2003 SUMMARY REPORT
of
LAKE FOREST POND

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Lake Forest Pond is a 6.6-acre manmade shallow lake located within the Prairie Wolf Slough Forest Preserve near the City of Lake Forest. This preserve is one of the Lake County Forest Preserve District's popular dog exercise areas. The lake has a maximum depth of 4.2 feet and an estimated mean depth of 2.1 feet. The volume is estimated at 13.86 acre-feet.

Water quality parameters, such as nutrients, suspended solids, dissolved oxygen, temperature and water clarity were measured and the plant community was assessed each month from May-September 2003. Lake Forest Pond 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 water clarity readings, which were usually one foot or less. The water column in Lake Forest Pond was completely mixed during the 2003 sampling season. Dissolved oxygen levels were high for the entire season, which is not uncommon for shallow lakes that do not stratify.

The aquatic plants in Lake Forest Pond were scattered and few, with only four species observed. Curlyleaf pondweed and sago pondweed were found most often. Curlyleaf pondweed is considered an exotic, invasive species. The plants that were observed usually were coated with sediment, which many submersed aquatic species do not tolerate well.

The majority of the shoreline surrounding Lake Forest Pond is undeveloped, and the most common types of shoreline are shrub and woodland. Twenty percent of the total shoreline was severely eroding, and 10% of the total shoreline was slightly eroding. The two most popular areas where dogs enter and leave the water are bare soil and are severely eroding. The shoreline plants are mostly aggressive, exotic species, including purple loosestrife, reed canary grass, teasel, honeysuckle and buckthorn.

The wildlife species observed at Lake Forest Pond did not constitute a large variety, and are prevalent in this area. Most of the species seen or heard were common songbirds. The exotic shoreline plants offer little habitat for wildlife. The removal of these plants and the installation of native beneficial plants would improve wildlife habitat, and may encourage more wildlife species to use the area. Although the fishery was not assessed, the lake's shallow depth and poor water quality does not allow for a high quality fishery.

LAKE IDENTIFICATION AND LOCATION

Lake Name: Lake Forest Pond

County: Lake

Nearest Municipality: Lake Forest, Illinois

Location: T43N, R12E, Section 17

Watershed: Chicago River

Sub-basin: Middle Fork, Chicago River

Major Tributaries: None

Receiving Body of Water: Middle Fork, Chicago River (North Branch)

Surface Area: 6.6 acres

Shoreline Length: 0.6 miles

Maximum Depth: 4.2 feet

Mean Depth (estimated): 2.1 feet

Volume (estimated): 13.9 acre-feet

Lake Type: Manmade, year unknown

Lake Forest Pond is located within the Prairie Wolf Slough Forest Preserve. This is one of four forest preserves in which visitors can allow their dogs to roam unleashed. Dogs are allowed to swim here, but no other uses (i.e., fishing, swimming or boating) are allowed. Forest Preserve staff is unsure when the lake was built, but the area was previously farmland according to a 1939 aerial photo. The next available aerial image[1] was taken in 1974, in which the lake can be seen.

[1] Lake County Mapping Services

LIMNOLOGICAL DATA - WATER QUALITY

Lake Forest Pond is a 6.6-acre body of water located within the Prairie Wolf Slough Forest Preserve near the City of Lake Forest. The lake has a maximum depth of 4.2 feet and an estimated mean depth of 2.1 feet. Water samples were analyzed for a variety of water quality parameters (See Appendix B for methodology). Because it is so shallow, samples were collected near the surface, from the deepest location in the lake (Figure 1). The lake receives flow from an unnamed creek at the northwest corner. This creek originates in the field to the northwest of the pond. Water exits the lake at the south end, eventually flowing into the Middle Fork of the Chicago River (North Branch).

Lake Forest Pond did not thermally stratify during May-September, 2003. The shallow water column was continually mixed by wind and wave action. Consequently, the dissolved oxygen concentrations were high throughout the water column for the entire season.

Water clarity is usually the first thing people notice about a lake, and typifies the overall water quality. A large amount of material in the water column can decrease water clarity as well as inhibit successful predation by sight-feeding fish, such as bass and pike. Sediment may also settle out and smother fish eggs. High turbidity caused by sediment or algae can shade out aquatic plants, resulting in the reduction or absence of these plants. This reduces or eliminates the benefits provided by plants, such as habitat for many fish species and the stabilization of lake bottom sediment. The water clarity in Lake Forest Pond, as measured by Secchi disk transparency readings during 2003 was very poor, ranging from 0.46 feet (July and September) to 1.51 feet (June). The seasonal average clarity of 0.71 feet is nearly five times lower than the Lake County median of 3.41 feet. The poor water clarity was due to the extremely high concentrations of total suspended solids (TSS) in the water column. The 2003 seasonal average TSS concentration in the lake was extremely high, at 54.1 mg/L, more than seven times higher than the Lake County median of 7.5 mg/L. TSS are composed of nonvolatile suspended solids (NVSS), non-organic materials such as clay or sediment particles, and volatile suspended solids (VSS) such as algae and other organic matter. In Lake Forest Pond, the calculated NVSS concentrations averaged 39.5 mg/L during 2003, which constitutes 73% of the TSS. Therefore, 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 sediment particles from eroding shorelines. Although not observed, common carp may be present in the pond as hydrologically it is connected to the Chicago River. Carp contribute to the sediment and nutrients in the water column through their foraging and breeding activities.

The high TSS concentrations and low Secchi depths were both influenced by and were the cause of the lack of aquatic plant diversity and abundance in Lake Forest Pond. A diverse community of aquatic plants is beneficial in many ways, including stabilizing sediment to prevent resuspension. Usually, a lake is either dominated by aquatic plants

INSERT FIGURE 1, SAMPLE POINT

or algae. In Lake Forest Pond, however, neither plants nor algae were seen as problematic. It is likely that the high TSS, which caused the poor water clarity, extinguished the majority of the sunlight penetration and not only curtailed aquatic plant growth, but also some algae growth as well. The sediment may have also played a role in the availability of phosphorus. Phosphorus can be bound to suspended sediment particles, making it unavailable for algal growth. Although planktonic algae blooms were not prevalent in Lake Forest Pond, phosphorus was in high concentrations. Total phosphorus (TP) concentrations averaged 0.107 mg/L during 2003, which is nearly twice as high as the Lake County TP median of 0.059 mg/L. Generally, nuisance algae blooms can occur with TP concentrations of 0.05 mg/L, so it is very likely that the phosphorus was bound to suspended sediment particles, preventing a widespread algae bloom.

TP concentrations can be used to determine the trophic state index (TSI), which classifies lakes according to the overall level of nutrient enrichment. The TSI uses phosphorus, chlorophyll *a* (algae biomass) 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. Most lakes in Lake County are classified as eutrophic. The TSI of Lake Forest Pond in terms of its phosphorus concentrations during 2003 was hypereutrophic, with a score of 71.6. The lake ranked 96th out of 130 Lake County lakes based on average total phosphorus concentrations of lakes studied since 1999.

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 Lake Forest Pond, TKN concentrations averaged of 1.16 mg/L in 2003, which is close to the Lake County TKN median of 1.22 mg/L. Ammonia, the most available form of nitrogen for algae growth, was detected in only one sample during 2003. One reason is because ammonia converts to other nitrogen forms in the presence of dissolved oxygen, which was abundant in Lake Forest Pond. A third nitrogen form, nitrate nitrogen, is often below detectable limits in surface waters. Although 65% of lakes that we sampled between 1999-2003 did not have detectable concentrations of nitrate nitrogen, in Lake Forest Pond, nitrate nitrogen was detected in all but the September sample. These concentrations are not excessively high since they were just above the laboratory detection limit. Algae and other plants in the pond may not be using the nitrogen due to the poor water clarity.

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. Lake Forest Pond has a TN:TP ratio of 11:1, meaning that sufficient amounts of both nutrients are available to support algae blooms.

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. Lake Forest Pond fully supports aquatic life according to these guidelines. Although people do not use Lake Forest Pond for swimming, boating or fishing, the low water clarity, and high NVSS concentrations placed the lake in the nonsupport category for these uses. The lake falls into the partial support category for overall use.

Conductivity is a measurement of water's ability to conduct electricity via total dissolved solids (TDS), which are dissolved ions (i.e., chlorides) 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 readings in Lake Forest Pond averaged lower, at 0.4864 mS/cm. The lake appears not to receive high amounts of road salt and mineral-laden runoff even though it is nearby U.S. Route 41. Most of the stormwater from Route 41 flows into a small stream south of Lake Forest Pond that drains into the North Branch of the Chicago River. The watershed of the pond is approximately 67 acres (Figure 2). The main land use (88% of the total; Figure 3) in the watershed is public and private open space (i.e., the Forest Preserve).

During 2003, we measured water elevation of the lake each month. The largest change in elevation was a 4.6-inch decrease occurring between August and September. These elevation changes are typical for lakes in Lake County and did not fluctuate greatly. Large water elevation fluctuations over time can lead to shoreline erosion.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

We randomly sampled locations in Lake Forest Pond 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 at few sample sites. Curlyleaf pondweed (an invasive, exotic plant) and sago pondweed were found most often, in 47% and 45% of the sample sites, respectively. Individual plants were scattered around the lake, and did not form defined beds of plants. Because curlyleaf pondweed is an early season plant, it dominated the findings in May and June.

Figure 2.

Figure 3

On the July sampling date, both sago pondweed and curlyleaf were found in about the same number of locations. After the curlyleaf had died back, sago pondweed was the dominant aquatic plant in August and September. Chara and small pondweed were each found only once. The optimal plant coverage for a bass/bluegill fishery, which is most common in this area, is 30-40% of the littoral zone. Although IEPA's aquatic use assessment guideline suggests that Lake Forest Pond fully supports aquatic life, it does so marginally. In Lake Forest Pond, the aquatic plants covered approximately 10% of the bottom, offering little in terms of food, shelter and nursery habitat for aquatic life. If the plant coverage were slightly less, the lake would only partially support aquatic life. The poor water clarity is the main reason for the lack of aquatic plants. Light levels were measured at one-foot intervals from the water surface to the lake bottom. When light intensity falls below 1% of the level at the water surface, plants are no longer able to grow. During 2003, the 1% light level in Lake Forest Pond reached 2.8 feet deep or less in July, August and September. No readings were taken in May. In June, the probe was resting at the bottom, but the light meter, which is attached approximately 0.2 feet above the bottom of the probe, was measuring 3% light at 3.83 feet deep. It is possible that the 1% light level could have reached the bottom at four feet. Even so, there were few aquatic plants growing in Lake Forest Pond. Another reason plant growth may have been hindered in addition to low light levels is because the plants that were observed usually were coated with sediment, which many submersed aquatic species do not tolerate well.

Table 3. Aquatic and shoreline plants on Lake Forest Pond, May – September 2003.

Aquatic Plants	
Chara	*Chara* spp.
Curlyleaf Pondweed^	*Potamogeton crispus*
Sago Pondweed	*Stuckinia pectinatus*
Small Pondweed	*Potamogeton pusillus*
Shoreline Plants	
Teasel^	*Dipsacus sylvestris*
Purple Loosestrife^	*Lythrum salicaria*
Reed Canary Grass^	*Phalaris arundinacea*
Trees/Shrubs	
Honeysuckle^	*Lonicera* sp.
Buckthorn^	*Rhamnus* sp.

^ Exotic plant species

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 of lakes measured from 2000 through 2003 ranges from 0 to 37.2, with an average of 14.7. Lake Forest Pond has a floristic quality of 4, far below the average aquatic plant diversity, based on 118 lakes.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

In July of 2003, we assessed the shoreline of Lake Forest Pond. See Appendix B for a discussion of the methods used. Ninety-four percent of the shoreline is classified as undeveloped. Figure 4 shows the two most common shoreline types: shrub (58% of the total shoreline) and woodland (20% of the total shoreline). Figure 5 shows the locations of erosion, which was noted along 30% of the shoreline (849 feet). Of this, 569 feet, or 20% of the total shoreline, was classified as severely eroding. The two muddy slopes where dogs enter the lake are severely eroding, some areas had vertical slopes of two to three feet at the water's edge. These two locations are the only ones that do not harbor any shoreline plants. The remainder of the shoreline is infested with invasive plants, including purple loosestrife, teasel, reed canary grass and buckthorn shrubs (Figure 6). The buckthorn shrubs were especially numerous, and the loosestrife, teasel and reed canary grass were scattered about the shoreline. These plant species are detrimental, as they can crowd out native, beneficial plants. Their removal is recommended. Buckthorn exudes a chemical that discourages other plant growth, leaving bare soil beneath the shrubs. Bare soil has a tendency to erode, and in one severely eroding location on the northeast shore, buckthorn shrubs and a steep slope may have contributed to its present condition. This erosion is contributing to the poor water clarity and high nutrient content in the water. It would be best if an erosion control plan, such as grading and installation of native plants was immediately undertaken after the removal of the exotic species along shore.

Insert FIGURE 4 SHORELINE TYPES

INSERT FIGURE 5 EROSION

INSERT FIGURE 6, INVASIVES

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Table 5 lists the wildlife species observed at Lake Forest Pond. Those noted are commonly found. The shoreline plants are not native species and offer little habitat for wildlife. Removal of the exotic shoreline plants and subsequent installation of native beneficial plants would improve wildlife habitat, and may encourage additional wildlife species to use the area. In addition, the lake's poor water clarity and high TSS concentrations generally do not allow for a high quality fishery. The condition of the fishery is unknown, since the LCFPD has not conducted a fishery assessment in Lake Forest Pond.

Table 5. Wildlife species observed on Lake Forest Pond, May – September 2003.

Birds	
Northern Oriole	*Icterus galbula*
Song Sparrow	*Melospiza melodia*
Red-tailed Hawk	*Buteo jamaicensis*
Indigo Bunting	*Passerina cyanea*
Redwing Blackbird	*Agelaius phoeniceus*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Barn Swallow	*Hirundo rustica*
Blue Jay	*Cyanocitta cristata*
Common Mallard	*Anas platyrhnchos*
Brown-headed Cowbird	*Molothrus ater*
Turkey Vulture	*Cathartes aura*
Mourning Dove	*Zenaida macroura*
Rough-winged Swallow	*Stelgidopteryx ruficollis*
Northern Cardinal	*Cardinalis cardinalis*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Warbling Vireo	*Vireo gilvus*
Savannah Sparrow	*Passerculus sandwichensis*
Tree Swallow	*Iridoprocne bicolor*
Great Blue Heron	*Ardea herodias*
Yellow Warbler	*Dendroica petechia*
Common Grackle	*Quiscalus quiscula*
Cedar Waxwing	*Bombycilla cedrorum*
Amphibians	
Western Chorus Frog	*Pseudacris triseriata triseriata*
Mammals	
Chipmunk	*Tamias striatus*

EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS

Lake Forest Pond is one of four dog parks in the Lake County Forest Preserve District. Due to its poor water clarity and high nutrient contents, the pond should be used for non-human recreational activities. Our two main recommendations are stabilization of the eroding shorelines and removal of exotic plant species.

- *Poor Water Clarity*

  Lake Forest Pond suffers from poor water clarity that is caused by extremely high total suspended solids (TSS) in the water, most of which is sediment. TSS concentrations were over seven times higher than the Lake County median. Wind and wave action also add to the solids in the water by resuspending the bottom sediment. The shoreline adds soil particles to the water as it continually erodes. Although not observed, carp may be present in the pond. Carp activity can contribute to the high TSS concentrations and poor clarity.

- *High Nutrient Concentrations*

  Lake Forest Pond has high phosphorus concentrations that are nearly twice as high as the Lake County median. The lake ranked 96th out of 130 Lake County lakes based on average total phosphorus concentrations of lakes studied since 1999. Sources for phosphorus include watershed inputs from the surrounding area, and wind, wave and carp action that can resuspend sediment bound phosphorus into the water column from the bottom.

- *Lack of Aquatic Plants*

  Lake Forest Pond 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 resuspended into the water column from wind and wave action. The recommended plant coverage of 20% - 40% would not only add to fishery habitat, but also keep some sediment from resuspending. The two factors hindering aquatic plant growth in Lake Forest Pond are the low water clarity and the high TSS concentrations, which coated the few plants seen growing here. Most aquatic plants will not thrive in these conditions. If plants were to be reintroduced, it would be best if emergent species were planted first before submergent species, since light penetration may preclude plant growth. Established emergent plants may help with shoreline stabilization and water clarity.

- *Shoreline Erosion*

  Thirty percent of the shoreline is eroding, with the majority of this eroding severely. Two of these locations, which are on the west shore, are areas where dogs run in and out of the water. Most of the eroding shoreline is steep, so that grading would be necessary as part of its rehabilitation. Because dogs use these locations, an option would be to install permeable pavers in these areas, which would stabilize the soil, and still allow dogs access. Depending on usage, some plants could become established within the spaces of the pavers. Another plan would be the installation of deep-rooted native plants in conjunction with biologs or A-Jax® along the steep, eroding areas. Dogs should be prohibited from using these areas until vegetation becomes established and instead should be encouraged to use areas of the shoreline with gentle slopes.

- *Invasive Shoreline Plant Species*

  We noted the presence of aggressive exotic plant species along most of the shoreline. The only places where they were not growing were the two bare eroding locations where dogs enter the water. The species noted included buckthorn (*Rhamnus* spp.), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*) and honeysuckle (*Lonicera* spp.). Some of the locations where buckthorn shrubs were growing were on steep, eroding slopes. Erosion control on these shorelines needs to be in place as these invasive plants are being removed.