***
Temperature	Hydrolab DataSonde® 4a or YSI 6600 Sonde®
Dissolved oxygen	Hydrolab DataSonde ®4a or YSI 6600 Sonde®
Nitrate nitrogen	Brucine method Standard Methods (SM) 14th ed 419D Detection Limit = 0.05 mg/L
Ammonia nitrogen	SM 18th ed. Electrode method, #4500 NH_3-F Detection Limit = 0.1 mg/L
Total Kjeldahl nitrogen	SM 18th ed, 4500-N_{org} C Semi-Micro Kjeldahl, plus 4500 NH_3-F Detection Limit = 0.5 mg/L
pH	Hydrolab DataSonde® 4a, or YSI 6600 Sonde® Electrometric method
Total solids	SM 18th ed, Method #2540B
Total suspended solids	SM 18th ed, Method #2540D Detection Limit = 0.5 mg/L
Total dissolved solids	SM 18th ed, Method #2540C
Total volatile solids	SM 18th ed, Method #2540E, from total solids
Alkalinity	SM 18th ed, Method #2320B, patentiometric titration curve method
Conductivity	Hydrolab DataSonde® 4a or YSI 6600 Sonde®
Total phosphorus	SM 18th ed, Methods #4500-P B 5 and #4500-P E Detection Limit = 0.01 mg/L
Soluble reactive phosphorus	SM 18th ed, Methods #4500-P B 1 and #4500-P E Detection Limit = 0.005 mg/L
Clarity	Secchi disk
Color	Illinois EPA Volunteer Lake Monitoring Color Chart
Photosynthetic Active Radiation (PAR)	Hydrolab DataSonde® 4a or YSI 6600 Sonde®, LI-COR® 192 Spherical Sensor

APPENDIX B. MULTI-PARAMETER DATA FOR SLOCUM LAKE IN 2005

Date MMDDYY	Time HHMMSS	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average	Extinction Coefficient 1.05
5/18/2005	8:56:34	0.25	0.569	15.36	11.58	116.1	1.109	8.38	2751.4	Surface		
5/18/2005	8:58:44	1	1.037	15.34	11.62	116.5	1.109	8.4	1414.5	Surface	100%	
5/18/2005	9:00:07	2	2.07	15.35	11.61	116.4	1.109	8.43	535.7	0.32	38%	3.03
5/18/2005	9:01:32	3	2.976	15.29	11.67	116.8	1.109	8.45	246.1	1.226	17%	0.86
5/18/2005	9:03:00	4	4.039	15.27	11.72	117.3	1.109	8.47	94.3	2.289	7%	0.90
5/18/2005	9:04:31	5	5.036	15.22	11.75	117.5	1.109	8.48	64.7	3.286	4.6%	0.38
5/18/2005	9:06:00	6	6.042	15.16	11.71	116.9	1.109	8.49	34.7	4.292	2.5%	0.62
5/18/2005	9:07:58	7	7.025	15.1	11.46	114.3	1.11	8.49	20.9	5.275	1.5%	0.52

Date MMDDYY	Time HHMMSS	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average	Extinction Coefficient 2.09
06/22/05		0.25	0.540	24.99	12.58	152.7	1.067	9.00	3398.4	Surface		
06/22/05		1	0.932	25.01	12.51	151.9	1.067	9.02	1912.7	Surface	100%	
06/22/05		2	2.025	25.00	12.34	149.8	1.067	9.06	343.9	0.275	18%	6.24
06/22/05		3	3.004	24.89	12.11	146.6	1.068	9.05	62.7	1.254	3%	1.74
06/22/05		4	3.998	24.82	11.94	144.4	1.068	9.03	23.6	2.248	1.2%	0.98
06/22/05		5	5.044	24.74	11.64	140.6	1.068	9.02	10.0	3.294	0.5%	0.82
06/22/05		6	6.053	23.97	7.91	94.2	1.079	8.74	5.2	4.303	0.3%	0.65

Date MMDDYY	Time HHMMSS	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission	Extinction Coefficient
											Average	2.15
7/20/2005		0.25	0.508	27.53	10.95	139.1	1.122	9.28	3025.3	Surface		
7/20/2005		1	1.088	27.53	10.95	139.2	1.122	9.34	1032.3	Surface	100%	
7/20/2005		2	2.099	27.52	10.82	137.5	1.122	9.37	40.5	0.349	4%	9.28
7/20/2005		3	3.018	27.47	10.72	136.0	1.122	9.37	23.1	1.268	2%	0.61
7/20/2005		4	4.040	27.23	8.82	111.4	1.123	9.28	9.6	2.29	0.9%	0.38
7/20/2005		5	4.948	27.12	7.14	90.1	1.122	9.21	5.2	3.198	0.5%	0.19
7/20/2005		6	5.957	26.99	5.58	70.2	1.123	9.11	1.7	4.207	0.2%	0.27

Date MMDDYY	Time HHMMSS	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission	Extinction Coefficient
											Average	2.38
8/17/2005		0.25	0.524	25.19	13.78	167.9	1.134	9.45	2967.8	Surface		
8/17/2005		1	0.987	25.14	14.12	171.9	1.134	9.55	1202.1	Surface	100%	
8/17/2005		2	1.953	24.98	13.77	167.1	1.135	9.58	220.2	0.203	18%	8.36
8/17/2005		3	3.034	24.82	11.97	144.9	1.135	9.46	43.1	1.284	4%	1.51
8/17/2005		4	4.024	24.68	10.07	121.5	1.134	9.41	22.0	2.274	2%	0.68
8/17/2005		5	4.978	24.46	6.75	81.1	1.136	9.18	9.7	3.228	0.8%	0.86
8/17/2005		6	5.949	24.31	4.93	59.1	1.140	9.08	6.0	4.199	0.5%	0.49

Date MMDDYY	Time HHMMSS	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission	Extinction Coefficient
											Average	1.79
9/21/2005		0.5	0.500	22.37	13.22	152.7	1.145	9.38	2688.0	Surface		
9/21/2005		1	1.047	22.35	13.30	153.7	1.158	9.42	882.8	Surface	100%	
9/21/2005		2	2.027	22.35	13.34	154.1	1.158	9.46	178.2	0.277	20%	5.78
9/21/2005		3	3.016	22.32	13.03	150.5	1.158	9.46	43.8	1.266	5%	1.42
9/21/2005		4	4.008	22.26	12.82	147.9	1.158	9.47	20.3	2.258	2%	0.78
9/21/2005		5	5.012	21.97	8.44	96.8	1.146	9.26	10.7	3.262	1.2%	0.64
9/21/2005		6	6.009	21.85	7.22	82.6	1.160	9.21	7.7	4.259	0.9%	0.33

APPENDIX C. INTERPRETING YOUR LAKE'S WATER QUALITY DATA

Lakes possess a unique set of physical and chemical characteristics that will change over time. These in-lake water quality characteristics, or parameters, are used to describe and measure the quality of lakes, and they relate to one another in very distinct ways. As a result, it is virtually impossible to change any one component in or around a lake without affecting several other components, and it is important to understand how these components are linked.

The following pages will discuss the different water quality parameters measured by Lake County Health Department staff, how these parameters relate to each other, and why the measurement of each parameter is important. The median values (the middle number of the data set, where half of the numbers have greater values, and half have lesser values) of data collected from Lake County lakes from 2000-2005 will be used in the following discussion.

Temperature and Dissolved Oxygen:

Water temperature fluctuations will occur in response to changes in air temperatures, and can have dramatic impacts on several parameters in the lake. In the spring and fall, lakes tend to have uniform, well-mixed conditions throughout the water column (surface to the lake bottom). However, during the summer, deeper lakes will separate into distinct water layers. As surface water temperatures increase with increasing air temperatures, a large density difference will form between the heated surface water and colder bottom water. Once this difference is large enough, these two water layers will separate and generally will not mix again until the fall. At this time the lake is thermally stratified. The warm upper water layer is called the ***epilimnion***, while the cold bottom water layer is called the ***hypolimnion***. In some shallow lakes, stratification and destratification can occur several times during the summer. If this occurs the lake is described as polymictic. Thermal stratification also occurs to a lesser extent during the winter, when warmer bottom water becomes separated from ice-forming water at the surface until mixing occurs during spring ice-out.

Monthly temperature profiles were established on each lake by measuring water temperature every foot (lakes $\leq$ 15 feet deep) or every two feet (lakes > 15 feet deep) from the lake surface to the lake bottom. These profiles are important in understanding the distribution of chemical/biological characteristics and because increasing water temperature and the establishment of thermal stratification have a direct impact on dissolved oxygen (DO) concentrations in the water column. If a lake is shallow and easily mixed by wind, the DO concentration is usually consistent throughout the water column. However, shallow lakes are typically dominated by either plants or algae, and increasing water temperatures during the summer speeds up the rates of photosynthesis and decomposition in surface waters. When many of the plants or algae die at the end of the growing season, their decomposition results in heavy oxygen consumption and can lead to an oxygen crash. In deeper, thermally stratified lakes, oxygen production is greatest in the top portion of the lake, where sunlight drives photosynthesis, and oxygen consumption is greatest near the bottom of a lake, where sunken organic matter accumulates and decomposes. The oxygen difference between the top and bottom water layers can be dramatic, with plenty of oxygen near the surface, but practically none near the bottom. The oxygen profiles measured during the water quality study can illustrate if

this is occurring. This is important because the absence of oxygen (anoxia) near the lake bottom can have adverse effects in eutrophic lakes resulting in the chemical release of phosphorus from lake sediment and the production of hydrogen sulfide (rotten egg smell) and other gases in the bottom waters. Low oxygen conditions in the upper water of a lake can also be problematic since all aquatic organisms need oxygen to live. Some oxygen may be present in the water, but at too low a concentration to sustain aquatic life. Oxygen is needed by all plants, virtually all algae and for many chemical reactions that are important in lake functioning. Most adult sport-fish such as largemouth bass and bluegill require at least 3 mg/L of DO in the water to survive. However, their offspring require at least 5 mg/L DO as they are more sensitive to DO stress. When DO concentrations drop below 3 mg/L, rough fish such as carp and green sunfish are favored and over time will become the dominant fish species.

External pollution in the form of oxygen-demanding organic matter (i.e., sewage, lawn clippings, soil from shoreline erosion, and agricultural runoff) or nutrients that stimulate the growth of excessive organic matter (i.e., algae and plants) can reduce average DO concentrations in the lake by increasing oxygen consumption. This can have a detrimental impact on the fish community, which may be squeezed into a very small volume of water as a result of high temperatures in the epilimnion and low DO levels in the hypolimnion.

Nutrients:

Phosphorus:
For most Lake County lakes, phosphorus is the nutrient that limits plant and algae growth. This means that any addition of phosphorus to a lake will typically result in algae blooms or high plant densities during the summer. The source of phosphorus to a lake can be external or internal (or both). External sources of phosphorus enter a lake through point (i.e., storm pipes and wastewater discharge) and non-point runoff (i.e., overland water flow). This runoff can pick up large amounts of phosphorus from agricultural fields, septic systems or impervious surfaces before it empties into the lake.

Internal sources of phosphorus originate within the lake and are typically linked to the lake sediment. In lakes with high oxygen levels (oxic), phosphorus can be released from the sediment through plants or sediment resuspension. Plants take up sediment-bound phosphorus through their roots, releasing it in small amounts to the water column throughout their life cycles, and in large amounts once they die and begin to decompose. Sediment resuspension can occur through biological or mechanical means. Bottom-feeding fish, such as common carp and black bullhead can release phosphorus by stirring up bottom sediment during feeding activities and can add phosphorus to a lake through their fecal matter. Sediment resuspension, and subsequent phosphorus release, can also occur via wind/wave action or through the use of artificial aerators, especially in shallow lakes. In lakes that thermally stratify, internal phosphorus release can occur from the sediment through chemical means. Once oxygen is depleted (anoxia) in the hypolimnion, chemical reactions occur in which phosphorus bound to iron complexes in the sediment becomes soluble and is released into the water column. This phosphorus is trapped in the hypolimnion and is unavailable to algae until fall turnover, and can cause algae blooms once

it moves into the sunlit surface water at that time. Accordingly, many of the lakes in Lake County are plagued by dense algae blooms and excessive, exotic plant coverage, which negatively affect DO levels, fish communities and water clarity.

Lakes with an average phosphorus concentration greater than 0.05 mg/L are considered nutrient rich. The median near surface total phosphorus (TP) concentration in Lake County lakes from 2000-2005 is 0.063 mg/L and ranged from a non-detectable minimum of <0.010 mg/L on five lakes to a maximum of 3.880 mg/L on Albert Lake. The median anoxic TP concentration in Lake County lakes from 2000-2005 was 0.174 mg/L and ranged from a minimum of 0.012 mg/L in West Loon Lake to a maximum of 3.880 mg/L in Taylor Lake.

The analysis of phosphorus also included soluble reactive phosphorus (SRP), a dissolved form of phosphorus that is readily available for plant and algae growth. SRP is not discussed in great detail in most of the water quality reports because SRP concentrations vary throughout the season depending on how plants and algae absorb and release it. It gives an indication of how much phosphorus is available for uptake, but, because it does not take all forms of phosphorus into account, it does not indicate how much phosphorus is truly present in the water column. TP is considered a better indicator of a lake's nutrient status because its concentrations remain more stable than soluble reactive phosphorus. However, elevated SRP levels are a strong indicator of nutrient problems in a lake.

Nitrogen:
Nitrogen is also an important nutrient for plant and algae growth. Sources of nitrogen to a lake vary widely, ranging from fertilizer and animal wastes, to human waste from sewage treatment plants or failing septic systems, to groundwater, air and rainfall. As a result, it is very difficult to control or reduce nitrogen inputs to a lake. Different forms of nitrogen are present in a lake under different oxic conditions. NH_4^+ (ammonium) is released from decomposing organic material under anoxic conditions and accumulates in the hypolimnion of thermally stratified lakes. If NH_4^+ comes into contact with oxygen, it is immediately converted to NO_2 (nitrite) which is then oxidized to NO_3^- (nitrate). Therefore, in a thermally stratified lake, levels of NH_4^+ would only be elevated in the hypolimnion and levels of NO_3^- would only be elevated in the epilimnion. Both NH_4^+ and NO_3^- can be used as a nitrogen source by aquatic plants and algae. Total Kjeldahl nitrogen (TKN) is a measure of organic nitrogen plus ammonium. Adding the concentrations of TKN and nitrate together gives an indication of the amount of total nitrogen present in the water column. If inorganic nitrogen (NO_3^-, NO_2^-, NH_4^+) concentrations exceed 0.3 mg/L in spring, sufficient nitrogen is available to support summer algae blooms. However, low nitrogen levels do not guarantee limited algae growth the way low phosphorus levels do. Nitrogen gas in the air can dissolve in lake water and blue-green algae can "fix" atmospheric nitrogen, converting it into a usable form. Since other types of algae do not have the ability to do this, nuisance blue-green algae blooms are typically associated with lakes that are nitrogen limited (i.e., have low nitrogen levels).

The ratio of TKN plus nitrate nitrogen to total phosphorus (TN:TP) can indicate whether plant/algae growth in a lake is limited by nitrogen or phosphorus. Ratios of less than 10:1

suggest a system limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. It is important to know if a lake is limited by nitrogen or phosphorus because any addition of the limiting nutrient to the lake will, likely, result in algae blooms or an increase in plant density.

Solids:

Although several forms of solids (total solids, total suspended solids, total volatile solids, total dissolved solids) were measured each month by the Lakes Management Staff, total suspended solids (TSS) and total volatile solids (TVS) have the most impact on other variables and on the lake as a whole. TSS are particles of algae or sediment suspended in the water column. High TSS concentrations can result from algae blooms, sediment resuspension, and/or the inflow of turbid water, and are typically associated with low water clarity and high phosphorus concentrations in many lakes in Lake County. Low water clarity and high phosphorus concentrations, in turn, exacerbate the high TSS problem by leading to reduced plant density (which stabilize lake sediment) and increased occurrence of algae blooms. The median TSS value in epilimnetic waters in Lake County is 7.9 mg/L, ranging from below the 1 mg/L detection limit (10 lakes) to 165 mg/L in Fairfield Marsh.

TVS represents the fraction of total solids that are organic in nature, such as algae cells, tiny pieces of plant material, and/or tiny animals (zooplankton) in the water column. High TVS values indicate that a large portion of the suspended solids may be made up of algae cells. This is important in determining possible sources of phosphorus to a lake. If much of the suspended material in the water column is determined to be resuspended sediment that is releasing phosphorus, this problem would be addressed differently than if the suspended material was made up of algae cells that were releasing phosphorus. The median TVS value was 132 mg/L, ranging from 34 mg/L in Pulaski Pond to 298 mg/L in Fairfield Marsh.

Total dissolved solids (TDS) are the amount of dissolved substances, such as salts or minerals, remaining in water after evaporation. These dissolved solids are discussed in further detail in the *Alkalinity* and *Conductivity* sections of this document. TDS concentrations were measured in Lake County lakes prior to 2004, but was discontinued due to the strong correlation of TDS to conductivity and chloride concentrations.

Water Clarity:

Water clarity (transparency) is not a chemical property of lake water, but is often an indicator of a lake's overall water quality. It is affected by a lake's water color, which is a reflection of the amount of total suspended solids and dissolved organic chemicals. Thus, transparency is a measure of particle concentration and is measured with a Secchi disk. Generally, the lower the clarity or Secchi depth, the poorer the water quality. A decrease in Secchi depth during the summer occurs as the result of an increase in suspended solids (algae or sediment) in the water column. Aquatic plants play an important role in the level of water clarity and can, in turn, be negatively affected by low clarity levels. Plants increase clarity by competing with algae for

resources and by stabilizing sediments to prevent sediment resuspension. A lake with a healthy plant community will almost always have higher water clarity than a lake without plants. Additionally, if the plants in a lake are removed (through herbicide treatment or the stocking of grass carp), the lake will probably become dominated by algae and Secchi depth will decrease. This makes it very difficult for plants to become re-established due to the lack of available sunlight and the lake will, most likely, remain turbid. Turbidity will be accelerated if the lake is very shallow and/or common carp are present. Shallow lakes are more susceptible to sediment resuspension through wind/wave action and are more likely to experience clarity problems if plants are not present to stabilize bottom sediment.

Common Carp are prolific fish that feed on invertebrates in the sediment. Their feeding activities stir up bottom sediment and can dramatically decrease water clarity in shallow lakes. As mentioned above, lakes with low water clarity are, generally, considered to have poor water quality. This is because the causes and effects of low clarity negatively impact the plant and fish communities, as well as the levels of phosphorus in a lake. The detrimental impacts of low Secchi depth to plants has already been discussed. Fish populations will suffer as water clarity decreases due to a lack of food and decreased ability to successfully hunt for prey. Bluegills are planktivorous fish and feed on invertebrates that inhabit aquatic plants. If low clarity results in the disappearance of plants, this food source will disappear too. Largemouth Bass and Northern Pike are piscivorous fish that feed on other fish and hunt by sight. As the water clarity decreases, these fish species find it more difficult to see and ambush prey and may decline in size as a result. This could eventually lead to an imbalance in the fish community. Phosphorus release from resuspended sediment could increase as water clarity and plant density decrease. This would then result in increased algae blooms, further reducing Secchi depth and aggravating all problems just discussed. The average Secchi depth for Lake County lakes is 3.17 feet. From 2000-2005, Fairfield Marsh and Patski Pond had the lowest Secchi depths (0.33 feet) and Bangs Lake had the highest (29.23 feet). As an example of the difference in Secchi depth based on plant coverage, South Churchill Lake, which had no plant coverage and large numbers of Common Carp in 2003 had an average Secchi depth of 0.73 feet (over four times lower than the county average), while Deep Lake, which had a diverse plant community and few carp had an average 2003 Secchi depth of 12.48 feet (almost four times higher than the county average).

Another measure of clarity is the use of a light meter. The light meter measures the amount of light at the surface of the lake and the amount of light at each depth in the water column. The amount of attenuation and absorption (decreases) of light by the water column are major factors controlling temperature and potential photosynthesis. Light intensity at the lake surface varies seasonally and with cloud cover, and decreases with depth. The deeper into the water column light penetrates, the deeper potential plant growth. The maximum depth at which algae and plants can grow underwater is usually at the depth where the amount of light available is reduced to 0.5%-1% of the amount of light available at the lake surface. This is called the euphotic (sunlit) zone. A general rule of thumb in Lake County is that the 1% light level is about 1 to 3 times the Secchi disk depth.

Alkalinity, Conductivity, Chloride, pH:

Alkalinity:

Alkalinity is the measurement of the amount of acid necessary to neutralize carbonate ($CO_3^{=}$) and bicarbonate (HCO_3^{-}) ions in the water, and represents the buffering capacity of a body of water. The alkalinity of lake water depends on the types of minerals in the surrounding soils and in the bedrock. It also depends on how often the lake water comes in contact with these minerals. If a lake gets groundwater from aquifers containing limestone minerals such as calcium carbonate ($CaCO_3$) or dolomite ($CaMgCO_3$), alkalinity will be high. The median alkalinity in Lake County lakes (162 mg/L) is considered moderately hard according to the hardness classification scale of Brown, Skougstad and Fishman (1970). Because hard water (alkaline) lakes often have watersheds with fertile soils that add nutrients to the water, they usually produce more fish and aquatic plants than soft water lakes. Since the majority of Lake County lakes have a high alkalinity they are able to buffer the adverse effects of acid rain.

Conductivity and Chloride:

Conductivity is the inverse measure of the resistance of lake water to an electric flow. This means that the higher the conductivity, the more easily an electric current is able to flow through water. Since electric currents travel along ions in water, the more chemical ions or dissolved salts a body of water contains, the higher the conductivity will be. Accordingly, conductivity has been correlated to total dissolved solids and chloride ions. The amount of dissolved solids or conductivity of a lake is dependent on the lake and watershed geology, the size of the watershed flowing into the lake, the land uses within that watershed, and evaporation and bacterial activity. Many Lake County lakes have elevated conductivity levels in May, but not during any other month. This was because chloride, in the form of road salt, was washing into the lakes with spring rains, increasing conductivity. Most road salt is sodium chloride, calcium chloride, potassium chloride, magnesium chloride or ferrocyanide salts. Beginning in 2004, chloride concentrations are one of the parameters measured during the lake studies. Increased chloride concentrations may have a negative impact on aquatic organisms. Conductivity changes occur seasonally and with depth. For example, in stratified lakes the conductivity normally increases in the hypolimnion as bacterial decomposition converts organic materials to bicarbonate and carbonate ions depending on the pH of the water. These newly created ions increase the conductivity and total dissolved solids. Over the long term, conductivity is a good indicator of potential watershed or lake problems if an increasing trend is noted over a period of years. It is also important to know the conductivity of the water when fishery assessments are conducted, as electroshocking requires a high enough conductivity to properly stun the fish, but not too high as to cause injury or death.

pH:
pH is the measurement of hydrogen ion (H^+) activity in water. The pH of pure water is neutral at 7 and is considered acidic at levels below 7 and basic at levels above 7. Low pH levels of 4-5 are toxic to most aquatic life, while high pH levels (9-10) are not only toxic to aquatic life but may also result in the release of phosphorus from lake sediment. The presence of high plant densities can increase pH levels through photosynthesis, and lakes dominated by a large amount of plants or algae can experience large fluctuations in pH levels from day to night, depending on the rates of photosynthesis and respiration. Few, if any pH problems exist in Lake County lakes. Typically, the flooded gravel mines in the county are more acidic than the glacial lakes as they have less biological activity, but do not usually drop below pH levels of 7. The median near surface pH value of Lake County lakes is 8.30, with a minimum of 7.06 in Deer Lake and a maximum of 10.28 in Round Lake Marsh North.

Eutrophication and Trophic State Index:

The word *eutrophication* comes from a Greek word meaning "well nourished." This also describes the process in which a lake becomes enriched with nutrients. Over time, this is a lake's natural aging process, as it slowly fills in with eroded materials from the surrounding watershed and with decaying plants. If no human impacts disturb the watershed or the lake, natural eutrophication can take thousands of years. However, human activities on a lake or in the watershed accelerate this process by resulting in rapid soil erosion and heavy phosphorus inputs. This accelerated aging process on a lake is referred to as cultural eutrophication. The term trophic state refers to the amount of nutrient enrichment within a lake system. *Oligotrophic* lakes are usually deep and clear with low nutrient levels, little plant growth and a limited fishery. *Mesotrophic* lakes are more biologically productive than oligotrophic lakes and have moderate nutrient levels and more plant growth. A lake labeled as *eutrophic* is high in nutrients and can support high plant densities and large fish populations. Water clarity is typically poorer than oligotrophic or mesotrophic lakes and dissolved oxygen problems may be present. A *hypereutrophic* lake has excessive nutrients, resulting in nuisance plant or algae growth. These lakes are often pea-soup green, with poor water clarity. Low dissolved oxygen may also be a problem, with fish kills occurring in shallow, hypereutrophic lakes more often than less enriched lakes. As a result, rough fish (tolerant of low dissolved oxygen levels) dominate the fish community of many hypereutrophic lakes. The categorization of a lake into a certain trophic state should not be viewed as a "good to bad" categorization, as most lake residents rate their lake based on desired usage. For example, a fisherman would consider a plant-dominated, clear lake to be desirable, while a water-skier might prefer a turbid lake devoid of plants. Most lakes in Lake County are eutrophic or hypereutrophic. This is primarily as a result of cultural eutrophication. However, due to the fertile soil in this area, many lakes (especially man-made) may have started out under eutrophic conditions and will never attain even mesotrophic conditions, regardless of any amount of money put into the management options. This is not an excuse to allow a lake to continue to deteriorate, but may serve as a reality check for lake owners attempting to create unrealistic conditions in their lakes.

The Trophic State Index (TSI) is an index which attaches a score to a lake based on its average

total phosphorus concentration, its average Secchi depth (water transparency) and/or its average chlorophyll *a* concentration (which represent algae biomass). It is based on the principle that as phosphorus levels increase, chlorophyll *a* concentrations increase and Secchi depth decreases. The higher the TSI score, the more nutrient-rich a lake is, and once a score is obtained, the lake can then be designated as oligotrophic, mesotrophic or eutrophic. Table 1 (below) illustrates the Trophic State Index using phosphorus concentration and Secchi depth.

Table 1. Trophic State Index (TSI).

Trophic State	TSI score	Total Phosphorus (mg/L)	Secchi Depth (feet)
Oligotrophic	<40	≤ 0.012	>13.12
Mesotrophic	≥40<50	>0.012 ≤ 0.024	≥6.56<13.12
Eutrophic	≥50<70	>0.024 ≤ 0.096	≥1.64<6.56
Hypereutrophic	≥70	>0.096	< 1.64

APPENDIX D. LAKE MANAGEMENT OPTIONS

D1. Options for Watershed Nutrient Reduction

The two key nutrients for plant and algae growth are nitrogen and phosphorus. Fertilizers used for lawn and garden care have significant amounts of both. The three numbers on the fertilizer bag identify the percent of nitrogen, phosphorus and potash in the fertilizer mixture. For example, a fertilizer with the numbers 5-10-5 has 5% nitrogen, 10% phosphorus and 5% potash. Fertilizers considered low in phosphorus (the second number) have a number of 5 or lower. A lower concentration of phosphorus applied to a lawn will result in a smaller concentration of phosphorus in stormwater runoff. An established lawn will not be negatively affected by a lower phosphorus rate. However, for areas with new seeding or new sod, the homeowner would still want to use a fertilizer formulated for encouraging growth until the lawn is established. A simple soil test can determine the correct type and amount of fertilizer needed for the soil. Knowing this, homeowners can avoid applying the wrong type or amount of fertilizer.

Option 1. Buffer Strips

Buffer strips of unmowed native vegetation at least 25 feet wide along the shoreline can slow nutrient laden runoff from entering a lake. It can help prevent shoreline erosion and provide habitat beneficial for wildlife. Different plant mixes can be chosen to allow for more aesthetically pleasing buffer strips and tall species can be used to deter waterfowl from congregating along the shore. Initially the cost of plants can be expensive, however, over time less maintenance is required for the upkeep of a buffer strip.

Option 2. Lake Friendly Lawn and Garden Care Practices – Phosphorus Reduction

a. Compost yard waste instead of burning. Ashes from yard waste contain nutrients and are easily washed into a lake.
b. Avoid dumping yard waste along or into a ditch, pond, lake, or stream. As yard waste decomposes, the nutrients are released directly into the water, or flushed to the lake via the ditch.
c. Avoid applying fertilizer up to the water's edge. Leave a buffer strip of at least 25 feet of unfertilized yard before the shoreline.
d. Avoid applying fertilizers when heavy rains are expected, or over-watering the ground after applying fertilizer.
e. When landscaping, keep site disturbance to a minimum, especially the removal of vegetation and exposure of bare soil. Exposed soil can easily erode.
f. When landscaping, seed or plant exposed soil and cover it with mulch as soon as possible to minimize erosion and runoff.
g. Use lawn and garden chemicals sparingly, or do not use them at all.

Option 3. Street Sweeping

Street sweeping has been used in communities to help prevent debris from clogging stormsewer drains, but it also benefits lakes by removing excess phosphorus, sand, silt and other pollutants. Leftover sand and salt applied to streets has been found to contain

higher concentrations of silt, phosphorus and trace metals than new sand and salt mixes. If a municipality does not manage the lake, the lake management entity may be able to offer the village or city extra payment for sweeping streets closest to the lake.

Option 4: Reduce Stormwater Volume from Impervious Surfaces

The quality and quantity of runoff directly affects the lake's water quality. With continued growth and development in Lake County, more impervious surfaces such as parking lots and buildings contribute to the volume of stormwater runoff. Runoff picks up pollutants such as nutrients and sediment as it moves over land or down gutters. A faster flow rate and higher volume can result in erosion and scouring, adding sediment and nutrients to the runoff.

Roof downspouts should be pointed away from driveways and foundations and toward lawns or planting beds where water can soak into the soil. A splash block directly below downspouts helps prevent soil erosion. If erosion still occurs, a flexible perforated plastic tubing attached to the downspout can dissipate the water flow.

Option 5: Required Practices for Construction

Follow the requirements in the Watershed Development Ordinance (WDO) concerning buffer strips. Buffer strips can slow the velocity of runoff and trap sediment and attached nutrients. Setbacks, buffer strips and erosion control features, when done properly, will help protect the lake from excessive runoff and associated pollutants. Information about the contents of the ordinance can be obtained through Lake County Planning and Development, (847) 360-6330.

Option 6. Organize a Local Watershed Organization

A watershed organization can be instrumental in circulating educational information about watersheds and how to care for them. Often a galvanized organization can be a stronger working unit and a stronger voice than a few individuals. Watershed residents are the first to notice problems in the area, such as a lack of erosion control at construction sites. This organization would be an advocate for the watershed, and members could voice their concerns about future development impacts to local officials. This organization could educate the community about how phosphorus (and other pollutants) affect lakes and can help people implement watershed controls. Several types of educational outreaches can be used together for best results. These include: community newsletters, newspaper articles, local cable and radio station announcements. In some cases fundraising may be utilized to secure more funding for a project.

Option 7. Motor Boat Restrictions for Shallow Lakes

To reduce resuspension of phosphorus from the sediment, communities that have a shallow lake or large shallow areas in their lake may want to restrict motorized boating. The action of a spinning prop in shallow areas can disturb the sediment. Flocculent sediment particles can release loosely attached phosphorus into the water. Restrictions

could include a ban of motorized traffic in certain areas or ban the use of motors entirely, however this could be hard to enforce without hiring law enforcement personnel. This would work best for lakes with shallow areas that have a large phosphorus source in the sediment.

Option 8. Discourage Waterfowl from Congregating

Waterfowl droppings (feces) can be a source of phosphorus (and bacteria) to the water, especially if they are congregating in large numbers along beaches and/or other nearshore areas. The annual nutrient load from two Canada Geese can be greater than the annual nutrient load from residential areas (Gremlin and Malone, 1986). These birds prefer habitat with short plants or no plants, such as lawns mowed to the water's edge and beaches. Waterfowl avoid areas with tall, dense vegetation through which they are unable to see predators. Tactics to discourage waterfowl from congregating in large groups include scare devices, a buffer strip of tall plants along the shoreline, and discouraging people from feeding geese and ducks. Signage could be erected at public parks/beaches discouraging people from feeding waterfowl. A template is available from Lakes Management Unit.

D2. Options for Nuisance Algae Management

Option 1: Algaecides

Algaecides are a quick and inexpensive way to temporarily treat nuisance algae. Copper sulfate ($CuSO_4$) and chelated copper products are the two main algaecides in use. There is also a non-copper based algaecide on the market called GreenClean™ from BIOsafe Systems, which contains the active ingredient sodium carbonate peroxyhydrate. Regardless of active ingredient, all forms act as contact killers. This means that the product has to come into contact with the algae to be effective. Algaecides come in two forms: granular and liquid. Granular algaecides are mainly used on filamentous algae where they are spread over their mats. Liquid algaecides are mixed with a known amount of water to achieve a known concentration and sprayed onto/into the water. Liquid forms are used on both filamentous and planktonic algae. When applying an algaecide it is important that the label is completely read and followed. If too much of the lake is treated, an oxygen crash caused by the decomposition of treated algae may cause fish kills. Additionally, treatments should never be applied when blooms/mats are at their fullest extent. It is best to divide the lake into at least two sections depending on the size of the lake, (larger lakes will need to be divided into more sections), and then treat the lake one section at a time allowing at least two weeks between treatments. Furthermore, application of algaecides should never be done in extremely hot weather (>90°F) or when dissolved oxygen concentrations are low. It is best to treat in spring or when the blooms/mats start to appear.

A properly implemented plan can often provide season long control with minimal applications. The fishery and waterfowl populations of the lake would also benefit due to a decrease in nuisance algal blooms, which would increase water clarity. This in turn would allow the native aquatic plants to return to the lake. Newly established stands of plants would improve spawning habitat and food source availability for fish. Waterfowl population would also benefit from increases in quality food sources. By implementing a good management plan, usage opportunities for the lake would increase. Activities such as boating and swimming would improve due to the removal of thick blooms and/or mats of algae.

The most obvious drawback of using algaecides is the input of chemicals into the lake. Even though the United States Environmental Protection Agency (USEPA) approved these chemicals for use, human error and overuse can make them unsafe and bring about undesired outcomes. As the algae are continuously exposed to copper, some species are becoming more and more tolerant. This results in the use of higher concentrations in order to achieve adequate control, which can be unhealthy for the lake. In other instances, by eliminating one type of algae, lake managers are finding that other species that are even more problematic are showing up. These species can often be more difficult to control due to an inherent resistance to copper products. Additionally, excessive use of copper products can lead to a build up of copper in lake sediment. This can cause problems for activities such as dredging. Due to a large amount of copper in the sediment, special permits and disposal methods would have to be utilized.

Option 2: Revegetation With Native Aquatic Plants

A healthy native plant population can reduce algal growth. Many lakes with long-standing algal problems have a sparse to non-existent plant population. This is due to reduction in light penetration by excessive algal blooms and/or mats. Revegetation should only be done when existing nuisance algal blooms are under control using one of the above management options. If the lake has poor clarity due to excessive algal growth or turbidity, these problems must be addressed before a revegetation plan is undertaken. Planting depth light levels must be greater than 1-5% of the surface light levels for plant growth. If aquatic herbicides are being used to control existing vegetation, their use should be scaled back or abandoned all together. This will allow the vegetation to grow back, which will help in controlling the algae in addition to other positive impacts associated with a healthy plant population.

There are two methods by which reestablishment can be accomplished. The first is use of existing plant populations to revegetate other areas within the lake. Plants from one part of the lake should be allowed to naturally expand into adjacent areas filling the niche left by the nuisance algae. The second method of reestablishment is to import native plants from an outside source. A variety of plants can be ordered from nurseries that specialize in native aquatic plants. These plants are available in several forms such as seeds, roots, and small plants. These two methods can be used in conjunction with each other to increase both quantity and biodiversity of plant populations. Additionally, plantings must be protected from waterfowl and other wildlife. Simple cages made out of wooden or

metal stakes and chicken wire should be erected around planted areas for at least one season. The cages are removed once the plants are established and less vulnerable. If large-scale revegetation is needed it would be best to use a consultant to plan and conduct the restoration. A list can be obtained from the Lake Management Unit that lists common, native plants that should be considered when developing a revegetation plan. Included in this list are emergent shoreline vegetation (rushes, cattails, etc) and submersed aquatic plants (pondweeds, *Vallisneria*, etc).

By revegetating opened areas, the lake will benefit in several ways. Once established, native plant populations will help to control growth of nuisance algae by shading and competition for resources. This provides a more natural approach as compared to other management options. Expanded native plant populations will also help with sediment stabilization. This in turn will have a positive effect on water clarity by reducing suspended solids and nutrients that decrease clarity and cause excessive algal growth. Properly revegetating shallow water areas with plants such as cattails, bulrushes, and water lilies can help reduce wave action that can lead to shoreline erosion. Increases in desirable vegetation will increase the plant biodiversity and also provide better quality habitat and food sources for fish and other wildlife. Recreational uses of the lake such as fishing and boating will also improve due to the improvement in water quality and the suppression of weedy species.

One drawback is the possibility of new vegetation expanding to nuisance levels and needing control. Another drawback could be high costs if extensive revegetation is needed using imported plants. If a consultant were used costs would be substantially higher. Additional costs could be associated with constructing proper herbivory protection measures.

D3. Option for Lakes with a High Carp Population

Rotenone is a piscicide that is naturally derived from the stems and roots of several tropical plants, making it biodegradable. It kills fish by chemically inhibiting the use of oxygen in biochemical pathways, therefore adult fish are much more susceptible than fish eggs. In the aquatic environment, fish come into contact with the rotenone by a different method than other organisms. With fish, the rotenone comes into direct contact with the exposed respiratory surfaces (gills), which is the route of entry. In other organisms this type of contact is minimal.

Rotenone has varying levels of toxicity on different fish species. Some species of fish can detoxify rotenone quicker than it can build up in their systems. Unfortunately, concentrations to remove undesirable fish, such as carp, bullhead and Green Sunfish, are high enough to kill more desirable species such as bass, Bluegill, crappie, Walleye, and Northern Pike. Rotenone is most effectively used when waters are cooling down (fall) not warming up (spring) and is most effective when water temperatures are $<50^{o}$F. To use rotenone in a body of water over 6 acres a *Permit to Remove Undesirable Fish* must

be obtained from the Illinois Department of Natural Resources (IDNR), Natural Heritage Division, Endangered and Threatened Species Program. Furthermore, only an IDNR fisheries biologist licensed to apply aquatic pesticides can apply rotenone in the state of Illinois, as it is a restricted use pesticide.

Rotenone is one of the only ways to effectively remove undesirable fish species, however it can be expensive. It allows for rehabilitation of the lake's fishery, which will allow for improvement of the aquatic plant community, and overall water quality. There are some negative impacts that may also occur with the use of rotenone. In the process of removing carp with rotenone, other desirable fish species will also be removed. The fishery can be replenished with restocking and quality sport fishing normally returns within 2-3 years. The IDNR will not approve application of rotenone to waters known to contain threatened and endangered fish species.

As with most intensive lake management techniques, a good bathymetric map is needed so that an accurate lake volume can be determined. To achieve a concentration of 6 ppm, which is the rate needed for most total rehabilitation projects (remove carp, bullhead and Green Sunfish), 2.022 gal/AF is required. In waters with high turbidity and/or planktonic algal blooms, the ppm may have to be higher. An IDNR fisheries biologist will be able to determine if higher concentrations will be needed.

D4. Options to Eliminate or Control Exotic Species

Option 1: Biological Control

Biological control (bio-control) is a means of using natural relationships already in place to limit, stop, or reverse an exotic species' expansion. In most cases, insects that prey upon the exotic plants in its native ecosystem are imported. Since there is a danger of bringing another exotic species into the ecosystem, state and federal agencies require testing before any bio-control species are released or made available for purchase. Control of exotics by a natural mechanism is preferable to chemical treatments, however there are few exotics that can be controlled by biological means. Insects, being part of the same ecological system as the exotic plant (i.e., the beetles and weevils with Purple Loosestrife) are more likely to provide long-term control. Chemical treatments are usually non-selective while bio-control measures target specific plant species. Bio-control can also be expensive and labor intensive.

Option 2: Control by Hand

Controlling exotic plants by hand removal is most effective on small areas (< 1 acre) and if done prior to heavy infestation. Some exotics, such as Purple Loosestrife and Reed Canary Grass, can be controlled to some degree by digging, cutting, or mowing if done early and often during the year. Digging may be required to ensure the entire root mass is removed. Spring or summer is the best time to cut or mow, since late summer and fall is when many of the plant seeds disperse. Proper disposal of excavated plants is important

since seeds may persist and germinate even after several years. Once exotic plants are removed, the disturbed ground should be planted with native vegetation and closely monitored since regrowth of the removed species is common. Many exotic species, such as Purple Loosestrife, Buckthorn, and Garlic Mustard are proficient at colonizing disturbed sites. This method can be labor intensive but costs are low.

Option 3: Herbicide Treatment

Chemical treatments can be effective at controlling exotic plant species, and works best on individual plants or small areas already infested with the plant. In some areas where individual spot treatments are prohibitive or impractical (i.e., large expanses of a wetland or woodland), chemical treatments may not be an option because in order to chemically treat the area, a broadcast application would be needed. Because many of the herbicides are not selective, meaning they kill all plants they contact, this may be unacceptable if native plants are found in the proposed treatment area.

Herbicides are commonly used to control nuisance shoreline vegetation by applying it to green foliage or cut stems. They provide a fast and effective way to control or eliminate nuisance vegetation by killing the root of the plant, preventing regrowth. Products are applied by either spraying or wicking (wiping) solution on plant surfaces. Spraying is used when large patches of undesirable vegetation are targeted. Herbicides are sprayed on growing foliage using a hand-held or backpack sprayer. Wicking is used when selected plants are to be removed from a group of plants. It is best to apply herbicides when plants are actively growing, such as in the late spring/early summer, but before formation of seed heads. Herbicides are often used in conjunction with other methods, such as cutting or mowing, to achieve the best results. Proper use of these products is critical to their success. Always read and follow label directions.

D5. Options to Reduce or Eliminate User Conflicts

One of the most challenging management issues on residential lakes involves their use by a variety of different interest groups (i.e., user conflicts). Problems occur when the lake is used at the same time for recreational activities that inherently conflict. Numerous potential conflicts can be cited. For example, fishermen may feel the quality of their fishing experience is greatly diminished when powerboats are using the lake. Often, the overriding priority when dealing with user conflicts is safety. Unfortunately, these conflicts are not limited to human-to-human conflicts. Fish and wildlife may also be adversely affected by human activities.

User conflicts can also have significant effects on how a lake is managed. For example, water skiers may feel that the aquatic plant population is impeding with their ability to safely use certain portions of the lake and want the plants removed or dramatically reduced. At the same time, the fishermen and wildlife enthusiasts do not want plant reductions because they believe the plants are enhancing the habitat in the lake.

Another important component to consider is the enforcement of any use conflict resolutions. As with any rule or regulation, it is only as good as the ability to enforce it. A significant factor is determining who has jurisdiction to enforce any regulations. Any law enforcement officer can enforce boating regulations or ordinances enacted by the State of Illinois or local government entities. Verbal or "gentlemen's" agreements that are more stringent than state laws are not legally binding. Similarly, a law enforcement officer may not enforce regulations adopted by a lake management association.

The following are several options that may help reduce some of the user conflicts that may be occurring on your lake.

Option 1: Time Zoning

As the name implies, time spacing requires that certain times of the day are allocated for various activities, while other activities are restricted or not permitted. For example, water skiing or jet skiing may only be permitted between certain periods of the day (i.e., 9AM to 6PM). This option may be combined with other options such as zone spacing or speed/power limits. Certain areas of the lake may be restricted only during parts of the day (i.e., early morning or evening) or users may be required to use "no-wake" speeds during these times. Time zoning allows various activities on the lake that may otherwise conflict. However, care should be taken in arrangement of times so all interest groups are considered.

Option 2: Space Zoning

Designating areas of the lake where uses are restricted or even not allowed is known as zone spacing. A "no-wake" zone is an example of using zone spacing to achieve a management goal. Zone spacing is generally used to isolate or consolidate certain lake activities for various reasons. Frequently, user safety is a priority and thus activities such as water skiing or jet skiing are limited to the deeper areas of the lake where they will not conflict with other lake users, such as swimmers.

Another reason zone spacing is implemented is for the prevention of shoreline erosion. Wave action generated by boat traffic can cause erosion, which can reduce property values and fish and wildlife habitat. In addition, the water quality of the lake may be degraded when wave activity suspends lake bottom nutrients and sediment. Shoreline erosion also adds nutrients and sediment to the lake, causing a decrease in water quality, which impacts all users of the lake. In some cases, certain areas of lakes may be zoned "no entry" or "restricted use only". This designation is usually to protect sensitive fish and wildlife habitat of threatened or endangered species. These areas may have this restriction only during times of the year that are the most critical for a particular species (i.e., nesting or spawning season), or the restrictions may be year-round.

A "no wake" zone is generally established in a defined area from the shoreline out to a certain point in a lake and is usually marked by buoys. This area should be wide enough to allow wave action from boats to dissipate before reaching the shoreline.

Option 3: Speed/Power Limits

Powerboat motor limits or no motor areas may be warranted on small shallow lakes or in areas of a lake that are particularly susceptible to erosion or otherwise need protection. As mentioned previously, boat traffic may produce wave action that may cause shoreline erosion or degrade fish and wildlife habitat. Limited boat traffic may lead to less wave action battering shorelines and causing erosion, thus reducing the suspension of nutrients and sediment in the water column. Less nutrients and sediment in the water column may improve water quality by increasing water clarity and limiting nutrient availability for excessive plant or algae growth. Motor limits can reduce boat speeds however, the type of boat may be more important that the motor size or speed limit. Recent studies have shown that a boat traveling at "near plane" speed actually displaces more water and potentially resuspend lake bottom sediment at a greater volume than boats traveling at either idle speeds or speeds high enough to allow the boat to plane on the water's surface. Enforcement would be the most difficult aspect of this option.

Another option is to limit the number of boats that use a lake at one time. This is generally most effective on private lakes where the number of boats can be more easily controlled. Large lakes with public access would have a difficult time enforcing regulations of this nature. To achieve this option, a lake management entity could issue a limited number of permits or require stickers for any boat using the lake.

APPENDIX E. WATER QUALITY STATISTICS FOR ALL LAKE COUNTY LAKES

2000 - 2005 Water Quality Parameters, Statistics Summary

	ALK (oxic) <=3ft 2000-2005	
Average	**167.0**	
Median	**162.0**	
Minimum	**64.9**	**IMC**
Maximum	**330.0**	**Flint Lake**
STD	**42.2**	
n =	**803**	

	ALK (anoxic) 2000-2005	
Average	**205**	
Median	**194**	
Minimum	**103**	**Heron Pond**
Maximum	**470**	**Lake Marie**
STD	**53**	
n =	**265**	

	Cond (oxic) <=3ft 2000-2005	
Average	**0.8536**	
Median	**0.7748**	
Minimum	**0.2305**	**White Lake**
Maximum	**6.8920**	**IMC**
STD	**0.5203**	
n =	**808**	

	Cond (anoxic) 2000-2005	
Average	**0.9606**	
Median	**0.8210**	
Minimum	**0.3031**	**White Lake**
Maximum	**7.4080**	**IMC**
STD	**0.7611**	
n =	**265**	

	NO3-N (oxic) <=3ft 2000-2005	
Average	**0.480**	
Median	**0.116**	
Minimum	**<0.05**	***ND**
Maximum	**9.670**	**South Churchill Lake**
STD	**1.019**	
n =	**808**	

*ND = Many lakes had non-detects (69%)
Only compare lakes with detectable
concentrations to the statistics above

	NH3-N (anoxic) 2000-2005	
Average	**2.296**	
Median	**1.560**	
Minimum	**<0.1**	***ND**
Maximum	**18.400**	**Taylor Lake**
STD	**2.483**	
n =	**265**	

*ND = 21% Non-detects from 32 different lakes

	pH (oxic) <=3ft 2000-2005	
Average	**8.31**	
Median	**8.30**	
Minimum	**7.06**	**Deer Lake**
Maximum	**10.28**	**Round Lake Marsh North**
STD	**0.46**	
n =	**807**	

	pH (anoxic) 2000-2005	
Average	**7.11**	
Median	**7.13**	
Minimum	**5.80**	**Third Lake**
Maximum	**8.48**	**Heron Pond**
STD	**0.41**	
n =	**265**	

	All Secchi 2000-2005	
Average	**4.39**	
Median	**3.17**	
Minimum	**0.33**	**Fairfield Marsh, Patski Pond**
Maximum	**29.23**	**Bangs Lake**
STD	**3.65**	
n =	**740**	

81 of 161 lakes had anoxic conditions
Anoxic conditions are defined <=1 mg/l D.O.
pH Units are equal to the -Log of [H] ion activity
Conductivity units are in MilliSiemens/cm
Secchi Disk depth units are in feet
All others are in mg/L

LCHD Lakes Management Unit ~ 12/8/2005

2000 - 2005 Water Quality Parameters, Statistics Summary continued

TKN (oxic)
<=3ft 2000-2005

Average	**1.457**	
Median	**1.220**	
Minimum	**<0.5**	***ND**
Maximum	**10.300**	**Fairfield Marsh**
STD	**0.831**	
n =	**808**	

*ND = 5% Non-detects from 19 different lakes

TKN (anoxic)
2000-2005

Average	**3.067**	
Median	**2.270**	
Minimum	**<0.5**	***ND**
Maximum	**21.000**	**Taylor Lake**
STD	**2.467**	
n =	**265**	

*ND = 5% Non-detects from 7 different lakes

TP (oxic)
<=3ft 2000-2005

Average	**0.098**	
Median	**0.063**	
Minimum	**<0.01**	**From 5 Lakes**
Maximum	**3.880**	**Albert Lake**
STD	**0.168**	
n =	**795**	

*ND = 0.1% Non-detects from 5 different lakes
(Bangs, Cedar, Carina, Minear,& Stone Quarry)

TP (anoxic)
2000-2005

Average	**0.320**	
Median	**0.174**	
Minimum	**0.012**	**West Loon Lake**
Maximum	**3.800**	**Taylor Lake**
STD	**0.412**	
n =	**265**	

TSS (all)
<=3ft 2000-2005

Average	**15.3**	
Median	**7.9**	
Minimum	**<0.1**	***ND**
Maximum	**165.0**	**Fairfield Marsh**
STD	**20.3**	
n =	**815**	

*ND = 2% Non-detects from 10 different lakes

TVS (oxic)
<=3ft 2000-2005

Average	**136.0**	
Median	**132.0**	
Minimum	**34.0**	**Pulaski Pond**
Maximum	**298.0**	**Fairfield Marsh**
STD	**40.4**	
n =	**758**	

No 2002 IEPA Chain Lakes

TDS (oxic)
<=3ft 2000-2004

Average	**470**	
Median	**454**	
Minimum	**150**	**Lake Kathryn, White**
Maximum	**1340**	**IMC**
STD	**169**	
n =	**745**	

No 2002 IEPA Chain Lakes, Data from 00-04.

CL (anoxic)
2004-2005

Average	**277**	
Median	**102**	
Minimum	**53**	**Banana Pond**
Maximum	**2390**	**IMC**
STD	**489**	
n =	**66**	

CL (oxic)
<=3ft 2004-2005

Average	**243.8**	
Median	**183.0**	
Minimum	**51.7**	**Heron Pond**
Maximum	**2760.0**	**IMC**
STD	**339.4**	
n =	**197**	

LakeCounty
Health Department and
Community Health Center

APPENDIX F. GRANT PROGRAM OPPORTUNITES

Table F1. A list of potential grant opportunities

Grant Program Name	Funding Source	Funding Focus			Cost Share	Typical Award
		Water Quality	Flooding	Habitat		
Challenge Grant Program	USFWS			X	>50%	<$10,000
Chicago Wilderness Small Grants Program	CW			X	None	$15,000
Conservation 2000 (C2000)	IDNR			X	None	$10,000 to $500,000
Conservation Reserve Program	NRCS			X	Land	Variable
Five Star Challenge Grant	NFWF			X	None	$5,000 to $20,000
Flood Mitigation Assistance Program	IEMA		X		25%	$200,000
Habitat Restoration Program for the Fox Watershed	LCSWCD			X	25%	<$1,000K
Illinois Clean Lakes Program (ICLP)	IEPA	X			>50%	$5,000 to $30,000
Illinois Clean Energy Community Foundation	ICECF			X	None	Variable
Lakes Education Assistance Grant Program (LEAP)	IEPA	X			None	$500
Northeast Illinois Wetland Conservation Account	USFWS	X		X	>50%	$600 to $200,000
Partners for Fish and Wildlife Program	USFWS			X	>50%	$3,000
Section 206: Aquatic Ecosystem Restoration	USACE			X	35%	<$1,000,000
Section 319: Non-Point Source Management Program	IEPA	X		X	>40%	Variable
STAG Grants	LCSMC	X			None	Variable
Stream Cleanup And Lakeshore Enhancement (SCALE)	IEPA	X			None	$2,000
Streambank Stabilization and Restoration Program (SSRP)	LCSWCD	X		X	25%	Variable
Unincorporated Lake County Drainage Fund	LCPBD		X		>50%	$5,000 to $10,000
Wildlife Habitat Incentives Program	NRCS			X	Land	Variable
Watershed Management Board	LCSMC	X	X	X	>50%	$5K to $10K
Wetland Reserve Program	NRCS			X	Land	Variable

CW = Chicago Wilderness
ICECF = Illinois Clean Energy Community Foundation
IEMA = Illinois Emergency Management Agency
IEPA = Illinois Environmental Protection Agency
IDNR = Illinois Department of Natural Resources
LCPBD = Lake County Planning, Building, and Development Department
LCSMC = Lake County Stormwater Management Commission
LCSWCD = Lake County Soil and Water Conservation District
NFWF = National Fish and Wildlife Foundation
NRCS = Natural Resources Conservation Service
USACE = United States Army Corps of Engineers
USFWS = United States Fish and Wildlife Service

Table F2. Grant Contacts

Chicago Wilderness (CW)
Elizabeth McCance, Director of Conservation Programs
Phone: (312) 580-2138
E-mail: emccance@chicagowilderness.org
http://www.chicagowilderness.org/

Illinois Clean Energy Community Foundation (ICECF)
2 N. LaSalle Street
Suite 950
Chicago, IL 60602
Phone: (312) 372-5191
Fax: (312) 372-5190
http://www.illinoiscleanenergy.org/

Illinois Department of Natural Resources (IDNR)
One Natural Resources Way
Springfield, IL 62702-1271
Phone: (217) 782-9740
http://dnr.state.il.us/orep/C2000

Illinois Emergency Management Agency (IEMA)
110 East Adams Street
Springfield, Illinois 62701
Phone: (217) 785-0229
http://www.state.il.us/iema/index.htm

Illinois Environmental Protection Agency (IEPA)
Bureau of Water - Surface Water Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
Telephone: (217) 782-3362
Fax: (217) 785-1225
http://www.epa.state.il.us/water/financial-assistance/non-point.html

Lake County Planning, Building, and Development Department (LCPBD)
18 N. County Street
Waukegan, IL 60085
Phone: (847) 377-2875
Fax: (847) 782-3016

Lake County Soil and Water Conservation District (LCSWCD)
100 N. Atkinson Road
Suite 102A
Grayslake, IL 60030
Phone: (847)-223-1056
Fax: (847)-223-1127
http://www.lakeswcd.org/

Lake County Stormwater Management Commission (LCSMC)
333-B Peterson Road
Libertyville, IL 60048
Phone: (847) 918-5260
Fax: (847) 918-9826
http://www.co.lake.il.us/smc

National Fish and Wildlife Foundation (NFWF)
Attn: Five Star Restoration Program
1120 Connecticut Avenue N.W., Suite 900
Washington, DC 20036
Phone: (202) 857-0166
Fax: (202) 857-0162
http://nfwf.org/programs/5star-rfp.htm

Natural Resources Conservation Service (NRCS)
Wildlife Habitat Incentives Program Coordinator
USDA Natural Resources Conservation Service
1902 Fox Drive
Champaign, IL 61820
Phone: (217) 398-5267
http://www.nrcs.usda.gov/programs/whip/

United States Army Corps of Engineers (USACE)
111 N. Canal Street
Chicago, Illinois 60606-7206
Telephone: (312)-846-5333
Fax: (312)-353-2169
http://www.lrc.usace.army.mil/

United States Fish and Wildlife Service (USFWS)
Chicago Field Office
1250 South Grove Avenue, Suite 103
Barrington, IL 60010
Phone: (847)-381-2253
Fax: (847)-381-2285

Other Related Contacts

Catalog of Federal Funding Sources for Watershed Protection Web Site
http://cfpub.epa.gov/fedfund/

Fox River Ecosystem Partnership (FREP)
http://foxriverecosystem.org/

North American Wetlands Conservation Act Grants Program
http://birdhabitat.fws.gov/NAWCA/grants.htm

North American Wetland Conservation Act Programs
http://birdhabitat.fws.gov/NAWCA/grants.htm

U.S. Fish and Wildlife Foundation
http://www.nfwf.org/