2001 SUMMARY REPORT
of
RASMUSSEN LAKE

Lake County, Illinois

Prepared by the

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LAKE IDENTIFICATION AND LOCATION

Lake Name: Rasmussen Lake

County: Lake

Nearest Municipality: Old Mill Creek

Location: T46N, R11E, Section 19, SW ¼

Watershed: Des Plaines River

Sub-Basin: Mill Creek

Major Tributaries: Mill Creek

Receiving Body of Water: Mill Creek

Surface Area: 58 acres

Shoreline Length: 2.7 miles

Maximum Depth: 11 feet

Mean Depth: 5.5 feet (estimated)

Volume: 319 acre-feet (estimated)

Lake Type: Manmade, constructed in 1957 by damming North Mill Creek

Elevation: Approximately 737 feet above mean sea level

LIMNOLOGICAL DATA - WATER QUALITY

Rasmussen Lake is located just north of the Village of Old Mill Creek in an unincorporated area in Newport Township. No boating is permitted and only bank fishing is allowed on this lake. Water samples were taken once a month, from June through September 2001, at the deepest location (See Figure 1)[1]. Samples were collected at three feet and seven feet deep and analyzed for a variety of parameters. See Appendix B for water quality sampling and laboratory methods.

The water clarity of Rasmussen Lake during 2001 was poor, averaging 1.80 feet deep. Fifty percent of Lake County lakes had a water clarity reading of at least 4.18 feet[2]. Rasmussen Lake experiences high turbidity due to high concentrations of total suspended solids (TSS). The lake had a seasonal TSS average of 22.8 mg/L, four times higher than the Lake County median of 5.7 mg/L. There are several sources that cause the high TSS average concentration. Approximately one third of the shoreline is severely eroding, which continually adds sediment to the water. Common carp, wind and wave action also resuspends the sediment in this shallow lake. Another source is treated effluent from the Lindenhurst sewage treatment plant that discharges into Hastings Creek, which flows into North Mill Creek shortly before it widens to form Rasmussen Lake. The treatment plant is about 2.8 miles upstream from the lake. Depending on flow rates, some suspended materials may drop out in the streambed before reaching the lake. Based on the average daily concentration from November 1, 2001 to January 2003 discharge monitoring reports for the National Pollution Discharge Elimination System, an estimate of TSS loading from this plant is 27 pounds per day, or 4.9 tons per year. Although the shoreline supports some heavy plant growth, some sediment may also enter the lake from the adjacent agricultural fields.

Nutrient concentrations in Rasmussen Lake were very high. Nutrient inputs can be attributed to effluent from the Lindenhurst sewage treatment plant, runoff from the adjacent agricultural fields (fertilizers and eroding soils), and streambank erosion contributing soil particles with attached nutrients. Total phosphorus (TP) concentrations in samples near the surface averaged 0.503 mg/L during 2001, or about ten times the Lake County median of 0.047 mg/L. Rasmussen Lake ranked #102 out of 103 Lake County lakes based on average total phosphorus concentrations (See Table 2 in Appendix A)[3]. Although TP analysis and removal is not part of the permit requirements for the Lindenhurst sewage treatment plant, a conservative calculation of loading (based on 1.0 mg/L per day) would be approximately 1.9 tons of phosphorus per year, based on a 1 mg/L TP effluent estimate.

[1] Rasmussen Lake was not sampled in May due to the inability to access the lake.
[2] This is the median value, or the point at which half of the lake samples have data less than this value, and the other half have greater values. Median and average values were calculated using results of lakes sampled by the LCHD from 1995 through 2001.
[3] Data set from 1998 to 2002.

INSERT FIG 1.

The total Kjeldahl nitrogen average concentration in the near surface samples (2.32 mg/L) was about twice as high as the Lake County median (1.12 mg/L). Nitrate nitrogen concentrations near the surface were also high each month, averaging 1.33 mg/L for the 2001 season. Of the samples near the surface that had detectable concentrations, the median nitrate nitrogen value for Lake County lakes is 0.076 mg/L. Ammonia nitrogen, which is not normally found in the near surface samples, was in detectable concentrations throughout the season, and averaged 0.322 mg/L. Lakes with ammonia nitrogen concentrations higher than 0.3 mg/L are indicative of nutrient rich systems. Ammonia nitrogen loading from the Lindenhurst sewage treatment plant is estimated at 3.2 pounds per day, or 0.6 tons per year.

The ratio of total nitrogen to total phosphorus (TN:TP) indicates if phosphorus or nitrogen limits 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. In Rasmussen Lake, the TN:TP ratio is 7:1, indicating a lake limited by nitrogen. This is unusual, since most lakes throughout Lake County are phosphorus limited. However, this lake does receive treated effluent from a sewage treatment plant that contributes phosphorus to the lake.

The trophic condition of a lake indicates the overall level of nutrient enrichment. A mesotrophic lake has an intermediate amount of nutrients and lower biological productivity than a lake with eutrophic status. Most lakes in Lake County are eutrophic or nutrient rich, and are productive lakes in terms of aquatic plants and/or algae and fish. Hypereutrophic lakes are those that have excessive nutrients. In calculating the lake's trophic status in terms of its TP content, Rasmussen Lake is hypereutrophic.

The Illinois Environmental Protection Agency has lake assessment indices to classify Illinois lakes for their ability to support aquatic life, swimming, or recreational uses. The guidelines consider several aspects, such as water clarity, phosphorus concentrations and aquatic plant coverage. Rasmussen Lake falls into the nonsupport category for all of these uses according to these guidelines. The high phosphorus concentrations, low water clarity and hypereutrophic condition are the principle reasons.

Thermal stratification occurs when a lake divides into an upper, warm water layer (epilimnion) and a lower, cold water layer (hypolimnion). When stratified, the epilimnetic and hypolimnetic waters do not mix, and the hypolimnion typically becomes anoxic (dissolved oxygen = 0 mg/l) by mid-summer in nutrient-enriched lakes. This phenomenon is a natural occurrence in deep lakes and is not necessarily a bad thing if enough of the lake volume remains well oxygenated. Rasmussen Lake was weakly stratified from June through August and completely mixed in September. A 5.0 mg/L concentration of dissolved oxygen (DO) is considered an amount adequate to support aquatic life, since some aquatic life, such as fish, suffer oxygen stress at a concentration less than this. The dissolved oxygen concentrations and temperature throughout the water column of Rasmussen Lake were measured from the surface down to the bottom in one-foot increments. The lake had DO concentrations of less than 5 mg/L below 3 feet deep in June, 5 feet deep in July and 2 feet deep in August. The water column was

completely mixed in September, and dissolved oxygen concentrations were greater than 5 mg/L down to the bottom. Because no bathymetric map with volume calculations exists for Rasmussen Lake, the volume of water with an adequate DO supply cannot be calculated.

The alkalinity concentrations were high, and the result in June (260 mg/L) for the near surface sample was the highest recorded in the 1995-2001 LCHD database for near surface samples. Data from both the epilimnion and hypolimnion were similar, averaging 248 and 249 mg/L $CaCO_3$, respectively.

Staff measured the water elevation at the spillway during 2001. Although the greatest change in water level (3.75 inches, from June to July) was minimal, staff noticed evidence of water elevation changes that were far greater. For example, in June, leaves on overhanging shrubs and trees above the water by one to two feet were covered in silt, a common high water mark indicator. Throughout the season, staff noted similar high water marks, which suggests that this flowage system, like most, has very dynamic water elevation fluctuations.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Staff randomly sampled locations in Rasmussen Lake each month for aquatic plants, and found virtually none. Two coontail (*Ceratophyllum demersum*) plants were located in June and two sightings of duckweed (*Lemna* spp.) were spotted in late August. Rasmussen Lake offers very poor habitat for submersed aquatic plants. Aquatic plants will not photosynthesize in water depths with less than 1% of the available sunlight. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow in a specific lake. In the case of Rasmussen Lake, the photic zone ranged from 2 feet deep (September) to 5 feet deep (August). Although it may appear that this light availability coupled with the shallow depths of this lake would support far more plants than these few sightings, other factors are preventing plant beds from becoming established. For example, although the northern and mid-sections of the lake range from 2.3 to 6.5 feet deep, the two rooted plant sightings (coontail) were found only in 2 – 3 foot depths. Incoming silt flowing downstream coated these plants, which would hinder the photosynthetic process as well as causing light extinction from the turbidity. The southern section of the lake had depths ranging from 7 to 11 feet deep with steep sides very close to shore. The low light availability, steep littoral zone and suspended silt are all reasons for a virtual lack of plants.

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 of 64 lakes measured in 2000 and 2001 ranges from 0 to 37.2, with an average of 14. Rasmussen Lake has a FQI of 7.1, indicating a less than average aquatic plant diversity based on the 64 lakes measured.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

In August, 2001, LCHD staff assessed the shoreline of Rasmussen Lake. See Appendix B for a discussion of the methods used. The only portion of the shoreline considered developed was the spillway (1% of entire shoreline). The types of shoreline that were recorded are woodland (59% of the shoreline), shrub (32%) and prairie (8%) (See Figure 2). Approximately 96% of the total shoreline is eroding. Figure 3 maps the locations of shoreline erosion. Thirty-three percent, or 4,277 feet of the shoreline is severely eroding, with vertical drops of approximately 10 feet high along some parts of the shoreline. Approximately 7% or 942 feet of the total shoreline is moderately eroding. The remainder (56% or 7,108 feet) is slightly eroding. Flowage systems with fluctuating water levels like Rasmussen Lake pose a challenge to erosion mitigation. Staff also noted the presence of invasive, exotic plants along much of the shoreline: reed canary grass (*Phalaris arundinacea*), buckthorn (*Rhamnus spp.*), and honeysuckle (*Lonicera spp*).

FIGURE 2

FIGURE 3.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Good numbers of wildlife, particularly birds, were noted on and around Rasmussen Lake. See Appendix B for methods. Several of the species listed in Table 3 were seen during spring or fall migration and were assumed not to be nesting around the lake.

Habitat around Rasmussen Lake is good, but has the potential to be better. Upland habitats, such as the wooded areas, harbored many species of birds, including some which are typically found in larger forested areas (i.e., hairy woodpecker, ovenbird, wood thrush). Large amounts of deadfall were seen along the shoreline, although no reptiles and few amphibians were seen. In September, large numbers of wood ducks were seen in these areas. Although non-native plant species were present along the shoreline, the potential for improving existing habitats is feasible.

Table 3. Wildlife species observed on Rasmussen Lake, June – September, 2001.

Birds	
Wood Duck	*Aix sponsa*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Common Flicker	*Colaptes auratus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villocus*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Pewee	*Contopus virens*
Willow Flycatcher	*Empidonax traillii*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Iridoprocne bicolor*
Rough-wing Swallow	*Stelgidopteryx ruficollis*
Chimney Swift	*Chaetura pelagica*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Black-capped Chickadee	*Poecile atricapillus*
House Wren	*Troglodytes aedon*
Brown Thrasher	*Toxostoma rufum*
Catbird	*Dumetella carolinensis*
Eastern Bluebird	*Sialia sialis*
American Robin	*Turdus migratorius*
Wood Thrush	*Hylocichla mustelina*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*

Table 3. Wildlife species observed on Rasmussen Lake, June – September, 2001 (cont'd).

Warbling Vireo	*Vireo gilvus*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Ovenbird	*Seiurus aurocapillus*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Northern Oriole	*Icterus galbula*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*
Indigo Bunting	*Passerina cyanea*
Song Sparrow	*Melospiza melodia*
Mammals	
Eastern Chipmunk	*Tamias striatus*
White-tailed Deer	*Odocoileus virginianus*
Amphibians	
Green Frog	*Rana clamitans melanota*
Reptiles	
None noted.	

*** Endangered in Illinois**
+Threatened in Illinois

EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS

Rasmussen Lake is relatively undeveloped. Wooded and shrubby areas along each shoreline provide good habitat for many wildlife species. Although non-native plant species were present, the potential for improving existing habitats is feasible.

- *Poor Water Quality*

The water clarity of Rasmussen Lake during 2001 was poor, averaging 1.80 feet deep. Rasmussen Lake experiences high turbidity due to high concentrations of high total suspended solids (TSS). The lake had a seasonal TSS average four times higher than the Lake County median. Several sources add to the TSS concentration: common carp, wind and wave action, severely eroding shorelines, and effluent from the Lindenhurst sewage treatment plant. Although the shoreline supports some heavy plant growth, some sediment may enter the lake from the adjacent agricultural fields.

Nutrient concentrations in Rasmussen Lake were very high. Total phosphorus concentrations in samples near the surface were about ten times higher than the Lake County median. All three forms of nitrogen, total Kjeldahl nitrogen, nitrate nitrogen and ammonia nitrogen were all in high concentrations.

Rasmussen Lake falls into the nonsupport category for aquatic life, swimming, and recreational uses according to Illinois Environmental Protection Agency lake assessment guidelines.

- *Lack of Aquatic Vegetation*

Rasmussen Lake has a lack of aquatic vegetation. Only two coontail (*Ceratophyllum demersum*) plants were located in June and two sightings of duckweed (*Lemna* spp.) were found in late August. Rasmussen Lake offers very poor habitat for submersed aquatic plants. Incoming silt flowing downstream coated the plants that were found and likely hindered photosynthesis as well as causing rapid light extinction from the turbidity. The southern section of the lake had depths ranging from 7 to 11 feet deep with steep sides very close to shore, which precluded plant growth. The low light availability, steep littoral zone and smothering silt are all reasons for a lack of plants. Emergent aquatic species planted close to shore would have a better chance of survival in Rasmussen Lake than submersed aquatic plants at this time. In addition, the emergent vegetation would improve wildlife habitat.

- *Shoreline Erosion*

  Approximately 96% of the total shoreline is eroding in some degree. Thirty-three percent of the shoreline is severely eroding, with vertical drops of approximately 10 feet high along some parts of the shoreline. Approximately 7% of the total shoreline is moderately eroding. The remainder (56%) is slightly eroding. Flowage systems with fluctuating water levels like Rasmussen Lake may require some of the more severely eroding areas to be stabilized with riprap or A-Jacks®, before planting deep rooted native vegetation above. The areas that are slightly eroding could be stabilized with native plantings or biologs.

- *Invasive Shoreline Plant Species*

  Staff also noted the presence of invasive, exotic plants along much of the shoreline: reed canary grass (*Phalaris arundinacea*), buckthorn (*Rhamnus spp.*), and honeysuckle (*Lonicera spp*). Several areas on which these plants grow are eroding, so a plan for mitigating shoreline erosion should be in place for these locations as soon as the invasive species are removed.