2003 SUMMARY REPORT
of
EAST LOON LAKE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

East Loon Lake is 184-acre glacial lake located in unincorporated Antioch Township just northwest of the intersections of Deep Lake Road and Grass Lake Road. The lake's main uses are recreational boating, fishing, and swimming. There are several access points on the lake that are open to the residents of their respective subdivisions. However, there is no public launch on East Loon Lake. The Loon Lakes Management Association (LLMA) acts as an umbrella organization, representing 15 subdivisions (seven on East Loon) as well as a conservation group within Special Service Area 8 (a special county taxing district), in matters pertaining to the management of East and West Loon Lakes.

East Loon Lake's water quality is *above average* in comparison to many other lakes in Lake County. In comparison to our past studies, the water quality of East Loon Lake has been stable for the last 12 years. Nutrient concentrations are low and with the assistance of healthy aquatic plant densities, keep nuisance algae blooms to a minimum. This has resulted in above average water clarity. The 2003 average Secchi transparency for East Loon Lake was 5.32 feet, and based on historical data, was similar to readings of the past 12 years. Average total phosphorus concentrations (0.024 mg/L) was two and a half times lower than the median value for Lake County (0.059 mg/L). Other water quality parameters were also at or near acceptable levels during the 2003 study and are largely unchanged compared to our past studies (1998, 1993, 1992, and 1991).

During the 2003 study, we found an above average diversity of plants in East Loon Lake with 21 species present. The most frequently occurring species during the study was the exotic and invasive Eurasian water milfoil, which occurred at 78% of all sample sites (May-September). The occurrence of more desirable native species such as American pondweed, Illinois pondweed, and large leaf pondweed, were low (3%, 4%, and 4%, respectively). Harvesting activities, which targeted areas of milfoil growth, helped to reduce surface coverage of milfoil, however, plant densities did not seem to be impacted by harvesting as in West Loon. Since East Loon does not have the native plant densities that West Loon has, reducing surface milfoil coverage to alleviate navigational issues seems to be the best management strategy at this time.

A majority of the shoreline on East Loon is developed (56.5%). The most common types of developed shoreline include rip rap (28%), manicured lawn (19%), and buffer (20%). The high percentage of natural shoreline types such as buffers is encouraging. However, the high occurrence of rip rap and lawn is of some concern from a wildlife habitat standpoint, as neither one provides quality habitat. Shoreline assessments found that there is little erosion on East Loon with only 4% of the lake's shoreline experiencing erosion. LLMA, as well as individual property owners, should promote and implement the use of naturalized shoreline types, such as buffer strips of native vegetation, when replacing existing structures. Additionally, emergent shoreline vegetation could be planted in near shore areas. This will benefit not only the water quality of East Loon Lake, but should also improve the fish and wildlife habitat surrounding the lake. Despite a few areas for improvement, East Loon Lake is a high quality natural resource and if properly managed will remain in this state.

LAKE IDENTIFICATION AND LOCATION

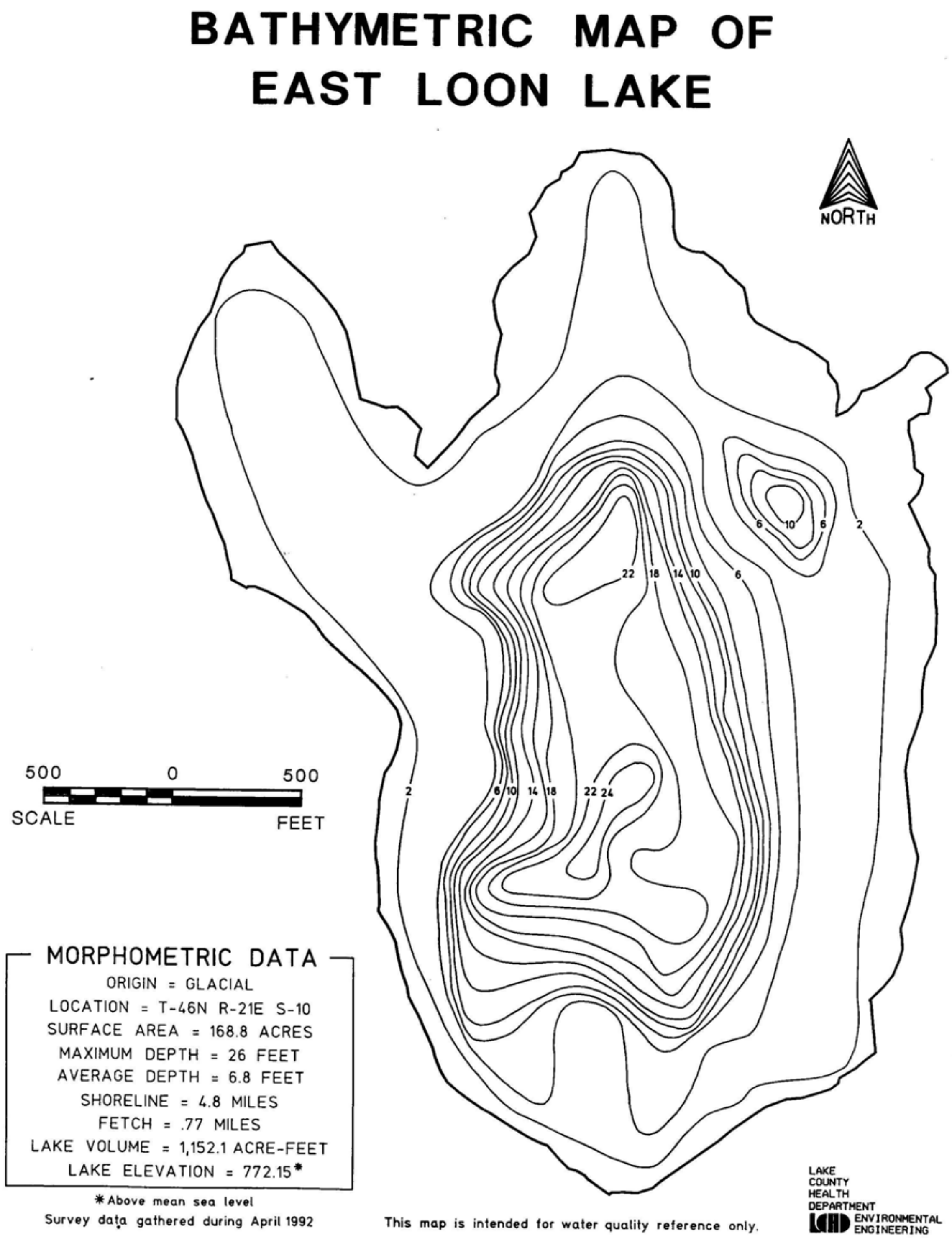
East Loon Lake is located northwest of the intersection of Deep Lake Road and Grass Lake Road in Antioch Township (T46N, R10E, Sections 16 & 21). East Loon Lake is a 184-acre glacial lake (including channels) with a current maximum depth of 26 feet, average depth of 6.35 feet and lake volume of 1,166 acre-feet (Lake County Health Department-Lakes Management Unit [LMU] calculations) (Figure 1). The United States Environmental Protection Agency (USEPA) lists East Loon Lake as an Advanced Identification (ADID) wetland. This is a designation given to high quality wetlands in order to provide long-term protection from development and other environmental impacts that might negatively affect the health of the water body. Both East and West Loon Lakes are also recognized by the Illinois Department of Natural Resources as a natural area due to the presence of threatened and endangered fish and plant species.

East Loon Lake is part of the Sequoit Creek drainage basin, which is part of the Fox River watershed. East Loon Lake drains to Sequoit Creek on the northwest side of the lake (Figure 2). This drainage continues to the north and eventually flows into Lake Marie and the Fox River. The lake's watershed is relatively large (approximately 5,279 acres) with a watershed to lake ratio of 29:1. For comparison, West Loon Lake's watershed is only 1,132 acres (4.6 times smaller than East Loon's). East Loon Lake receives drainage from four other lakes in its watershed: West Loon to the west, and Cedar, Deep, and Sun from the south. The watershed reaches as far south as Grand Avenue in Lake Villa to land north of the intersection of Route 173 and Deep Lake Road (Figure 2). Watershed land-use is mainly water (18%), single-family homes (17%), agriculture (13%), private and public open space (15%), and forest and grassland (11.5%). Other types of land usage included transportation, retail/commercial, disturbed land, government and institutional, industrial, transportation (roads), multi-family, office, and utility and waste facilities (Figure 3). Although only a small isthmus and an approximately 140 foot channel separate East and West Loon Lakes, they are considerably different from one another in many aspects including morphology, water quality, and shoreline development. These differences will be covered in the body of the report.

BRIEF HISTORY OF EAST LOON LAKE

In C.F. Johnson's 1896 book titled, *Angling in the Lakes of Northern Illinois,* he includes a brief chapter on East and West Loon Lakes along with a hand drawn illustrations of the lakes (Figure 4). Johnson's details of the lake are almost nonexistent as he spends most of the chapter on anecdotal stories that have nothing to do with the Loon Lakes. Interestingly, in Johnson's drawing of East and West Loon Lake he has East Loon depicted as much smaller than West Loon when in actuality, even without the Lagoona channels, the two lakes are very similar in size. On his illustration of East Loon Lake, he notes several areas of "Bass Weeds", which were probably large leaf pondweed ~ *Potamogeton amplifolius* or Illinois pondweed ~ *Potamogeton illinoensis,* as he does on many of his lake illustrations. He also makes notes of large rush beds (i.e., pencil weeds)

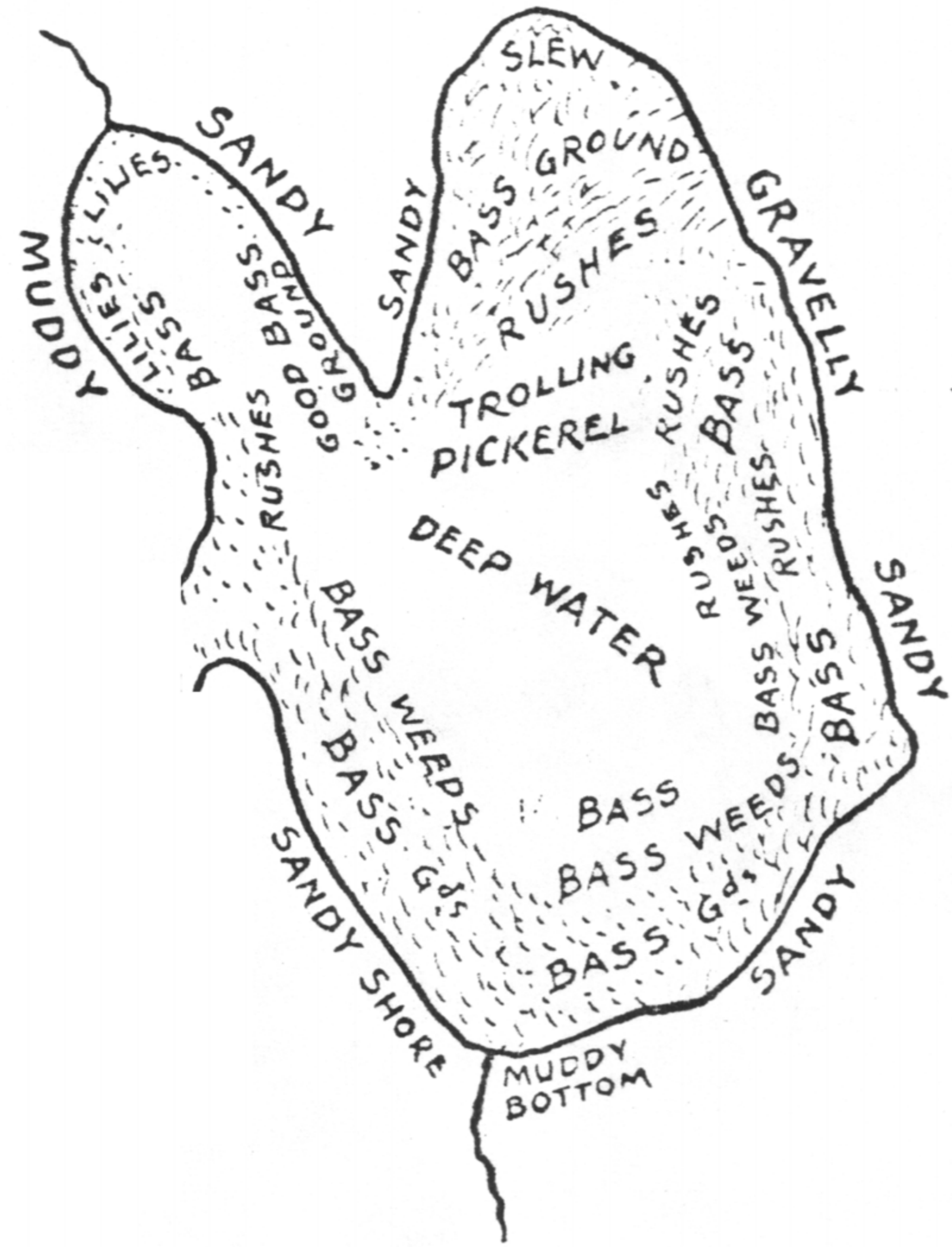
Figure 1. 1991 bathymetric map of East Loon Lake.



2 (watershed)

3 (Landuse)

Figure 4. 1896 C.F. Johnson's map of East Loon Lake.



in several areas of the lake. Regretfully, these rush beds have been drastically reduced and now only occupy a small area on the eastern side of the lake. The “Bass Weeds” are still present in the form of Illinois and large leaf pondweeds, both of which can be found scattered in the shallow areas of the lake.

The Loon Lakes Management Association (LLMA) oversees the management of the lake. LLMA was formed in 1983 and acts as an umbrella organization that represents the 13 subdivisions and groups on the lake (East and West Loon), as well as 3 subdivisions that do not have direct access to the lakes. In 1989, LLMA formed Special Service Area 8 (SSA8), a special taxing district set up by the County of Lake (Figure 5). Under SSA8, LLMA receives $50,000 per year to manage both lakes. These funds, which are collected from households within the taxing district, are delegated to LLMA by the LMU. With these funds, LLMA conducts management activities such as weed harvesting, equipment maintenance, and special projects as well as addressing any issues that involve the lake (i.e., watershed issues, user conflicts, etc.). LLMA operates two aquatic weed harvesters (purchased in 1988 and 1995, respectively) from May through September in both East and West Loon Lakes on an as needed basis. These harvesters are currently the only aquatic plant management techniques carried out by LLMA. However, there are a few private individuals and neighborhood associations that are using aquatic herbicides on lake bottom under their ownership.

SUMMARY OF CURRENT AND HISTROICAL LAKE USES

East Loon Lake bottom ownership is split between several private owners, 6 subdivisions, and the Lake County Forest Preserve District. Launching of watercraft by non-association members and non-approved personnel at the subdivision access points is prohibited. Recreational opportunities on East Loon Lake have gone unchanged for decades, largely consisting of boating, swimming, and fishing. Additionally, in the fall, the lake is used on a limited basis for waterfowl hunting. Currently, there is no Illinois Department of Public Health (IDPH) licensed bathing beach on East Loon Lake. We used to test three beaches (East Loon Lakes Shores, Wedgewood, and Pine View), however, these beaches never became licensed by the IDPH and therefore we have not sampled them since 1993. Additionally, several residents and subdivision properties on the lake have private beaches on their property and are not monitored.

LIMNOLOGICAL DATA - WATER QUALITY

Water samples collected from East Loon Lake were analyzed for a variety of water quality parameters. Samples were collected at three feet from the surface and three feet off the bottom (21-22 foot deep) at the deep hole location in the lake (Figure 6). East Loon Lake is thermally stratified, which means the lake divides into a warm upper water layer (epilimnion) and cool lower water layer (hypolimnion). This stratification is due to the deeper lake morphology of East Loon Lake (see *Interpreting Your Lake’s Water*

Figure 5. SSA8

Figure 6. Access locations

Quality for further explanation). The lake was weakly stratified by our first sampling date in May (5/7/03) and remained stratified for the rest of the summer. This separation of the lake into layers is reflected in the water quality data. Below is a discussion of the highlights from the complete data set for East Loon Lake (Table 1, *Appendix A* and Mulitparameter Data, *Appendix C*).

In the discussion below, comparisons between East and West Loon Lake are made where applicable. Even though East and West Loon Lake are connected, their water quality is extremely different. While both lakes have good water quality compared to many of the other lakes in the county, West Loon Lake has much better water quality than East Loon. One of the main reasons is watershed size. West Loon's watershed is approximately 1,132 acres while East Loon's is nearly five times larger at 5,279 acres. East Loon Lake simply receives more drainage (66% of the Sequoit Creek watershed), possibly carrying with it higher pollutant loads, which have an impact on water quality. However, despite having a large watershed, East Loon Lake is in very good shape, which can be attributed to the quality of upstream sources such as Cedar, Deep, and Sun Lakes in addition to West Loon. Another major difference between the two lakes is morphology. East Loon is much shallower (average depth of 6.4 feet) compared to West Loon (average depth of 14.8 feet) and much of the lake is dominated by shallow shelves. Another difference between the two lakes is substrate type. In general, East Loon Lake has a much more organic substrate compared to West Loon, which is dominated by sandy, gravel bottoms. Lakes with highly organic substrate tend to have higher suspended sediment and nutrient concentrations compared to lakes with sandy or gravel bottoms.

Dissolved oxygen (DO) concentrations in East Loon Lake were *good* during the entire study. The amount of the lake that had enough DO to support aquatic life (>5.0 mg/L) varied from month to month but ranged from 64 -100% of total lake volume. When DO concentrations drop below 1.0 mg/L (hypoxia), biological and chemical processes may release nutrients into the water, which are then sequestered in the hypolimnion due to stratification. This is why nutrient concentrations are much higher in the hypolimnion (Table 1, *Appendix A*). The depth at which this hypoxic boundary formed varied from month to month but ranged from 26 feet (May) to 10 feet (August). This hypoxic zone represents 0-15% of the total lake volume, respectively (LMU morphometric data). These nutrients are eventually mixed into the lake during fall turnover. However, since we did not collect samples after turnover, the impact of this mixing on nutrient concentrations in East Loon Lake is unknown.

Secchi disk transparency is a direct indicator of water clarity as well as overall water quality. In general, the greater the Secchi transparency, the clearer and better the water quality. Based on Secchi transparency, East Loon Lake has slightly *above average* water quality. The 2003 average Secchi transparency on East Loon Lake was 5.32 feet, which is slightly greater than the Lake County median Secchi transparency of 3.41 feet. Monthly readings ranged from 3.05 feet in September to as deep as 7.97 feet in May. Variations in monthly transparency readings can be attributed to changes in the concentration of suspended organic and inorganic particles in the water column (Figure 7). Secchi readings by the Illinois Volunteer Lake Monitoring Program (VLMP) in 2003

Figure 7. (TSS vs. Secchi)

on East Loon Lake were similar to our data, with an average of 5.71 feet and similar monthly variations. The 2003 average Secchi transparency for East Loon Lake was slightly lower (worse) when compared to our past study in 1998, which had an average Secchi transparency of 5.94 feet. However, the 2003 average Secchi transparency is similar to the average Secchi transparency over the past 15 years (5.16 feet) based on VLMP and our data (Figure 8). For comparison, the 2003 average Secchi reading on West Loon Lake is 11.96 feet, which is over double that of East Loon's.

Average total suspended solids (TSS), which is a measurement of suspended particles in the water such as silt, clay, algae and organic matter, was 4.1 mg/L. This is almost two times lower than the county median of 7.5 mg/L. As previously stated, monthly variations in TSS had an impact on water clarity (Secchi transparency). When compared to our 1998 average TSS (4.0 mg/L), average TSS in 2003 is very similar. Furthermore, when compared to studies done before 1998 (1991, 1992, 1993), the average 2003 TSS concentration has shown little change and was similar to the historical average (4.2 mg/L). In comparison, the 2003 West Loon average TSS was 1.8 mg/L. Nonvolatile suspended solids (NVSS), which is the part of TSS that is inorganic particles (such as sediment) was also very low (3.0 mg/L). NVSS accounted for a large majority (73 %) of the TSS, which is reflected in the low occurrence of planktonic algal blooms on East Loon Lake.

While TSS concentrations have remained stable, concentrations of other types of solids have increased since the 1998 study. Total volatile solids (TVS), which is a measurement of organic particles (i.e., algae, plant matter, etc.) increased by 27% from 1998 to 2003, which is one of the reasons there was a slight decrease in Secchi transparency from 1998 to this year's study. Average total dissolved solids (TDS) in 2003 was 454 mg/L, which is similar to the Lake County median value of 451 mg/L. However, as compared to our 1998 study of East Loon (371 mg/L), this is a 22% increase. This increase is an area of concern since TDS is a measurement of the concentration of dissolved minerals such as chlorides, which is a common component of road salt. Consequently, there was also a significant increase in the average conductivity in the last five years from 0.6710 milliSiemens/cm in 1998 to 0.8160 milliSiemens/cm in 2003. Conductivity is a measurement of water's ability to conduct electricity via dissolved minerals (i.e., chlorides) in the water column. Since both TDS and conductivity indirectly measure chlorides, these increases can be linked to runoff from East Loon Lake's large watershed, which contains several major roads such as Routes 173 and 83, Deep and Grass Lake Roads, and Grand Avenue. This phenomenon is also occurring in other county lakes with major roads in their watersheds. However, West Loon Lake had no change in both parameters since 1998.

Another area of concern that may directly impact solids concentrations, and the overall health of East Loon Lake, is the development taking place at the intersection of Route

Figure 8 (Historic Secchi)

173 and Deep Lake Road. Currently, a Super Walmart is being built on the site with plans for more retail space to be built in subsequent phases. The runoff from this development flows into East Loon Lake on the northeast side of the lake near the Wedgewood subdivision. During the first phase of this construction, control of runoff was a significant problem (i.e., a TSS concentration of 482 mg/L at the outfall of the construction site detention pond on 3/5/04). However, after the installation of a polymer system, the concentrations were reduced (i.e., from 181 mg/L in the pond to 49 mg/L after flowing through the polymers on 3/24/04), but were negated by runoff that was not treated flowing in the ditch along Highway 173 (177 mg/L on 3/24/04). This site, as well as future sites, need to be monitored to prevent future degradation of the watershed.

High nutrient concentrations are usually indicative of water quality problems. Algae need light and nutrients, most importantly carbon, nitrogen (N) and phosphorus (P), to grow. Light and carbon are not normally in short supply (limiting). This means that nutrients (N&P) are usually the limiting factors in algal growth. To compare the availability of these nutrients, a ratio of total nitrogen to total phosphorus is used (TN: TP). Ratios < 10:1 indicate nitrogen is limiting. Ratios of >15:1 indicate phosphorus is limiting. Ratios >10:1, <15:1 indicate that there is enough of both nutrients for excessive algae growth. In 2003, East Loon Lake had a TN:TP ratio of 46:1, which means that the lake is highly phosphorus limited. Due to the highly phosphorus limited nature of East Loon Lake, external inputs of phosphorus should be carefully monitored as even small increases could trigger algae blooms. The 2003 ratio was higher than our 1998 study, which showed East Loon Lake to be less phosphorus limited (37:1). This increase in phosphorus limitation may be due to seasonal fluctuations in environmental factors. Fluctuations in temperature, sunlight, rainfall, etc, can cause variations in algae blooms.

The average epilimnetic total phosphorus (TP) concentration in East Loon Lake in 2003 was 0.028 mg/L, which is two and a half times lower than the county median concentration of 0.059 mg/L. TP concentrations fluctuated slightly throughout the 2003 study and ranged from 0.018 - 0.040 mg/L. The 2003 average epilimnetic TP concentration as compared to 1998 (0.028 mg/L) is unchanged and similar to our past studies. This is similar to West Loon Lake, where 2003 TP concentrations went largely unchanged when compared to our previous studies. The 2003 median hypolimnetic TP concentration was 0.294 mg/L and increased on a month-to-month basis throughout the study, which is common in stratified lakes. Compared to the county median (0.186 mg/L), East Loon Lake has high hypolimnetic TP concentrations. However, since East Loon Lake has such a large oxic volume, when fall turnover occurs the hypolimnetic TP is diluted thoughout the lake. Since we did not sample after fall turnover, the extent of this dilution is unknown.

In lakes, phosphorus originates from two main sources. One source is from within the lake (internal). This is a common source of phosphorus in lakes, which contain nutrient rich sediment. Biological and chemical processes release phosphorus from the anoxic sediment. Since East Loon Lake is stratified, released phosphorous is sequestered in the hypolimnion where it stays until fall turnover. Additionally, sediment bound phosphorus is also mixed into the water column by wind/wave action in shallow areas. On East Loon

Lake, sediment resuspension may not be a major concern since the shallow areas of the lake are well vegetated. However, this vegetation is dominated by the aquatic invasive Eurasian water milfoil, which has poor root systems and concentrates most of its biomass near the surface instead of closer to the lake bottom like many other aquatic plants. This can allow wind and wave action to disrupt bottom sediment in milfoil-dominated areas. Additionally, the dense surface canopy of milfoil allows for increased occurrence of filamentous algae growth, which can also have an impact on nutrient concentrations. The other main input of phosphorus is from sources outside of the lake (external). These external inputs consist of a variety of sources. They can include fertilizer runoff and sediment from shoreline erosion.

Nitrogen concentrations, nitrate and ammonia (NO_3-N & NH_3-N, respectively), were below detectable concentrations in the epilimnion for the duration of the study. This is a slight decrease compared to our 1998 study in which there were detectable concentrations of both forms of nitrogen. The 2003 average total Kjeldahl nitrogen (TKN) concentration, which is a measurement of organic forms of nitrogen (such as algae bound nitrogen), was 1.29 mg/L, which is near the county median of 1.22 mg/L. However, the 2003 concentration was a 33% increase over the 1998 study. This increase is likely due to an increase in the amount of algae in the lake in 2003. TSS and Secchi transparency, which are both directly impacted by increases in algae, have also changed slightly compared to our 1998 study.

Another way to look at phosphorus concentrations and how they affect the productivity of the lake is to use a Trophic State Index based on phosphorus (TSIp). TSIp values are commonly used to classify and compare lake productivity (trophic state). The higher the phosphorus concentration the greater amount of algal biomass, which then results in a higher TSI and corresponding trophic state. Based on a TSIp value of 52.2, East Loon Lake is classified as *eutrophic* ($\geq$50, <70 TSI). Additionally, based on a Secchi transparency TSI of 53.0, East Loon Lake is also classified as eutrophic. A eutrophic lake is defined as a productive system that has above average nutrient concentrations and high algal biomass (growth). East Loon Lake is slightly eutrophic and did experience small planktonic as well as filamentous algae blooms throughout the summer. The limited nature of these blooms was partially due to East Loon Lake's aquatic plant community and the many benefits they bring (such as competition with algae for available resources) along with low nutrient concentrations. Without an established aquatic plant population, algal blooms in East Loon Lake might be more widespread and of greater intensity. TSIp can also be used to compare lakes within the county. Based on the average TSIp, East Loon Lake ranks 27 out of 130 lakes studied by our unit between 1999-2003 (Table 2, *Appendix A*). For comparison, West Loon Lake ranks 7 out of 130.

TSI values along with other water quality parameters can be used to calculate use impairment indexes established by the Illinois Environmental Protection Agency (IEPA). Most impairment assessments (P, NO_3-N, NH_3-N, pH, DO, TDS, NVSS) were listed as *None*. The only impairment assessments were for *Exotic Species* (Eurasian water milfoil and curly leaf pondweed) and *Nuisance Aquatic Plant Growth* (moderate). IEPA impairment indices such as Aquatic Life Use, Swimming Use, and Overall Use, East

Loon Lake was ranked as providing *Full* support. Under the Recreational Use index East Loon Lake was ranked as providing *Partial* support due to the moderate growth of aquatic vegetation. However, the benefits of the aquatic vegetation far outweigh any negative impacts they may have on recreational opportunities on East Loon Lake.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

A healthy aquatic plant population is critical to good lake health. Aquatic vegetation provides important fish and wildlife habitat and food sources. Additionally, aquatic plants provide many water quality benefits such as sediment stabilization. Aquatic plant surveys were conducted every month for the duration of the study (*Appendix A* for methodology). Shoreline plants of interest were also observed (Table 3). However, no formal surveys were made of these shoreline species and all data is purely observational.

During the 2003 study, 21 species of aquatic plants were found (including the macro alga *Chara* sp.). The months with the highest plant diversity were July and August, in which 16 species were sampled (Table 4, *Appendix A*). The most frequently occurring species during the study was the exotic, invasive Eurasian water milfoil (EWM), which occurred at 78% of all sample sites (May-September). While EWM is less of a problem in West Loon Lake, mainly due to a healthy native plant community, it is at problematic levels in East Loon. This can be largely attributed to the lack of adequate native plant densities and suitable substrate type. The more organic substrate of East Loon Lake is much more suitable for EWM growth than is the more rock/sand substrate that dominates many parts of West Loon. The occurrence of more desirable native species such as American pondweed, Illinois pondweed, and large leaf pondweed, were low (3%, 4%, and 4%, respectively). Other plants that were commonly found during the 2003 study included sago pondweed (25%), coontail (18%), white water lily (18%), and curly leaf pondweed (13%). Our surveys show that EWM densities remained fairly stable over the course of the study ranging from 70-86% of sample sites. Harvesting activities, which targeted areas of EWM growth, helped to reduce surface coverage of milfoil, however, densities did not seem to be impacted by harvesting as in West Loon. Since East Loon does not have the native plant densities that West Loon has, reducing surface milfoil coverage to alleviate navigational issues seems to be the best management strategy at this time. However, harvesting should be avoided in areas that have higher native plant densities such as the northeast corner and some areas of the east side of the lake.

Table 3. Aquatic and shoreline plants on East Loon Lake, May – September 2003.

Aquatic Plants	
Chara	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Common Bladderwort	*Utricularia vulgaris*
Northern Water Milfoil	*Myriophyllum sibiricum*
Eurasian Water Milfoil#	*Myriophyllum spicatum*
Largeleaf Pondweed	*Potamogeton amplifolius*
Leafy Pondweed	*Potamogeton foliosus*
Curlyleaf Pondweed#	*Potamogeton crispus*
Illinois Pondweed	*Potamogeton illinoensis*
American Pondweed	*Potamogeton nodosus*
Sago Pondweed	*Potamogeton pectinatus*
Flat Stem Pondweed	*Potamogeton zosteriformis*
Slender Naiad	*Najas flexilis*
Water Star Grass	*Heteranthera dubia*
Vallisneria	*Vallisneria americana*
White Water Lily	*Nymphaea tuberosav*
Yellow Pond Lily	*Nuphar advena*
Spatterdock	*Nuphar variegatum*
Common Duckweed	*Lemna minor*
Star Duckweed	*Lemna trisulca*
Watermeal	*Wolffia columbiana*
Shoreline Plants	
Barnyard Grass	*Echinochloa crusgalli*
Black Oak	*Quercus velutina*
Blue Flag Iris	*Iris hexagona*
Box Elder	*Acer negundo*
Bull Thistle#	*Cirsium vulgare*
Burr Marigold	*Bidens mitis*
Canada Thistle#	*Cirsium arvense*
Chairmaker's Rush	*Scirpus pungens*
Common Arrowhead	*Sagittaria latifolia*
Common Buckthorn#	*Rhamnus cathartica*
Common Cattail	*Typha latifolia*
Common Milkweed	*Asclepias syriaca*
Common Reed	*Phragmites australis*
Cottonwood	*Populus deltoides*
Grass-leaved Arrowhead	*Sagittaria graminea*
Green Foxtail	*Setaria viridis*
Hawkweed	*Hieracium* sp.

Table 3. Aquatic and shoreline plants on East Loon Lake, May – September 2003 (cont'd).

Shoreline Plants	
Honeysuckle[#]	*Lonicera* sp.
Ivyleaf Morning Glory[#]	*Ipomoea hederacea*
Jewelweed	*Impatiens pallida*
Multiflora Rose[#]	*Rosa multiflora*
Pickerelweed	*Pontederia cordata*
Purple Loosestrife[#]	*Lythrum salicariajmk*
Queen Ann's Lace[#]	*Daucus carota*
Reed Canary Grass[#]	*Phalaris arundinaea*
Silver Maple	*Acer saccharinum*
Softstem Bulrush	*Scirpus validus*
Sow Thistle#	*Sonchus* sp.
Staghorn Sumac	*Rhus typhina*
Swamp Milkweed	*Asclepias incarnata*
Water Smartweed	*Polygonum amphibium*
Weeping Willow	*Salix alba tristis*
White Birch	*Betula papyrifera*
White Oak	*Quercus alba*
Wild grape	*Vitis* sp.

+Threatened in Illinois
Exotic Species

Based on a floristic quality index (FQI), aquatic plant *diversity* on East Loon Lake is above average. The FQI is a rapid assessment metric 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 (Nichols,1999). For this assessment, each submersed and floating aquatic plant species (emergent shoreline species were not counted) in the lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). Nonnative species (exotics), which are scored a zero, were also counted in the FQI calculations for Lake County lakes. We then averaged these numbers 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. During the 2003 study, East Loon Lake had an FQI of 28.4 (4 out of 118 lakes), which is well above the Lake County average of 14.7 (2000-2003). Interestingly, East Loon has a higher FQI than West Loon (26.0). This FQI reinforces that East Loon Lake has *very good* aquatic plant diversity. However, one point of concern is that we did not find the State of Illinois endangered plant species fern-leaf (*Potamogeton robbinsii*), which is listed as occurring in East Loon Lake by us as well as the Illinois Department of Natural Resources (IDNR) in 1994 and 1992, respectively. However, this does not mean that these species are no longer present in the lake but possibly are at low enough numbers that they were not picked up by our monthly surveys.

Aquatic plant *densities* on East Loon Lake were excessive. The extent to which aquatic plants grow is largely dictated by light availability. Aquatic plants need at least 1% of surface light levels in order to survive. Based on our light penetration measurements, aquatic plants could have grown to a depth of 6.3 feet (August) to 12.3 feet (May). During our 2003 study we found that plants grew to a maximum depth of 12.7 feet. Based on morphometric data, this is equal to about 81.5% bottom coverage. However, coverage within this range was not contiguous. Plant growth in deeper depths, as well as some shallow areas, was sporadic. However, 81.5% coverage is excessive and is well above the 30- 40% coverage range that is considered beneficial for overall lake health.

The LLMA's harvesting program has done a good job trying to meet the navigational needs of the residents of East Loon Lake. Currently, LLMA is using aquatic plant harvesting to reduce EWM surface densities and theoretically, let native plant densities expand. However, since no occurrence data was collected during our past studies, it is difficult to assess the success of this program prior to 2003. LLMA may want to consider developing a protocol to monitor changes in plant densities in order to monitor changes in the EWM as well as native plant communities. Any future efforts to manage the aquatic plant communities of East Loon Lake should take into consideration the native plants and the benefits they provide.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at East Loon Lake on August 4 and September 3, 2003. The shoreline was assessed for a variety of criteria (*Appendix B* for methodology). At the time of the assessment, 56.5% (14,599 feet) of East Loon Lake's shoreline was developed. The majority of developed shoreline consists of rip rap (4,033 feet or 28%), manicured lawn (2,795 feet or 19%), and buffer strips (2,940 feet or 20%)(Figure 9). While the high percentage of buffer is encouraging, especially on a residential lake, the dominance of rip rap and manicured lawn is an area of concern. These shoreline types can be considered *undesirable* as they provide little habitat. Furthermore, both types can be prone to erosion due to poor root systems (manicured lawn) and improper installation (rip rap). Other types of shoreline included wetland (2,478 feet or 17%), seawall (1,076 feet or 7%), beach (1,062 feet or 7%), shrub (93 feet or 1%), and woodland (122 feet or 1%). It is our recommendation that LLMA, as well as the neighborhood associations and individual homeowners, promote the use of well-maintained, naturalized shoreline (buffer strips) and to minimize the use of beaches, rip rap, seawalls, and manicured lawns. LLMA should also promote the use of buffer strips of deep-rooted native vegetation around the entire lake regardless of shoreline type (i.e., behind seawalls, rip rapped areas, and beaches).

The overall occurrence of erosion on East Loon Lake is *very low*. Based on our assessment, 96% (24,800 feet) of the shoreline was listed as having no erosion (Figure 10). This is largely due to the high occurrence of buffer strips on developed shoreline, which are not normally prone to erosion, and that a third of the lake is undeveloped wetlands. Additionally, the topography immediately around East Loon Lake is fairly flat, which also helps to minimize erosion on areas that would normally be more prone to erosion such as beaches and manicured lawns. The erosion found on East Loon Lake was assessed as *Slight* (919 feet) erosion and *Moderate* (122 feet), with none listed as *Severe*. The majority of this *Slightly* eroded shoreline was manicured lawn (600 feet). Other types of *Slightly* eroded types included buffer (134 feet), shrub (95 feet), and seawall (90 feet). All of the *Moderately* eroded shoreline was manicured lawn (122 feet). Rehabilitating these *Slightly* and *Moderately* eroded areas on the lake would not be overly difficult. In some cases it would involve minimal cost and effort for homeowners to retrofit or repair damaged seawalls, manage buffers better, and naturalize the eroded lawn areas, which would prevent future damage to these shorelines.

Water levels in East Loon Lake fluctuated on a monthly basis during the 2003 study. Extreme water level fluctuations can have a negative impact on shoreline erosion. In the spring of 2003, the lake increased by 4.1 inches from May to June. After spring/early summer, rainfall decreased and from June to July the lake dropped 3.5 inches. As rains increased during July and August the lake levels rose for the next two months by 3.3 inches in August and 2.25 inches in September. The maximum change for the season was 6.63 inches (May to September). These measurements were taken off of a fixed pier pole, however LLMA should establish a staff gage at a permanent location on the lake in order to monitor lake elevation.

Type

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (Table 5). Wildlife habitat on East Loon Lake is above average for a residential lake. On many lots around the lake there are healthy populations of mature trees that provide good habitat for a variety of bird species. Additionally, since the lake is only about half developed, there are several shrub and wetland areas that provide habitat for smaller bird and mammal species. We observed 42 different species of birds on East Loon Lake. However, there are several areas for habitat improvement. The invasive species (purple loosestrife, buckthorn, and reed canary grass) were observed along the shores of East Loon Lake on 61 different properties out of 124 that were assessed (49%). The degree of infestation varied from parcel to parcel with most assessed as only having light infestation. However, there were several parcels that were assessed as having moderate or heavy infestations; especially in the Lagoona channels, the northern end of lake interspersed among the cattails, and the far southern end of the lake, which is now owned by the Lake County Forest Preserve District. These nuisance species should be controlled or eliminated before they spread and become more established and displace more desirable native species such as bulrushes and common arrowhead. These invasive plants are seldom used by wildlife for food or shelter. Additionally, shoreline habitat should be improved after their removal and should include native buffer strips and more naturalized shoreline areas.

While we did not conduct mussel surveys on East Loon Lake as we did with West Loon, it appears at this time that East Loon has not yet been infested with zebra mussels. The reason behind this is not understood since water flows freely from West to East Loon; however, it may just be a matter of time. Regretfully, there is not much that can be done to stop their inevitable spread to East Loon Lake.

There have been several fishery studies conducted in the past 40 years on East Loon Lake, all of which indicate the fishery to be in good condition. The most recent survey was conducted by the IDNR during the summer of 2003. Preliminary data indicates that the main species, such as largemouth bass, northern pike, black crappie, and bluegill, are in relatively good condition with an even distribution within size classes. Past studies by the IDNR have similar findings. Additionally, past surveys (as recent as 1998) have found five State of Illinois endangered and threatened species in East Loon Lake (blacknose shiner, blackchin shiner, pugnose shiner, Iowa darter, and banded killifish). While there was a fish assessment conducted by the Max McGraw wildlife foundation on West Loon in 2002, East Loon was not sampled. However, it is still presumed that these species still inhabit the lake since they were all found in West Loon Lake in 2002.

Table 5. Wildlife species observed on East Loon Lake, May – September 2003.

Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Ruddy Duck	*Oxyura jamaicensis*
Ring-billed Gull	*Larus delawarensis*
Caspian Tern	*Sterna caspia*
Great Egret	*Casmerodius albus*
Great Blue Heron	*Ardea herodias*
Killdeer	*Charadrius vociferus*
Turkey Vulture	*Cathartes aura*
Mourning Dove	*Zenaida macroura*
Belted Kingfisher	*Megaceryle alcyon*
Red-bellied Woodpecker	*Melanerpes carolinus*
Common Flicker	*Colaptes auratus*
Downy Woodpecker	*Picoides pubescens*
Eastern Pewee	*Contopus virens*
Great Crested Flycatcher	*Myiarchus crinitus*
Purple Martin	*Progne subis*
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*
American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*
Warbling Vireo	*Vireo gilvus*
House Sparrow	*Passer domesticus*
Yellow-rumped Warbler	*Dendroica coronata*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Common Grackle	*Quiscalus quiscula*
Starling	*Sturnus vulgaris*
Northern Oriole	*Icterus galbula*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*

Table 5. Wildlife species observed on East Loon Lake, May – September 2003 (cont'd).

Birds (cont'd)	
Chipping Sparrow	*Spizella passerina*
Song Sparrow	*Melospiza melodia*
Amphibians	
Bull Frog	*Rana catesbeiana*
Green Frog	*Rana clamitans melanota*
Reptiles	
Painted Turtle	*Chrysemys picta*
Snapping Turtle	*Chelydra serpentina*

* Endangered in Illinois
+Threatened in Illinois
Exotic Species

EXISTING LAKE QUALITY PROBLEMS

While not as good as West Loon, the water quality of East Loon Lake is still *good,* and better than many of the lakes in Lake County. As with West Loon, the overall water quality of East Loon has remained fairly stable over the past decade. Water clarity is above average and average nutrient and total suspended solids concentrations were at least two times below their respective Lake County average concentrations. One area of concern is the increase in conductivity and total dissolved solids concentrations, an indication of increased road salts that can be attributed to East Loon Lake's large watershed. The aquatic plant community of East Loon Lake is diverse and despite the presence of EWM, contains several higher quality species. Recreational opportunities for boating, swimming, and fishing have been maintained and in some circumstances are being enhanced. However, as is almost always true of any lake, there is room for improvement.

- *Shoreline Condition*

  While the high occurrence of buffer strips on East Loon Lake is encouraging, the presence of less desirable developed types of shoreline was also high. Manicured lawn, which was the third most common type of shoreline (19%), can be prone to erosion due to the poor root systems of turf grass. Consequently, during our shoreline assessment we found that lawn was the most eroded type of shoreline. Furthermore, lawns and rip rap, which was the most common developed shoreline type (28%), provide little in the way of wildlife habitat. These undesirable shoreline types could be greatly improved by simply establishing areas of native vegetation behind them to act as a buffer between upland lawns and the lake, providing erosion control as well as improving wildlife habitat.

- *Exotic Species*

  There are many invasive species that have become established in Lake County and East Loon Lake is no exception. Three exotic invasive species that were commonly found along East Loon Lake's shoreline are buckthorn, reed canary grass and purple loosestrife, with heavy infestation in several areas around the lake. These three plants were found on 49% of the shoreline parcels we assessed. None of these species provide quality food or habitat for wildlife. Furthermore, all three species are extremely aggressive and will displace desirable, native vegetation, which will lead to further loss of food and habitat. The spread of these three aggressive species must be stopped before they become further established on East Loon Lake. All three of these noxious weeds can be controlled using several different management techniques. LLMA should educate residents about these unwanted shoreline plants and promote their immediate removal.

POTENTIAL OBJECTIVES FOR EAST LOON LAKE MANAGEMENT PLAN

I. Wildlife Habitat Improvement
II. Eliminate or Control Invasive Species
III. Permanent Staff Gage

OPTIONS FOR ACHIEVING THE LAKE MANAGEMENT PLAN OBJECTIVES

Objective I: Wildlife Habitat Improvement

The key to increasing wildlife species in and around a lake can be summed up in one word: habitat. Due to its residential, developed nature the preservation/development of wildlife habitat on West Loon Lake has been neglected. Wildlife need the same four things all living creatures need: food, water, shelter, and a place to raise their young. Since each wildlife species has specific habitat requirements, which fulfill these four basic needs, providing a variety of habitats will increase the chance that wildlife species may use an area. Groups of wildlife are often associated with the types of habitats they use. For example, grassland habitats may attract wildlife such as northern harriers, bobolinks, meadowlarks, meadow voles, and leopard frogs. Marsh habitats may attract yellow-headed blackbirds and sora rails, while manicured residential lawns attract house sparrows and gray squirrels. Thus, in order to attract a variety of wildlife, a variety of habitats are needed. In most cases quality is more important than quantity (i.e., five 0.1-acre plots of different habitats may not attract as many wildlife species than one 0.5 acre of one habitat type).

It is important to understand that the natural world is constantly changing. Habitats change or naturally succeed to other types of habitats. For example, grasses may be succeeded by shrub or shade intolerant tree species (e.g., willows, locust, and cottonwood). The point at which one habitat changes to another is rarely clear, since these changes usually occur over long periods of time, except in the case of dramatic events such as fire or flood.

In all cases, the best wildlife habitats are ones consisting of native plants. Unfortunately, non-native plants dominate many of our lake shorelines. Many of them escaped from gardens and landscaped yards (i.e., purple loosestrife) while others were introduced at some point to solve a problem (i.e., reed canary grass for erosion control). Wildlife species prefer native plants for food, shelter, and raising their young. In fact, one study showed that plant and animal diversity was 500% higher along naturalized shorelines compared to shorelines with conventional lawns (University of Wisconsin – Extension, 1999). More information about non-native (exotic) plants can be found in the section *Objective II: Eliminate or control invasive species***.**

<u>Option 1: No Action</u>

This option means that the current land use activities will continue. No additional techniques will be implemented on West Loon Lake. Allowing a field to go fallow or not mowing a manicured lawn would be considered an action.

Pros

Taking no action may maintain the current habitat conditions and wildlife species present, depending on environmental conditions and pending land use actions. If all things remain constant there will be little to no effect on lake water quality and other lake uses.

Cons

If environmental conditions change or substantial land use actions occur (i.e., development) wildlife use of the area may change. For example, if a new housing development with manicured lawns and roads is built next to an undeveloped property, there will probably be a change in wildlife present.

Conditions in the lake (i.e., siltation or nutrient loading) may also change the composition of aquatic plant and invertebrate communities and thus influence biodiversity. Siltation and nutrient loading will likely decrease water clarity, increase turbidity, increase algal growth (due to nutrient availability), and decrease habitat for fish and wildlife.

Costs

The financial cost of this option is zero. However, due to continual loss of habitats many wildlife species have suffered drastic declines in recent years. The loss of habitat affects the overall health and biodiversity of the lake's ecosystems.

Option 2: Increase Habitat Cover

This option can be incorporated with Option 3 (see below). One of the best ways to increase habitat cover is to leave a minimum 25-foot buffer between the edge of the water and any mowed grass. Allow native plants to grow or plant native vegetation along shorelines, including emergent vegetation such as cattails, rushes, and bulrushes (see Table 6 for costs and seeding rates). This will provide cover from predators and provide nesting structure for many wildlife species and their prey. It is important to control or eliminate non-native plants such as buckthorn, purple loosestrife, garlic mustard, and reed canary grass, since these species out compete native plants and provide little value for wildlife.

Occasionally high mowing (with the mower set at its highest setting) may have to be done for specific plants, particularly if the area is newly established, since competition from weedy and exotic species is highest in the first couple years. If mowing, do not mow the buffer strip until after July 15 of each year. This will allow nesting birds to complete their breeding cycle.

Brush piles make excellent wildlife habitat. They provide cover as well as food resources for many species. Brush piles are easy to create and will last for several years. They should be placed at least 10 feet away from the shoreline to prevent any debris from washing into the lake. Trees that have fallen on the ground or into the water are beneficial by harboring food and providing cover for many wildlife species. In a lake, fallen trees provide excellent cover for fish, basking sites for turtles, and perches for herons and egrets. Increasing habitat cover should not be limited to the terrestrial environment. Native aquatic vegetation, particularly along the shoreline, can provide cover for fish and other wildlife.

Pros

Increased cover will lead to increased use by wildlife. Since cover is one of the most important elements required by most species, providing cover will increase the chances of wildlife using the shoreline. Once cover is established, wildlife usually have little problem finding food, since many of the same plants that provide cover also supply the food the wildlife eat, either directly (seeds, fruit, roots, or leaves) or indirectly (prey attracted to the plants).

Additional benefits of leaving a buffer include: stabilizing shorelines, reducing runoff which may lead to better water quality, and deterring nuisance Canada geese. Shorelines with erosion problems can benefit from a buffer zone because native plants have deeper root structures and hold the soil more effectively than conventional turfgrass. Buffers also absorb much of the wave energy that batters the shoreline. Additionally, buffer strips help filter run-off from lawns and agricultural fields by trapping nutrients, pollutants, and sediment that would otherwise drain into the lake. This may have a positive impact on the lake's water quality since there will be less "food" for nuisance algae. Buffer strips can filter as much as 70-95% of sediment and 25-60% of nutrients and other pollutants from runoff. This has a "domino effect" since less run-off flowing into a lake means less nutrient availability for nuisance algae, and less sediment means less turbidity, which leads to better water quality. All this is beneficial for fish and wildlife, such as sight-feeders like bass and herons, as well as people who use the lake for recreation.

Finally, a buffer strip along the shoreline can serve as a deterrent to Canada geese from using a shoreline. Canada geese like flat, open areas with a wide field of vision. Ideal habitat for them are areas that have short grass up to the edge of the lake. If a buffer is allowed to grow tall, geese may choose to move elsewhere. Emergent vegetation can provide additional help in preserving shorelines and improving water quality by absorbing wave energy that might otherwise batter the shoreline. Calmer wave action will result in less shoreline erosion and resuspension of bottom sediment, which may result in potential improvements in water quality.

Cons

There are few disadvantages to this option. However, if vegetation is allowed to grow, lake access and visibility may be limited. If this occurs, a small path can be made to the shoreline. Composition and density of aquatic and shoreline vegetation are important. If vegetation consists of non-native species such as or

Eurasian water milfoil or purple loosestrife, or in excess amounts, undesirable conditions may result. A shoreline with excess exotic plant growth may result in a poor fishery (exhibited by stunted fish) and poor recreation opportunities (i.e., boating, swimming, or wildlife viewing).

Costs

The cost of this option would be minimal. The purchase of native plants can vary depending upon species and quantity. Based upon 100 feet of shoreline, a 25-foot buffer planted with a native forb and grass seed mix would cost between $165-270 (2500 sq. feet would require 2.5, 1000 sq. feet seed mix packages at $66-108 per package). This could be a cost share project between the Association and individual homeowners in order to offset costs. This price does not include labor that would be needed to prepare the site for planting and follow-up maintenance, which could be done y the homeowner. This cost can be reduced or minimized if native plants are allowed to grow. However, additional time and labor may be needed to insure other exotic species, such as buckthorn, reed canary grass, and purple loosestrife, do not become established.

Option 3: Increase Natural Food Supply

This can be accomplished in conjunction with Option 2. Habitats with a diversity of native plants will provide an ample food supply for wildlife. Food comes in a variety of forms, from seeds to leaves or roots to invertebrates that live on or are attracted to the plants. Plants found in Table 6 should be planted or allowed to grow. In addition, encourage native aquatic vegetation, such as water lily, sago pondweed, largeleaf pondweed, and wild celery to grow. Aquatic plants such as these are particularly important to waterfowl in the spring and fall, as they replenish energy reserves lost during migration.

Providing a natural food source in and around a lake starts with good water quality. Water quality is important to all life forms in a lake. If there is good water quality, the fishery benefits and subsequently so does the wildlife (and people) who prey on the fish. Insect populations in the area, including beneficial predatory insects, such as dragonflies, thrive in lakes with good water quality.

Dead or dying plant material can be a source of food for wildlife. A dead standing or fallen tree will harbor good populations of insects for woodpeckers, while a pile of brush may provide insects for several species of songbirds such as warblers and flycatchers.

Supplying natural foods artificially (i.e., birdfeeders, nectar feeders, corn cobs, etc.) will attract wildlife and in most cases does not harm the animals. However, “people food” such as bread should be avoided. Care should be given to maintain clean feeders and birdbaths to minimize disease outbreaks.

Pros
Providing food for wildlife will increase the likelihood they will use the area. Providing wildlife with natural food sources has many benefits. Wildlife attracted to a lake can serve the lake and its residents well, since many wildlife species (i.e., many birds, bats, and other insects) are predators of nuisance insects such as mosquitoes, biting flies, and garden and yard pests (such as certain moths and beetles). Effective natural insect control eliminates the need for chemical treatments or use of electrical "bug zappers" that have limited effect on nuisance insects.

Migrating wildlife can be attracted with a natural food supply, primarily from seeds, but also from insects, aquatic plants or small fish. In fact, most migrating birds are dependent on food sources along their migration routes to replenish lost energy reserves. This may present an opportunity to view various species that would otherwise not be seen during the summer or winter.

Cons
Feeding wildlife can have adverse consequences if populations become dependent on hand-outs or populations of wildlife exceed healthy numbers. This frequently happens when people feed waterfowl like Canada geese or mallard ducks. Feeding these waterfowl can lead to a domestication of these animals. As a result, these birds do not migrate and can contribute to numerous problems, such as excess feces, which is both a nuisance to property owners and a significant contribution to the lake's nutrient load. Waterfowl feces are particularly high in phosphorus. Since phosphorus is generally the limiting factor for nuisance algae growth in many lakes in the Midwest, the addition of large amounts of this nutrient from waterfowl may exasperate a lake's excessive algae problem. In addition, high populations of birds in an area can increase the risk of disease for not only the resident birds, but also wild bird populations that visit the area.

Finally, tall plants along the shoreline may limit lake access or visibility for property owners. If this occurs, a path leading to the lake could be created or shorter plants may be used in the viewing area.

Costs
The costs of this option are minimal. The purchase of native plants and food and the time and labor required to plant and maintain would be the limit of the expense. See *Option 2: Increase Habitat Cover* above for prices.

Option 4: Increase Nest Availability
Wildlife are attracted by habitats that serve as a place to raise their young. Habitats can vary from open grasslands to closed woodlands (similar to Options 2 and 3). Standing dead or dying trees provide excellent habitat for a variety of wildlife species. Birds such as swallows, woodpeckers, and some waterfowl need dead trees to nest in. Generally, a cavity created and used by a woodpecker (e.g., red-headed or downy woodpecker, or

common flicker) in one year, will in subsequent years be used by species like tree swallows or chickadees. Over time, older cavities may be large enough for waterfowl, like wood ducks, or mammals (e.g., flying squirrels) to use. Standing dead trees are also favored habitat for nesting wading birds, such as great blue herons, night herons, and double-crested cormorants, which build stick nests on limbs. For these birds, dead trees in groups or clumps are preferred as most herons and cormorants are colonial nesters.

In addition to allowing dead and dying trees to remain, erecting bird boxes will increase nesting sites for many bird species. Box sizes should vary to accommodate various species. Swallows, bluebirds, and other cavity nesting birds can be attracted to the area using small artificial nest boxes. Larger boxes will attract species such as wood ducks, flickers, and owls. A colony of purple martins can be attracted with a purple martin house, which has multiple cavity holes, placed in an open area near water.

Bat houses are also recommended for any area close to water. Bats are voracious predators of insects and are naturally attracted to bodies of water. They can be enticed into roosting in the area by the placement of bat boxes. Boxes should be constructed of rough non-treated lumber and placed >10 feet high in a sunny location.

Pros

Providing places were wildlife can rear their young has many benefits. Watching wildlife raise their young can be an excellent educational tool for both young and old. The presence of certain wildlife species can help in controlling nuisance insects like mosquitoes, biting flies, and garden and yard pests. This eliminates the need for chemical treatments or electric “bug zappers” for pest control. Various wildlife species populations have dramatically declined in recent years. Since, the overall health of ecosystems depend, in part, on the role of many of these species, providing sites for wildlife to raise their young will benefit not only the animals themselves, but the entire lake ecosystem.

Cons

Providing sites for wildlife to raise their young have few disadvantages. Safety precautions should be taken with leaving dead and dying trees due to the potential of falling limbs. Safety is also important when around wildlife with young, since many animals are protective of their young. Most actions by adult animals are simply threats and are rarely carried out as attacks. Parental wildlife may chase off other animals of its own species or even other species. This may limit the number of animals in the area for the duration of the breeding season.

Costs

The costs of leaving dead and dying trees are minimal. The costs of installing the bird and bat boxes vary. Bird boxes can range in price from $10-100.00. Purple martin houses can cost $50-150. Bat boxes range in price from $15-50.00. These prices do not include mounting poles or installation. This is an excellent option for the residents to become actively involved with improving wildlife opportunities on West Loon Lake.

<u>Option 5: Limit Disturbance</u>

Since most species of wildlife are susceptible to human disturbance, any action to curtail disturbances will be beneficial. Limiting disturbance can include posting signs in areas of the lake where wildlife may live (e.g., nesting waterfowl), establish a "no wake" area, boat horsepower or speed limits, or establish restricted boating hours. These are examples of time and space zoning for lake usage. Enforcement and public education are needed if this option is to be successful. In some areas, off-duty law enforcement officers can be hired to patrol the lake.

Pros

Limiting disturbance will increase the chance that wildlife will use the lake, particularly for raising their young. Many wildlife species have suffered population declines due to loss of habitat and poor breeding success. This is due in part to their sensitivity to disturbance.

This option also can benefit the lake in other ways. Limited boat traffic may lead to less wave action to batter shorelines and cause erosion, which results in 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.

Recreation activities such as canoeing and paddleboating may be enhanced by the limited disturbance.

Cons

One of the strongest oppositions to this option would probably be from the powerboat users and water skiers. However, this problem may be solved if a significant portion of the daylight hours and the use of the middle part of the lake (assuming the lake is deep enough) are allowed for powerboating. For example, powerboating could be allowed between 9 AM and 6 PM within the boundaries established by "no wake" restricted area buoys.

Costs

The costs of this option include the purchase and placement of signs and public educational materials as well as enforcement. Off-duty law enforcement officers usually charge $25/hour to enforce boating laws or local ordinances.

Objective II: Eliminate or Control Invasive Species

Numerous exotic plant species have been introduced into our local ecosystems. Some of these plants are aggressive, quickly out-competing native vegetation and flourishing in an environment where few natural predators exist. Plants such as purple loosestrife (*Lythrum salicaria*), buckthorn (*Rhamnus athartica*), and reed canary grass (*Phalaris arundinacea*) are three examples. These exotic and invasive plants have made their way onto the shores of West Loon Lake. The outcome is a loss of plant and animal diversity. This section will address terrestrial shoreline exotic species.

Purple loosestrife is responsible for the "sea of purple" seen along roadsides and in wetlands during summer. It can quickly dominate a wetland or shoreline. Due in part to an extensive root system, large seed production (estimates range from 100,000 to 2.7 million per plant), and high seed germination rate, purple loosestrife spreads quickly. Buckthorn is an aggressive shrub species that grows along lake shorelines as well as most upland habitats. It shades out other plants and is quick to become established on disturbed soils. Reed canary grass is an aggressive plant that if left unchecked will dominate an area, particularly a wetland or shoreline, in a short period of time. Since it begins growing early in the spring, it quickly out-competes native vegetation that begins growth later in the year. Control of purple loosestrife, buckthorn, and reed canary grass are discussed below. However, these control measures can be similarly applied to other exotic species such as garlic mustard (*Allilaria officianalis*) or honeysuckle (*Lonicera* spp.) as well as some aggressive native species, such as box elder (*Acer negundo*).

Presence of exotic species along a lakeshore is by no means a death sentence for the lake or other plant and animal life. If controlled, many exotic species can perform many of the original functions that they were brought here for. For example, reed canary grass was imported for its erosion control properties. It still contributes to this objective (offering better erosion control than commercial turfgrass), but needs to be isolated and kept in control. Many exotics are the result of garden or ornamental plants escaping into the wild. One isolated plant along a shoreline will probably not create a problem by itself. However, problems arise when plants are left to spread, many times to the point where treatment is difficult or cost prohibitive. A monitoring program should be established, problem areas identified, and control measures taken when appropriate. This is particularly important in remote areas of lake shorelines where the spread of exotic species may go unnoticed for some time.

Option 1: No Action

No control will likely result in the expansion of the exotic species and the decline of native species. This option is not recommended if possible.

Pros

There are few advantages with this option. Some of the reasons exotics were brought into this country are no longer used or have limited use. However, in some cases having an exotic species growing along a shoreline may actually be preferable if the alternative plant is commercial turfgrass. Since turfgrass has shallow roots and is prone to erosion along shorelines, exotics like reed canary grass or common reed (*Phragmites australis*) will control erosion more effectively. Native plants should take precedent over exotics when possible. Table 6 lists several native plants that can be planted along shorelines.

Cons

Native plant and wildlife diversity will be lost as stands of exotic species expand. Exotic species are not under the same stresses (particularly diseases and predators) as native plants and thus can out-compete the natives for nutrients, space, and light. Few wildlife species use areas where exotic plants dominate. This happens because many wildlife species either have not adapted with the plants and do not view them as a food resource, the plants are not digestible to the animal, or their primary food supply (i.e., insects) are not attracted to the plants. The result is a monoculture of exotic plants with limited biodiversity.

Recreational activities, especially wildlife viewing, may be hampered by such monocultures. Access to lake shorelines may be impaired due to dense stands of non-native plants. Other recreational activities, such as swimming and boating, may not be affected.

Costs

Costs with this option are zero initially, however, when control is eventually needed, costs will be substantially more than if action was taken immediately. Additionally, the eventual loss of ecological diversity is difficult to calculate financially.

Option 2: Hand Removal

Controlling exotic plants by hand removal is most effective on small areas (< 1 acre) and if done prior to heavy infestation. This is probably the best method (combined with herbicides) for removal of invasive species on West Loon Lake. 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 excavated. This is probably the most effective method of removal on West Loon Lake for purple loosestrife. 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. Many exotic species, such as purple loosestrife, buckthorn, and garlic mustard are proficient at colonizing disturbed sites.

Pros

Removal of exotics by hand eliminates the need for chemical treatments. Costs are low if stands of plants are not too large already. Once removed, control is simple with yearly maintenance. Control or elimination of exotics preserves the ecosystem's biodiversity. This will have positive impacts on plant and wildlife presence as well as some recreational activities.

Cons
This option may be labor intensive or prohibitive if the exotic plant is already well established. Costs may be high if large numbers of people are needed to remove plants. Soil disturbance may introduce additional problems such as providing a seedbed for other non-native plants that quickly establish disturbed sites, or cause soil-laden run-off to flow into nearby lakes or streams. In addition, a well-established stand of an exotic like purple loosestrife or reed canary grass may require several years of intense removal to control or eliminate.

Costs
Cost for this option is primarily in tools, labor, and proper plant disposal.

Option 3: Herbicide Treatment

Treatment with herbicides is one of the best options for controlling **mature stands** of invasive species on West Loon Lake. Chemical treatments can be effective at controlling exotic plant species. However, chemical treatment works best on individual plants or small areas already infested with the plant. In some areas where individual spot treatments are prohibitive or unpractical (i.e., large expanses of a wetland or woodland), chemical treatments may not be an option due to the fact that in order to chemically treat the area a broadcast application would be needed. Since many of the herbicides that are used 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 such as buckthorn and purple loosestrife. Herbicides are applied to green foliage or cut stems. 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. The herbicide solution is wiped on foliage, bark, or cut stems using a herbicide soaked device. Trees are normally treated by cutting a ring in the bark (called girdling). Herbicides are applied onto the ring at high concentrations. Other devices inject the herbicide through the bark. 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. The label is the law. Table 7 contains herbicides that are approved for use near water for control of nuisance vegetation. Included in this table are rates, costs, and restrictions on use.

Pros

Herbicides provide a fast and effective way to control or eliminate nuisance vegetation. Unlike other control methods, herbicides kill the root of the plant, which prevents regrowth. If applied properly, herbicides can be selective. This allows for removal of selected plants within a mix of desirable and undesirable plants.

Cons

Since most herbicides are non-selective, they are not suitable for broadcast application. Thus, chemical treatment of large stands of exotic species may not be practical. Native species are likely to be killed inadvertently and replaced by other non-native species. Off target injury/death may result from the improper use of herbicides. If herbicides are applied in windy conditions, chemicals may drift onto desirable vegetation. Care must also be taken when wicking herbicides as not to drip on to non-targeted vegetation such as native grasses and wildflowers. Another drawback to herbicide use relates to their ecological soundness and the public perception of them. Costs may also be prohibitive if plant stands are large. Depending on the device, cost of the application equipment can be high.

Costs

See Table 7 for herbicide rates and prices. Total cost to treat the limited amount of purple loosestrife and other invasive species on West Loon Lake would be minimal and could be done by individual homeowners or the LLMA. Hand-held and backpack sprayers costs from $25-$45 and $80-150, respectively. Wicking devices are $30-40. For other species, such as buckthorn, a device such as a Hydrohatchet®, a hatchet that injects herbicide through the bark (about $300) may be needed. Another injecting devise, E-Z Ject® is $450. A low cost alternative to specialized spray equipment is the use of household spray bottles (commonly used for window and bathroom cleaners). These bottles can be purchased at department stores for minimal costs. However, after there use for herbicide application they should not be used for anything else. Similarly, spray canisters like those used to apply lawn chemicals also provide lower costs alternatives to commercial spray equipment. Individual homeowners more than likely have the some of the equipment used in these types of applications so equipment costs could be drastically reduced for this option.

Option 4: 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.

Recently two leaf beetles (*Galerucella pusilla* and *G. calmariensis*) and two weevils, one a root-feeder (*Hylobius transversovittatus*) and one a flower-feeder (*Nanophyes marmoratus*) have offered some hope to control purple loosestrife by natural means. These insects feed on the leaves, roots, or flowers of purple loosestrife, eventually weakening and killing the plant or, in the case of the flower-feeder, prevent seeding. In large stands of loosestrife, the beetles and weevils naturally reproduce and in many locations, significantly reduce plant densities. The insects are host specific, meaning that they will attack no other plant but purple loosestrife. Currently, the beetles have proven to be most effective and are available for purchase. There are no designated stocking rate recommendations, since using bio-control insects are seen as an inoculation and it may take 3-5 years for beetle populations to increase to levels that will cause significant damage. Depending on the size of the infested area, it may take 1,000 or more adult beetles per acre to cause significant damage.

Pros

Control of exotics by a natural mechanism is preferable to chemical treatments. Insects, being part of the same ecological system as the exotic plant (i.e., the beetles and weevils and the purple loosestrife) are more likely to provide long-term control. Chemical treatments are usually non-selective while bio-control measures target specific plant species. This technique is beneficial to the ecosystem since it preserves, even promotes, biodiversity. As the exotic plant dies back, native vegetation can reestablish the area.

Cons

Few exotics can be controlled using biological means. Currently, there are no bio-control techniques for plants such as buckthorn, reed canary grass, or a host of other exotics. One of the major disadvantages of using bio-control is the costs and labor associated with it.

Use of biological mechanisms to control plants such as purple loosestrife is still under debate. Similar to purple loosestrife, the beetles and weevils that control it are not native to North America. Due to the poor historical record of introducing non-native species, even to control other non-native species, this technique has its critics.

Costs

The New York Department of Natural Resources at Cornell University (email: bb22@cornell.edu, 607-255-5314, or visit the website: www.invasiveplants.net) sells over wintering adult leaf beetles (which will lay eggs the year of release) for $1 per beetle and new generation leaf beetles (which will lay eggs beginning the following year) at $0.25 per beetle. The root beetles are sold for $5 per beetle. Some beetles may be available for free by contacting the Illinois Natural History Survey (INHS; 217-333-6846). The INHS also conducts a workshop each spring at Volo Bog for individuals and groups interested in learning how to rear their own beetles.

Objective III: Permanent Staff Gage

Fluctuating water levels can significantly impact many aspects of lake management. The ability to monitor these levels is critical to developing effective management plans. It is recommended that a permanent staff gage be mounted somewhere on East Loon Lake and daily measurements taken during the year (except during ice coverage). The gage should be mounted on a permanent object (i.e., seawall or level pole) that will stay submerged year-round.