

**2003 SUMMARY REPORT
of
REDWING MARSH**

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Redwing Marsh is a 12-acre shallow water marsh located in Antioch Township southeast of the intersection of Deep Lake Road and IL State Route 173. It is currently owned by the Lake County Forest Preserve District, but does not have public access. The marsh has a maximum depth of 3.0 feet and an estimated mean depth of 1.5 feet. The Eagle Ridge subdivision to the east of the marsh drains into a 1-acre detention pond that flows into Redwing Marsh when the water level overtops a small earthen spillway.

Water quality parameters, such as nutrients, suspended solids, oxygen, temperature and water clarity were measured and the plant community was assessed each month from May-September 2003. Redwing Marsh had poor water quality in comparison to other lakes throughout Lake County. Total Kjeldahl nitrogen, total phosphorus and total suspended solid (TSS) concentrations were higher than the Lake County medians. The high TSS concentrations resulted in low Secchi disk readings, which were one foot or less. Redwing Marsh was completely mixed during the 2003 sampling season, and dissolved oxygen levels were high throughout the water column for the entire season.

The aquatic plants in Redwing Marsh were scattered and few, with only four species observed. Fortunately, none of these species were exotic, invasive plants. The plants that were observed usually were coated with sediment, which many submersed aquatic species do not tolerate well.

The shoreline of Redwing Marsh is completely undeveloped, most of it surrounded by emergent wetland species. One small section of shoreline supported shrubs. No area of the shoreline was eroding. A few purple loosestrife plants were noticed along the shoreline. Although it is not at nuisance levels now, this exotic plant species can rapidly infest an area; it out-competes native vegetation and provides poor habitat for wildlife. A good mix of waterfowl and songbird species were observed on and around the marsh throughout the summer.

LAKE IDENTIFICATION AND LOCATION

Lake Name: Redwing Marsh

County: Lake

Nearest Municipality: Antioch, Illinois

Location: T46N, R10E, Section 15

Watershed: Fox River

Sub-basin: Sequoit Creek

Major Tributaries: None

Receiving Body of Water: East Loon Lake

Surface Area: 12.07 acres

Shoreline Length: 0.78 miles

Maximum Depth: 3 feet

Mean Depth (estimated): 1.5 feet

Volume (estimated): 18.1 acre-feet

Lake Type: Shallow marsh

LIMNOLOGICAL DATA - WATER QUALITY

Redwing Marsh is located near the Village of Antioch, southeast of the intersection of Route 173 and Deep Lake Road and is owned by the Lake County Forest Preserve District. Directly north of Route 173 is Redwing Slough, a high quality marsh system owned by the Illinois Department of Natural Resources. The marsh and the slough were hydrologically connected at one time as the marsh used to flow into the slough. The marsh and slough may still be connected by groundwater, but the surface flow has changed. The flow was diverted when Route 173 was built and now Redwing Marsh flows west under Deep Lake Road, through a wetland and then eventually reaches East Loon Lake. At this time, the marsh does not have public access. The Eagle Ridge subdivision east of the marsh drains into a 1-acre detention pond, which then flows into the Redwing Marsh if the water level overtops an earthen spillway. Water samples were analyzed for a variety of water quality parameters (See Appendix B for methodology). Because it is so shallow, samples were collected just below the surface, from the deepest location in the marsh (Figure 1).

Redwing Marsh did not thermally stratify during May-September, 2003. The shallow water column was continually mixed by wind, wave and carp action, and dissolved oxygen was high for the entire season.

Water clarity is usually the first thing people notice about a lake, and typifies the overall water quality. The water clarity in Redwing Marsh during 2003 was poor, with the worst reading in May (0.62 feet) and the best in September, when the disk could be seen at the bottom (2.23 feet). The seasonal average of 0.88 feet is nearly four times lower than the Lake County median. The poor water clarity was due to the high concentrations of total suspended solids (TSS) in the water column. The seasonal average TSS in Redwing Marsh was 28.2 mg/L, approximately 3.5 times higher than the Lake County median of 7.5 mg/L. TSS are composed of nonvolatile suspended solids (NVSS), inorganic materials such as clay or sediment particles, and volatile suspended solids (VSS) such as algae and other organic matter. In Redwing Marsh, the calculated NVSS concentrations averaged 19.16 mg/L during 2003, which constitutes 68% of the TSS. Therefore, although algae is present in the water, sediment is the major component of TSS that caused the low water clarity. The sediment is disturbed and resuspended from the bottom by wind and wave action, and carp activity.

The combination of high TSS and low Secchi depth was both caused by and was the most likely reason for an absence of aquatic plants in Redwing Marsh. A diverse community of aquatic plants is beneficial in many ways, including stabilizing sediment to prevent resuspension, causing soil particles entering the lake through non-point runoff to settle out quickly, competing with planktonic algae for resources and providing habitat and a food base for a healthy fish community.

INSERT FIGURE 1, SAMPLE POINT

Although planktonic algae blooms were not seen to be a problem in Redwing Marsh, two important nutrients required for algae growth, nitrogen and phosphorus, were in high concentrations. It is likely that the high TSS extinguished the majority of the sunlight penetration and not only curtailed aquatic plant growth, but also some algae growth as well. The suspended sediment may have had phosphorus adsorbed to it. Phosphorus can bind to resuspended sediment particles, making it unavailable for algal growth. Total phosphorus (TP) averaged 0.207 mg/L during 2003, which is 3.5 times higher than the Lake County TP median of 0.059 mg/L. Generally, nuisance algae blooms can occur with TP concentrations higher than 0.05 mg/L, so it is very likely that the phosphorus was bound to resuspended sediment particles, making it unavailable for a large algae bloom to occur. Similar conditions have been noted in other turbid, shallow water systems.

TP also can be used in determining the trophic state index (TSI), which classifies lakes according to the overall level of nutrient enrichment. The TSI uses phosphorus concentrations, chlorophyll *a* (algae biomass) levels and Secchi depth to classify and compare lake trophic states using just one value. The TSI is set up so that an increase in phosphorus concentration is related to an increase in algal biomass and a corresponding decrease in Secchi depth. Using the total phosphorus concentration, the TSI score can be calculated. The score falls within the range of one of four categories: hypereutrophic, eutrophic, mesotrophic and oligotrophic. Hypereutrophic lakes are those that have excessive nutrients, with nuisance algae growth reminiscent of “pea soup” and have a TSI score greater than 70. Lakes with a TSI score of 50 or greater are classified as eutrophic or nutrient rich, and are productive lakes in terms of aquatic plants and/or algae and fish. Mesotrophic and oligotrophic lakes are those with lower nutrient levels. These are very clear lakes, with little or no plant and/or algae growth. Mesotrophic and oligotrophic lakes are those with low and poor nutrient levels, respectively. Most lakes in Lake County are classified as eutrophic or nutrient rich, and are productive lakes in terms of aquatic plants and/or algae and fish. The TSI of Redwing Marsh based on phosphorus concentrations during 2003 was hypereutrophic, with a score of 81. The Marsh ranked 121st out of 130 Lake County lakes studied since 1999. Of the 16 lowest ranking lakes for total phosphorus concentrations in Lake County (Table 2, Appendix A), all but one are very shallow systems, five are marshes and eight are flow through systems that are online with poor quality streams.

The other nutrient critical for algae growth is nitrogen. Total Kjeldahl nitrogen (TKN) is a measure of organic nitrogen, and is typically bound up in algal cells. In Redwing Marsh, TKN concentrations averaged 3.97 mg/L in 2003, which is more than three times higher than the Lake County TKN median. Sources of nitrogen are numerous, and include resuspended sediment, rain, fertilizer, the atmosphere and watershed sources, and can be difficult to pinpoint, and virtually impossible to control.

The ratio of total nitrogen to total phosphorus (TN:TP) indicates if the amount of phosphorus or nitrogen would limit algae and/or plant growth in the lake. Lakes with TN:TP ratios of more than 15:1 are usually limited by phosphorus. Those with ratios less than 10:1 are usually limited by nitrogen. Most lakes in Lake County are limited by phosphorus. Although it has high concentrations of TP, Redwing Marsh is limited by

phosphorus, with a TN:TP ratio of 19:1. This is due to the high TKN concentrations throughout the season.

The Illinois Environmental Protection Agency (IEPA) has indices to classify Illinois lakes for their ability to support aquatic life, swimming, or recreational uses. The guidelines consider several aspects, such as phosphorus concentrations, water clarity and aquatic plant coverage. Redwing Marsh partially supports aquatic life according to these guidelines. Although people do not swim or boat in Redwing Marsh, the low water clarity, high phosphorus concentrations and high NVSS concentrations placed the marsh in the nonsupport category for these uses. The marsh falls into the nonsupport category for overall use.

Conductivity is a measurement of water's ability to conduct electricity via total dissolved solids (TDS), which are dissolved minerals or salts in the water column. Because of the use of road salts, lakes with residential and/or urban land uses are often noted to have higher conductivity readings and higher total dissolved solids concentrations than lakes that are not surrounded by development. Stormwater runoff from impervious surfaces such as asphalt and concrete can deliver high concentrations of these salts to nearby lakes and ponds. The 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. The Lake County average conductivity reading of water near the surface is 0.7907 mS/cm. During 2003, the conductivity levels in Redwing Marsh averaged 0.9626 mS/cm. The marsh receives some runoff from Route 173, which is the most likely source of road salt. Although the high conductivity levels are cause for concern, there may not be much that can be done about them. Non-point runoff, such as that which picks up road salt and enters the lake during rain events, is very difficult to control.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

We randomly sampled locations in Redwing Marsh each month for aquatic plants. Four species were identified. Shoreline plants were also recorded. Table 3 lists the plants that were identified by their common and scientific names. Table 4 in Appendix A lists the plant species and the frequency in which they were found. Aquatic plants were found in few sample sites. Coontail was found most often, in 58% of the sample sites. There were no defined beds of coontail, however, but a few scattered individuals. To support a healthy fishery, the Illinois Department of Natural Resources (IDNR) suggests that aquatic plants cover approximately 20% to 40% of the lake bottom. In Redwing Marsh, the aquatic plants covered less than 1% of the bottom, offering little in terms of food, shelter and nursery habitat for aquatic life. The large population of carp may have been keeping the plant population down in the marsh as they either ate or uprooted them. In addition, rooted plants have difficulty growing in hard or very flocculent substrates. We noted both types of these substrates in Redwing Marsh.

Table 3. Aquatic and Shoreline Plants on Redwing Marsh, May – September, 2003.

<u>Aquatic Plants</u>	
Coontail	<i>Ceratophyllum demersum</i>
Northern Water Milfoil	<i>Myriophyllum sibiricum</i>
Sago Pondweed	<i>Stuckinia pectinatus</i>
Duckweed	<i>Lemna</i> sp.
<u>Shoreline Plants</u>	
Jewelweed	<i>Cirsium arvense</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Cattail	<i>Typha</i> sp.
Smartweed	<i>Polygonum</i> sp.
<u>Trees/Shrubs</u>	
Willow	<i>Salix</i> spp.

Floristic quality index is a measurement designed to evaluate the closeness of the flora (plants species) of an area to that with 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 floating and submersed aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). These numbers are then used to calculate the floristic quality index (FQI). A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake, and better plant diversity. Nonnative species are included in the FQI calculations for Lake County lakes. The FQI scores lakes measured from 2000 through 2003 ranges from 0 to 37.2, with an average of 14.7. Redwing Marsh has a floristic quality of 5.5, indicating a lower than average aquatic plant diversity.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

In August 2003, we assessed the shoreline of Redwing Marsh. See Appendix B for a discussion of the methods used. One hundred percent of the shoreline is classified as undeveloped. Figure 2 shows the two shoreline types: wetland (96% of the total shoreline) and shrub (4% of the total shoreline). No erosion was noted.

Large water elevation fluctuations over time can lead to shoreline erosion. During 2003, we measured water elevation of the marsh each month. The largest change in elevation was a 5.26-inch decrease occurring between July and August. Over the season, the change between elevation readings was greatest from July through September, with a loss

in elevation totaling 9.63 inches. Because there was little rain between the July and September sampling dates, the water loss was inevitable. These elevation changes are typical for other similar bodies of water in Lake County and did not fluctuate greatly. Most likely, the lack of erosion was due to the high density of native wetland plants that surround the shoreline. We also noticed the presence of a few purple loosestrife plants along the shoreline. Although this aggressive plant species is not in dense stands at this time, these plants can quickly spread. Their immediate removal is recommended.

INSERT FIGURE 2, SHORELINE TYPES

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Table 5 lists the wildlife species observed at Redwing Marsh. We noted species that are common in wetland systems. Although the wetland shoreline offers some habitat for a variety of wildlife, the marsh's shallow depth and poor water quality does not allow for a high quality fishery. In addition, the close proximity to two major roadways probably discourages a wide variety of waterfowl. Furthermore, the marsh is infested with carp, which not only feed and uproot aquatic plants that try to grow here, but they also increase sediment resuspension into the water with their feeding and spawning activities. The removal of carp could allow the regrowth of the remaining native aquatic seed bank and could improve the water clarity. But because of the shallow morphometry of Redwing Marsh, this step would not guarantee an improvement in the fishery.

**Table 5. Wildlife species observed on Redwing Marsh,
May – September 2003.**

<u>Birds</u>	
Canada Goose	<i>Branta canadensis</i>
Mallard	<i>Anas platyrhynchos</i>
Great Blue Heron	<i>Ardea herodias</i>
Green Heron	<i>Butorides striatus</i>
Mourning Dove	<i>Zenaida macroura</i>
Eastern Pewee	<i>Contopus virens</i>
Barn Swallow	<i>Hirundo rustica</i>
Tree Swallow	<i>Iridoprocne bicolor</i>
Blue Jay	<i>Cyanocitta cristata</i>
American Robin	<i>Turdus migratorius</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Yellow Warbler	<i>Dendroica petechia</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Common Grackle	<i>Quiscalus quiscula</i>
Northern Oriole	<i>Icterus galbula</i>
House Sparrow	<i>Passer domesticus</i>
American Goldfinch	<i>Carduelis tristis</i>
Chipping Sparrow	<i>Spizella passerina</i>
<u>Mammals</u>	
Muskrat	<i>Ondatra zibethicus</i>
<u>Amphibians</u>	
Bull Frog	<i>Rana catesbeiana</i>
Green Frog	<i>Rana clamitans melanota</i>

**Table 5. Wildlife species observed on Redwing Marsh,
May – September 2003, con't.**

Reptiles

Snapping Turtle

Chelydra serpentina

Fish

Common Carp

Cyprinus carpio

EXISTING LAKE QUALITY PROBLEMS

Highpoints of the Marsh:

- A. Wetland plants surround the shoreline
- B. No erosion present along the shoreline

- *Poor Water Clarity*

Redwing Marsh suffers from poor water clarity that is caused by the high total suspended solids in the water, most of which is sediment. Wind, wave and carp action suspends TSS in the water by disturbing the bottom. Water clarity could improve if the carp are removed.

- *High Nutrient Concentrations*

Redwing Marsh has high nutrient concentrations. Total phosphorus concentrations are 3.5 times higher than the Lake County median, and total Kjeldahl nitrogen is 3 times higher than the Lake County median. Marshes by nature are highly organic and nutrients are most likely resuspended continually from the sediment. The removal of carp would help prevent some sediment/nutrient resuspension.

- *Lack of Aquatic Plants*

The marsh has few aquatic plants, and a low diversity of plant species. This results in a lack of habitat for aquatic life. The root systems of aquatic plants can also assist in stabilizing the sediment, making it less likely that it will be swept into the water column from wind and wave action and carp activity. The infestation of carp is a likely reason few plants are present, since their feeding and foraging habits are targeted toward plants.

- *Carp*

Carp infest Redwing Marsh, creating turbid water by disturbing the bottom sediment, and probably repressing the growth of some native plants. Without the carp, there is the possibility that a native seed bank could begin to grow again. The Forest Preserve may want to try using Rotenone to eradicate the carp. The removal of carp can allow aquatic plants to grow and help further stabilize the sediment. However, in the process of removing carp with rotenone, other desirable fish species will also be removed. The fishery can be replenished with restocking. Other aquatic organisms, such as mollusks, frogs, and invertebrates (insects, zooplankton, etc.), can also be negatively impacted. However, this disruption is temporary and studies show that recovery occurs within a few months. 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 such as Redwing Marsh, the ppm may have to be higher. The volume of the marsh is estimated at 18.1 acre/feet. The minimum amount needed for the marsh is approximately $(18.1 \text{ acft}) \times (2.022 \text{ gal/acft}) = 37 \text{ gallons}$. The cost per gallon ranges from \$50-75, which would total \$1,850- 2,775.