2000 SUMMARY REPORT
of
LAKE FAIRFIELD

Lake County, Illinois

Prepared by the

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July 2001

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LAKE IDENTIFICATION AND LOCATION

Lake Fairfield is located in unincorporated Fremont Township between Gossell Road and Fairfield Road (T 44N, R 10E, S 18). The lake is a shallow, manmade impoundment with a surface area of 18.2 acres and mean and maximum depths of 8.3 feet and 16.0 feet, respectively. Lake volume is approximately 151.1 acre-feet. Lake Fairfield is part of the Mutton Creek sub basin, which is within the Fox River Watershed. Water exits the lake and flows north through a culvert into a small tributary that leads into Art Baker Lake 2, which is the first lake of ADID 203. Art Baker 2 then flows through the second lake (unnamed) of ADID 203. The water then flows from ADID 203 under Gossell Road and enters Mutton Creek, eventually emptying into the Fox River.

BRIEF HISTORY OF LAKE FAIRFIELD

Lake Fairfield is a private lake and bottom ownership belongs, in part, to twenty-six homeowners on the lake. It is believed that the lake was created prior to 1952 by dredging a small lake already in existence to create the western part of the current lake.

SUMMARY OF CURRENT AND HISTORICAL LAKE USES

No public access is available to Lake Fairfield, and only homeowners who live on the lake (and their guests) can use the lake for recreation. Historically, fish surveys have been the primary management technique employed by the lake owners, and the lake's main uses include fishing and swimming. Rowboats and small boats with electric motors are the most common watercraft on the lake, as the lake association does not allow gas-powered motors. To prevent the introduction of undesirable fish species, the use of live bait is also prohibited, and anglers may only use worms and artificial bait. The Lake Fairfield Estates Association meets once a year to address lake management issues, and every homeowner on the lake is required to pay a fee of $250.00 per year for maintenance of Lake Fairfield. Currently, the biggest management concerns include water quality, the fish community and aquatic plant control. Lake Fairfield's watershed is dominated by agricultural and residential land. The shoreline of the lake is approximately one mile long and dominated by single-family residences.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Lake Fairfield were analyzed for a variety of water quality parameters (See *Appendix A* for methodology). Samples were collected at 3 foot and 11 or 12 foot depths (depending on water level) from the deep hole location in the lake (Figure 1). Lake Fairfield was thermally stratified in 2000. Thermal stratification occurs when a lake divides into an upper, warm water layer (epilimnion) and a lower, cold water layer (hypolimnion). When stratified, the epilimnetic and hypolimnetic waters do not

mix, and the hypolimnion typically becomes anoxic by mid-summer. This is exactly what happened in Lake Fairfield from May through August as surface waters heated up and bottom waters lost much or all of their dissolved oxygen. This was determined by assessing the water quality data which showed that concentrations of most parameters collected from shallow water samples differed from those same parameters collected from deep water samples, especially with regard to temperature and dissolved oxygen concentrations. Therefore, data from both the epilimnetic and hypolimnetic samples will be discussed. Although the bottom water lost most or all dissolved oxygen, 97% of the lake volume remained oxic. Therefore, fish kills from low oxygen levels would be a rare occurrence and artificial aeration would not be necessary. Water quality parameters are discussed in detail in a document which accompanies this report*: Interpreting Your Water Quality Data*. The complete data set for Lake Fairfield is located in Table 1. Below is a brief discussion of the analysis of the water quality data collected over the five month study of Lake Fairfield.

Phosphorus is a nutrient that can enter lakes through runoff or from the lake sediment, and high levels of phosphorus typically trigger algal blooms. Average phosphorus concentrations in the hypolimnion of stratified lakes will be higher than in the epilimnion due to release of phosphorus from the bottom sediments. Both the average epilimnetic phosphorus concentration (0.03 mg/l) and hypolimnetic phosphorus concentration (0.08 mg/l) in Lake Fairfield were below their respective County averages (0.066 mg/l and 0.287 mg/l) (1995-2000). As a result of these relatively low phosphorus concentrations and heavy algicide application throughout the summer, lake wide blue-green algal blooms did not occur on Lake Fairfield from May through September, and Secchi depth was higher than average from May through July. Secchi depth is a direct indicator of water clarity and overall water quality. In general, the greater the Secchi depth, the better the water clarity. Water clarity and quality can be reduced by either algae or sediment in the water column. Secchi depth readings in Lake Fairfield were good in May, June and July, but began to drop from 6 feet in July to below the Lake County average (5 feet) in August, and remained low in September (approximately 4 feet during both months). Water color changed from a relatively green color in July to colors which contained more brown in August and September. The drop in Secchi depth corresponded with a decrease of viable *Chara* plants from July through September. *Chara*, a macroalgae, competes with filamentous and microscopic algae for light and prevent the resuspension of sediments from the lake bottom by wave and wind action. With the reduction of viable aquatic plants in August and September, suspended sediments in the water column increased. A corresponding decrease in Secchi depth and a water color change were observed. The decline of healthy *Chara* was the result of excessive copper sulfate application, as the *Chara* had characteristic copper “burn marks” later in the summer. According to McCloud Inc., removal of *Chara* is desired by the Estates Association. It is recommended that this treatment be discontinued, as the *Chara* appears to be keeping water clarity in Lake Fairfield high.

The amount of bottom sediment resuspended by wind and wave action in Fairfield Lake in late summer was potentially augmented by carp activity in the lake. Grass carp (*Ctenopharyngodon idella* Val.) were stocked in Lake Fairfield from 1995-1997 as a

plant management treatment measure. Although these fish do not reproduce, their feeding activities can reduce water transparency. As the summer progresses and the carp begin to eradicate the plant community in the lake, they will resort to bottom feeding in order to sustain themselves. The loss of plants through herbicide treatment, carp activities and natural senescence, and the potential disturbance of sediment during carp feeding, reduced water clarity in Lake Fairfield in August and September.

Most other variables measured during the 2000 lake study (alkalinity, conductivity, total nitrogen, ammonia, total dissolved solids, total volatile solids, total suspended solids and pH) were below the Lake County averages. The definitions and relative significance of each of these variables can be found in a document which accompanies this report*: Interpreting Your Water Quality Data*.

Typically, lakes are either phosphorus or nitrogen limited. This means that one of these nutrients is in short supply and that any addition of phosphorus or nitrogen to the lake will result in an increase of plant or algal growth. Other resources necessary for plant and algae growth, such as light or carbon, can be limiting, but this is rarely observed. Most lakes in Lake County are phosphorus limited, but to compare the availability of nitrogen and phosphorus, a ratio of total nitrogen to total phosphorus (TN:TP) is used. Ratios less than or equal to 10:1 indicate nitrogen is limiting. Ratios greater than or equal to 15:1 indicate that phosphorus is limiting. Ratios greater than 10:1, but less than 15:1 indicate that there are enough of both nutrients to facilitate excess algal or plant growth. Lake Fairfield had a TN:TP ratio of 49:1. This indicates that it is highly phosphorus limited and that care should be taken to ensure that the amount of phosphorus entering the lake does not increase. At this ratio, even a relatively small increase in phosphorus entering the lake would have noticeable impacts. High nitrogen concentrations are the main cause of this high ratio. Average nitrate levels in Lake Fairfield were above the county average. Nitrate can come from many sources, including septic systems, watershed runoff, soils and the atmosphere, and is very difficult to control. However, a large source of nitrogen to Lake Fairfield is believed to be lawn fertilizer. Many of the residents around the lake add fertilizer to their lawns throughout the summer. Rain will wash excess fertilizer off the lawns and directly into the lake, increasing both nitrate and total nitrogen concentrations. A reduction in the use of these fertilizers would greatly benefit water quality in Lake Fairfield.

Sources of phosphorus that would be detrimental to Lake Fairfield can be either external or internal. External sources originate outside of the lake and can include fertilizer runoff, erosion, or failing septic systems. Internal sources originate from lake sediment. Internal sources are a common source of phosphorus in man-made lakes, which typically contain rich, organic sediments. Phosphorus can be released in shallow lakes from oxic sediments through biological or mechanical processes, such as carp activity, macroinvertebrate burrowing, or wave action which disturb the sediments. In these shallow lakes, released phosphorus is easily distributed throughout the water column. In deeper lakes that stratify and lose oxygen, phosphorus can be released through chemical processes under anoxic conditions in the hypolimnion. This phosphorus will stay in the hypolimnion until the lake turns over in the fall, at which time it is mixed throughout the

water column and can result in late season algal blooms. The source of phosphorus in Lake Fairfield appears to be internal. Phosphorus levels in the epilimnion did not coincide with rainfall levels from month to month, as would be expected if the source of phosphorus was external. Increases occurred in the hypolimnion as phosphorus was released from bottom sediment each month. Phosphorus levels in the epilimnion only increased once the lake began to lose its stratification and turn over in late August and September. At that time, phosphorus released from bottom sediment was distributed throughout the water column, increasing phosphorus concentrations in the epilimnion and decreasing levels in the hypolimnion. The increase in phosphorus also corresponded to the senescence of *Chara* in Lake Fairfield. As the plants began dying, phosphorus that had been taken up from the sediment and stored in the plant tissues was released into the water column and may have contributed to the phosphorus increase in the epilimnion.

Phosphorus levels can also be used to indicate the trophic state (productivity level) of a lake. The Trophic State Index (TSI) uses phosphorus levels, chlorophyll *a* levels and Secchi depth to classify and compare lake trophic states using just one value. The TSI is set up so that an increase in phosphorus concentration is related to an increase in algal biomass and a corresponding decrease in Secchi depth. A high TSI value indicates eutrophic (TSI=50-69) to hypereutrophic (TSI ≥70) lake conditions. Lake Fairfield has a phosphorus TSI value of 53.03, indicating slightly eutrophic conditions. This means that the lake is a moderately productive system with relatively good water quality. The TSI of Lake Fairfield is not unusual for Lake County, where most man-made lakes fall into the eutrophic and hypereutrophic categories.

Most of the water quality parameters just discussed can be used to analyze the water quality of Lake Fairfield based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, Lake Fairfield provides *Full* overall use, along with *Full* aquatic life, swimming and recreation use support as a result of the low phosphorus levels and moderate to high Secchi depths.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant surveys were conducted every month for the duration of the study (See *Appendix A* for methodology). Shoreline plants of interest were also observed and recorded. However, no quantitative surveys were made of these shoreline species and all data are purely observational. Based on the 1% light level, depth at which plant growth could occur in Lake Fairfield differed on a monthly basis, but varied from the bottom (13 feet) in May, June and July to 10 feet in August and September. Lake Fairfield has, historically, been treated with both herbicides and algicides. Copper sulfate is currently used bi-weekly from May-August to treat for *Chara* and planktonic algae. In 1998 and 2000, whole-lake Sonar™ treatments were used, and in 1999, Reward® was used to spot treat two beach areas of the lake for leafy pondweed. As a result, there was little diversity in the plant community, which was dominated by *Chara* throughout the summer. Plants observed also included a small amount of flatstem pondweed, sago

pondweed, curlyleaf pondweed and duckweed. *Chara* was present in 80% of the plant survey sites during the summer of 2000, and its high abundance was a main reason for high water clarity, despite the small number of species making up the plant community in Lake Fairfield (Tables 2 & 3). The natural senescence of and copper damage to the *Chara* towards the end of summer contributed to the decrease in Secchi depth in August and September.

Table 2: Aquatic and Shoreline Plants on Lake Fairfield, May-Sept. 2000

Aquatic Plants	
Chara	*Chara* sp.
Duckweed	*Lemna minor*
Curlyleaf pondweed	*Potamogeton crispus*
Sago pondweed	*Potamogeton pectinatus*
Flatstem pondweed	*Potamogeton zosterifomis*
Shoreline Plants	
Hardstem Bullrush	*Scirpus acutus*
Slender Spikerush	*Eleocharis acicularis*
Common Cattail	*Typha latifolia*
Common Reed	*Phragmites australis*
Purple loostrife	*Lythrum salicaria*

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

Shoreline assessment was conducted at Lake Fairfield on May 31, 2000. The shoreline was assessed for a variety of criteria (See *Appendix A* for methods). Based on these assessments, several important generalizations could be made. Virtually all of Lake Fairfield's shoreline (94.7%) is developed, and the majority of this developed shoreline (60.2%) is comprised of manicured lawn. The other main shoreline type was beach (20.3%), and small components of the shoreline were made up of buffer strips (7.1%), prairie (6.8%), rip rap (6.5%), seawall (2.7%), and woodland (2.0%) (Figure 2). Manicured lawns provide a poor shoreline-water interface due to the poor root structure of turf grasses. These grasses are incapable of stabilizing shorelines and typically lead to erosion. In fact, 87.8% of the shoreline on Lake Fairfield consisting of manicured lawns had slight erosion occurring. Although seawalls and rip rap shorelines are considered undesirable, they typically protect well against erosion. This was not the case on Lake Fairfield. Poorly constructed seawalls and rip rap resulted in 100% of both types of shoreline exhibiting slight erosion. No erosion was occurring along more desirable shoreline, such as buffer strips, prairie and woodland area, but these shoreline types were present in small quantities along the lake. Although little moderate or severe erosion was

occurring, a total of 50% of the shoreline along Lake Fairfield exhibited slight erosion (Figure 3). Suggested solutions to the erosion problems are discussed in detail in *Objective III: Shoreline Erosion Control* (p. 18).

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Historically, the Lake Fairfield Estate Association has been surveying the lake's fish populations since the mid-1960's and have used several measures including fish removal and fish stocking to improve the fish community in the lake. The most recent fish survey performed on Lake Fairfield by the Illinois Department of Natural Resources (IDNR, formerly known as the Illinois Department of Conservation (IDOC)) was in 1994. This was the third fish population survey conducted since the 1982 effort to reduce the bluegill population. Electroshocking and gill nets were used to collect the data. Bluegill dominated the sport fish populations in terms of relative abundance (77%), while largemouth bass numbers remained relatively low (6.2%). Reproduction and recruitment of large mouth bass were poor due to overabundant bluegill. The bluegill population also showed signs of distress and was dominated by relatively small fish. Ten yellow bass, an undesirable species that preys upon largemouth bass and typically has an adverse effect on the overall balance and quality of the fishery were found during the 1994 survey and were believed to have been illegally introduced into Lake Fairfield. Channel catfish were also found in the lake, but did not appear to be reproducing. The poor condition of the fish community was determined by the IDNR to be the result of excessive *Chara* coverage in the littoral zone, which was thought to provide too much cover for bluegill and other sunfish, inhibiting effective predation by bass and leading to an unbalanced fish community. IDNR recommendations to improve the fishery included (1) an aquatic plant control program directed at reducing *Chara* through grass carp stocking or herbicide applications, (2) a 15 inch size limit and catch limit on large mouth bass, (3) the stocking of northern strain largemouth bass fingerlings for three consecutive years and of channel catfish annually, (4) removal of all bluegill or yellow bass caught regardless of size, and (5) destruction of bluegill spawning beds. The LCHD-Lakes Management Unit does not agree with the first IDNR recommendation and feels that 30-40% plant coverage is necessary for a healthy fish community. Additionally, the stocking of grass carp will typically result in a decrease of water clarity and lake quality and is never recommended. Channel catfish, northern pike, walleye pike, grass carp and largemouth bass were stocked in 1995, 1996 and 1997. No fish surveys have been performed since these stockings. *Chara* still dominates the plant community and was estimated to cover 80% of the littoral zone during the 2000 lake survey.

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See *Appendix A* for methodology). All observations were visual and several types of waterfowl were observed over the course of the study (Table 4). Poor wildlife habitat was found around Lake Fairfield. Several areas of the shoreline consisted of prairie, woodland or buffer, but most lots had manicured lawn down to the water's edge. This encouraged and supported large numbers of Canada geese, which were observed around the lake throughout the summer. There are many areas in which habitat

can be improved to facilitate more bird and waterfowl nesting. Purple loosestrife (*Lythrum salicaria*), an invasive plant species, was observed along the shoreline. This plant is seldom used by wildlife for food or shelter and can easily displace other native, more desirable plant species. Actions should be taken to control or eliminate purple loosestrife around Lake Fairfield. Additionally, shoreline habitat should be improved to include buffer strips and more naturalized shoreline areas. *See Objective III: Wildlife Habitat Improvement* (p. 22).

Table 4: Observed Wildlife Species on Lake Fairfield, May-September 2000

Birds

Canada Goose	*Branta canadensis*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Belted Kingfisher	*Megaceryle alcyon*
Red-winged Blackbird	*Agelaius phoeniceus*
Northern cardinal	*Cardinalis cardinalis*

EXISTING WATER QUALITY PROBLEMS

- *Poor Plant Diversity*

One key to a healthy lake is a healthy aquatic plant community. Lake Fairfield has abundant *Chara*, which appears to be keeping water clarity relatively high. However, a more diverse plant community would improve overall lake health as well as the health of the fish community. The high percent coverage of *Chara* in the littoral zone appears to be having a negative effect on the largemouth bass population in the lake.

- *Poor Natural Shoreline Conditions*

Virtually all of the shoreline of Lake Fairfield is developed by single-family residences, and nearly all of this developed shoreline consists of manicured lawns, rip rap or seawalls. These types of shoreline do not provide quality wildlife habitat, and erosion has occurred along almost 100% of these shorelines. A total of 50% of Lake Fairfield's shoreline had slight erosion occurring during the summer of 2000.

POTENTIAL OBJECTIVES FOR LAKE FAIRFIELD MANAGEMENT PLAN

I. Better Aquatic Plant Management Techniques
II. Shoreline Erosion Control
III. Wildlife Habitat Improvement
IV. Eliminate or Control Invasive Species
V. Alleviate Excessive Numbers of Canada Geese (*Branta canadensis*)

ALTERNATIVES FOR ACHIEVING THE LAKE MANAGEMENT PLAN OBJECTIVES

Objective I: Better Aquatic Plant Management Techniques

All aquatic plant management techniques have both positive and negative characteristics. If used properly, they can all be beneficial to a lake's well being. If misused or abused, they all share similar outcomes - negative impacts to the lake. Putting together a good aquatic plant management plan should not be rushed. Plans should consist of a realistic set of goals well thought out before implementation. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance/restoration, and limitations of the lake. For an aquatic plant management plan to achieve long term success, follow up is critical. A good aquatic plant management plan considers both the short and long-term needs of the lake. The management of the lake's vegetation does not end once the nuisance vegetation has been reduced/eliminated. It is critical to continually monitor problematic areas for regrowth and remove as necessary. An association or property owner should not always expect immediate results. A quick fix of the vegetation problems may not always be in the best interest of the lake. Sometimes the best solutions take several seasons to properly solve the problem. The management options covered below are commonly used techniques that are coming into wider acceptance and have been used in Lake County. There are other plant management options that are not covered below as they not are very effective, or are too experimental to be widely used.

<u>Option 1: No Action</u>
If the lake is dominated by native, non-invasive species, the no action option could be ideal. Under these circumstances native plant populations could flourish and keep nuisance plants from becoming problematic. With a no action aquatic plant management plan in a lake with non-native nuisance species, nothing would be done to control the aquatic plant population of the lake regardless of the type and extent of the vegetation. Nuisance vegetation could continue to grow until epidemic proportions are reached. Growth limitations of the plant and the characteristics of the lake itself (light penetration, lake morphology, substrate type, etc.) will dictate the extent of infestation. Rooted

plants, such as curly leaf pondweed (*Potamogeton crispus*) and elodea (*Elodea canadensis*), will be bound by physical factors such as substrate type and light availability. Plants such as Eurasian watermilfoil and coontail, which can grow unrooted at the surface regardless of water depth, could grow to cover 100% of the water's surface. This could cause major inhibition of the lakes recreational uses and impact fish and other aquatic organisms adversely.

Pros

There are positive aspects associated with the no action option for plant management. The first, and most obvious, is that there is no cost. However, if an active management plan for vegetation control were eventually needed, the cost would be substantially higher than if the no action plan had not been followed in the first place. Another benefit of this option would be the lack of environmental manipulation. Under the no action option, no chemicals, mechanical altercation, or introduction of any organisms would take place. This is important since studies have shown that nuisance plants are more likely to invade disrupted areas. Expansion of the native plant population would increase the overall biodiversity and health of the lake. Habitat, breeding area, and food source availability would greatly improve. Use of the lake would continue as normal and in some cases might improve (fishing) if native plants kept "weedy" plants under control.

An additional benefit of the no action option is the possible improvement in water quality. Turbidity could decrease and clarity should increase due to sediment stabilization by the plant's roots. Algal blooms could be reduced with decreased nutrient availability due to plant uptake and sediment stabilization. However, the occurrence of filamentous algae may increase due to their surface growth habitat. The lake's fishery could improve due to a more diverse habitat, which in turn would have numerous positive effects on the rest of the lake's ecosystem.

Cons

Under the no action option, if nuisance vegetation is dominant in the lake and were uninhibited and able to reach epidemic proportions, there will be many negative impacts on the lake. By their weedy nature, the nuisance plants would out-compete the more desirable native plants. This could eventually, drastically reduce or even eliminate the native plant population of the lake and reduce the lake's biodiversity. This will also impact fish populations. The fishery of the lake may become stunted due the to lack of quality forage fish habitat and reduced predation. Predation will decrease due to the difficulty of finding prey in the dense stands of vegetation. This will cause an explosion in the small fish population and, with food resources not increasing, growth of fish will be reduced. Decreased dissolved oxygen levels, due to high biological oxygen demand from the excessive vegetation, will also have negative impacts on the aquatic life. Wildlife populations will also be negatively impacted by these dense stands of vegetation. Birds and waterfowl will have difficulty in finding quality plants for food or in locating prey within the dense plant stands.

Water quality could also be negatively impacted with the implementation of the no action option. Deposition of large amounts of organic matter and release of nutrients upon the death of the massive stands of vegetation is a probable outcome of the no action option. These dead plants will contribute to the sediment load of the lake and could accelerate its filling in. The large nutrient release when the plants die back in the fall could lead to lake-wide algae blooms and an overall increase of the internal nutrient load to the lake. In addition, the decomposition of the massive amounts of vegetation will lead to a depletion of the lakes dissolved oxygen. This can cause fish stress, and eventually, if the stress is frequent or severe enough, fish kills. All of the impacts above could in turn have negative impacts on numerous aspects of the lake's ecosystem.

In addition to the ecological impacts, many physical uses of the lake will be negatively impacted. Boating could be nearly impossible without becoming entangled in thick mats of plants. Swimming could also become increasingly difficult due to thick vegetation that would develop at beaches. Fishing could become more and more exasperating in thick vegetation with a stunted fish population. In addition, the aesthetics of the lake will also decline if large areas of the lake covered by tangled mats of vegetation and odors develop when they decay. The combination of the above events could cause property values on the lake to suffer. Property values on lakes with weedy plant/algae problems have been shown to decrease by as much as 15-20%.

Costs

No cost will be incurred by implementing the no action management option.

Option 2: Aquatic Herbicides

Aquatic herbicides are the most common method to control nuisance vegetation/algae. When used properly, they can provide selective and reliable control. Products can not be licensed for use in aquatic situations unless there is less than a 1 in 1,000,000 chance of any negative effects on human health, wildlife, and the environment. Aquatic herbicides are not allowed to be environmentally persistent, bioaccumulate, or have any bioavailability. Prior to herbicide application, licensed applicators should evaluate the lake's vegetation and, along with the lake's management plan, choose the appropriate herbicide and treatment areas, and apply the herbicides during appropriate conditions (i.e., low wind speed). The Lake Fairfield Estate Association is currently using herbicides and algicides to control curly leaf pondweed and *Chara* in the lake.

There are two groups of herbicides: contact and systemic. Contact herbicides, like their name indicates, kill on contact. These herbicides affect only the above ground portion of the plant that they come into contact with and therefore do not kill the root system. The Lake Fairfield Estate Association used the contact herbicide Reward® in 1999. Systemic herbicides are taken up by the plant and disrupt cellular processes, which in turn cause plant death. These herbicides kill both the upper portions of the plant as well as the root system. Lake Fairfield Estate Association used Sonar™, a systemic herbicide, in 1998 and 2000 at a concentration of 10 ppb. Both types of herbicides are available in liquid or

granular forms. Liquid forms are concentrated and need to be mixed into water to obtain the desired concentration. The solution is then sprayed on the water's surface or injected into the water in the treatment areas. Granular herbicides are broadcast in a known rate over the treatment area where they sink to the bottom and slowly release the herbicide which is then taken up by the plant. These are referred to as SRP formulations (Slow Release Pellet). Other granular herbicides come in crystal form and dissolve as they come in contact with water. This is typical of herbicides such as copper sulfate. Many herbicides come in both liquid and granular forms to fit the management needs of the lake. Herbicide applications can either be done as whole lake treatments or as more selective spot treatments. Multiple herbicides are often mixed and applied together (tank mix), which saves time, energy, and cost.

Aquatic herbicides are best used on actively growing plants to ensure optimal herbicide uptake. For this reason, herbicides are normally applied in mid to late spring when water temperatures are above 60^0F. This is the time of year when the plants are most actively growing and before seed/vegetative propagule formation. Follow up applications should be done as needed. When choosing an aquatic herbicide it is important to know what plants are present, which ones are problematic, which plants are beneficial, and how a particular herbicide will act upon these plants. The herbicide label is very important and should always be read before use. As with other management options, proper usage is the key to herbicide effectiveness, benefits, and disadvantages. The Lake Fairfield Estate Association is currently getting good control of the curly leaf pondweed with Sonar, and water clarity has remained high due to the presence of *Chara* and bi-weekly copper sulfate treatments for algae. However, these results may not last forever. Research and experience have shown that many alga species become intolerant to copper sulfate and more and more must be added to gain control of the algae until it is no longer controllable. The solution would be to increase the diversity of the native plant community. If the application concentration of Sonar was reduced to 6 or 8 ppb, complete control of curly leaf pondweed would still be achieved, while allowing native pondweeds such as sago and flatstem to flourish. The result would be a more diverse plant community which would improve water quality, improve the fish community by providing additional habitat and spawning areas, and save the Estate Association money in two ways: (1) Using a lower concentration of Sonar would require the purchase of less herbicide (half the amount currently used if the concentration is reduced to 6 ppb) and (2) a more diverse plant community would successfully compete with algae for resources, decreasing algal density and reducing the necessity of copper sulfate treatments to maintain control of algal blooms. Another option to improve the plant community diversity would be to eliminate the use of Sonar and move to using Reward only. This is a contact herbicide that can be used in the spring to spot treat curly leaf pondweed just as it is emerging. Typically the curly leaf will not return at high densities (since it naturally dies off by the end of June). By using a spot treatment instead of a whole-lake approach, the native pondweeds will be protected and allowed to grow while the nuisance curly leaf will controlled.

Pros

When used properly, aquatic herbicides can be a powerful tool in management of excessive vegetation. Often, aquatic herbicide treatments can be more cost effective in the long run compared to other management techniques. A properly implemented plan can often provide season long control with minimal applications. Ecologically, herbicides can be a better management option than using mechanical harvesting or grass carp. When properly applied, aquatic herbicides may be selective for nuisance plants such as Eurasian watermilfoil and curly leaf pondweed but allow desirable plants such as the native pondweeds to remain. This removes the problematic vegetation and allows native and more desirable plants to remain and flourish with minimal manipulation.

The fisheries and waterfowl populations of the lake would greatly benefit due to an increase in quality habitat and food supply. Dense stands of curly leaf would be thinned out and improve spawning habitat and food source availability for fish. Waterfowl populations would greatly benefit from increases in quality food sources, such as flat stemmed pondweed (*Potamogeton zosterifomis*). Another environmental benefit of using aquatic herbicides over other management options is that they are organism specific. The metabolic pathways by which herbicides kill plants are plant specific and not carried out by humans and other organisms. Organisms such as fish, birds, mussels, and zooplankton are generally unaffected.

By implementing a good management plan with aquatic herbicides, usage opportunities of the lake would increase. Activities such as boating and swimming would improve due to the removal of dense stands of vegetation. The quality of fishing may recover because of improved habitat. In addition to increased usage opportunities, the overall aesthetics of the lake would improve, potentially increasing property values on the lake.

Cons

The most obvious drawback of using aquatic herbicides is the input of chemicals into the lake. Although the United States Environmental Protection Agency (USEPA) has approved these chemicals for use, human error can make them unsafe and bring about undesired outcomes. If not properly used, aquatic herbicides can remove too much vegetation from the lake. This could drastically alter the biodiversity and ecological balance of the lake. Total removal or over-removal of plants can cause a variety of problems lake-wide. The fishery of the lake may decline and/or become stunted due to predation issues related to decreased water clarity. Other wildlife, such as waterfowl, which commonly forage on aquatic plants, would also be negatively impacted by the decrease in vegetation.

Another problem associated with removing too much vegetation is the loss of sediment stabilization by plants, which can lead to increased turbidity and resuspension of nutrients. The increase in turbidity can cause a decrease in light penetration, which can further aggravate the aquatic plant community. The

resuspension of nutrients will contribute to the overall nutrient load of the lake, which can lead to an increased frequency of noxious algal blooms. Furthermore, the removal of aquatic vegetation, which compete with algae for resources, can directly contribute to an increase in blooms.

After the initial removal, there is a possibility for regrowth of vegetation. Upon regrowth, weedy plants such as Eurasian watermilfoil and coontail quickly reestablish, form dense stands, and prevent the growth of desirable species. This causes a decrease in plant biodiveristy. Additionally, these dense stands of nuisance vegetation can lead to an overpopulation of stunted fish due to a decrease in predation of forage species by predatory fish. This disruption in the fisheries can have negative impacts throughout the ecosystem from zooplankton to higher organisms such as waterfowl and other wildlife. Additionally, some herbicides have use restrictions regarding their use in relation to fish, swimming, irrigation, etc.

Overremoval, and possible regrowth of nuisance vegetation that may follow will drastically impair recreational use of the lake. Swimming could be adversely affected due to the likelihood of increased algal blooms. Swimmers may become entangled in large mats of filamentous algae. Blooms of planktonic species, such as blue-green algae, can produce harmful toxins as well produce noxious odors. If regrowth of nuisance vegetation were to occur, motors could become entangled making boating difficult. Fishing would also be negatively impacted due to the decreased health of the lake's fishery. The overall appearance of the lake would also suffer due to an increase in unsightly algal blooms and massive stands of vegetation. This in turn could have an unwanted effect on property values. Studies have shown that problematic algal blooms can decrease property values by 15-20%. If Sonar™ continues to be used at such a high concentration in Lake Fairfield, many of the negative impacts of plant overremoval could be realized.

Costs

The Lake Fairfield Estate Association currently has an herbicide/algicide treatment program in place. As mentioned above, costs could be reduced by decreasing Sonar application rates, allowing a more diverse plant community to become established and potentially reducing the amount of copper sulfate applied.

Option 3: Grass Carp

Triploid grass carp (*Ctenopharyngodon idella*) are biological control agents that are used to control nuisance aquatic vegetation. These fish are sterile so they cannot reproduce and become an ecological nuisance. The U.S. Fish and Wildlife Service first started using grass carp in 1963 in the southern states. Currently, they can be legally used in many states for aquatic plant control. Grass carp can be an effective biocontrol agent due to their appetite and fast growth rate (they may grow as large as 60 lbs.). Their effectiveness can even match that of other management practices such as herbicides and harvesting. A licensed individual may stock grass carp with a permit from the Illinois Department of Natural Resources. **Furthermore, grass carp can only be stocked in man-made bodies of water with controlled outlets and inlets. They cannot be**

stocked in glacial lakes, slough potholes, bottomlands, backwaters, streams, rivers, if state threatened or endangered plant or animal species are present, or in any state inventory natural area or nature preserve. In addition, to these limitations, there are several considerations when deciding if grass carp are appropriate in a lake management plan.

The first consideration that must be made is the desired degree of plant control. This will directly affect stocking rates. The greater the area of vegetation needing control, the greater number of grass carp required. Also, plant species in the lake must be identified. Grass carp, like people, have certain likes and dislikes. If a lake has a variety of plants in it, carp may not prefer to eat targeted plants. This may cause the elimination of desirable species of plants and the expansion of undesirable species. For example, grass carp do not like to eat Eurasian water milfoil. They will eat more desirable plants such as slender naiad (*Najas flexilis)* before they feed on the milfoil. This preference in food can cause differences in stocking rates. The less preferred the plant, the higher the stocking rate. At the suggestion of the IDNR, 75 grass carp were stocked in Lake Fairfield from 1995 to 1997. **It is our recommendation that no more grass carp be stocked in the lake.**

Pros

Grass carp are a non-chemical or mechanical means of plant control/removal. If a lake association or property owner has a goal of non-chemical or mechanical plant management, grass carp may be a possibility. They would be an especially attractive possibility if total vegetation removal were the goal. Due to their propensity to completely remove aquatic plants from a lake over long periods of time, grass carp may be less expensive than continual herbicide use and or mechanical harvesting. However, total elimination of aquatic vegetation is rarely an acceptable management goal for any lake.

If grass carp would only remove some excess vegetation, recreational impairments of the lake would improve. Opportunities such as swimming and boating would improve with the expansion of open water areas. The fishery of the lake may improve due to increased predation by predatory fish and food source availability for forage fishes. Other forms of wildlife, such as wading birds and waterfowl, could also benefit from the decrease in vegetation. Finally, aesthetic appearances may improve with the removal of unsightly mats of vegetation and increased lakefront property values may increase.

Cons

Overall, using grass carp as a management tool is not recommended. This is due to their inconsistent and uncontrollable nature, which often leads to complete removal of aquatic vegetation. In the long run, complete removal of vegetation is not in the best interest for the ecological health of lake. Over-removal of plants by grass carp can cause a variety of problems. One problem is the loss of sediment stabilization by the plants, which can lead to increased turbidity and resuspension of nutrients. The increased turbidity will cause decreased light penetration, which will further aggravate the aquatic plant community. The

resuspension of nutrients will also contribute to overall nutrient load of the lake, which may lead to increased frequency of algal blooms. Furthermore, the removal of aquatic vegetation, which competes with algae for resources, may directly contribute to an increase in algal blooms. The fishery of the lake may decline and/or become stunted due changes in predation related to decreased water clarity. Other wildlife such as waterfowl, which commonly forage on aquatic plants, would also be negatively impacted by decrease in food availability.

After the initial removal, and if the initial grass carp population dwindles, there is a possibility for regrowth of vegetation. Upon regrowth, weedy plants such as Eurasian watermilfoil and coontail quickly reestablish, form dense stands, and prevent the growth of more desirable species. This causes decreases in plant biodiversity. Additionally, these dense stands of nuisance vegetation will lead to an over-population of stunted fish due to a decrease in predation of forage species by predatory fish. This disruption in the fisheries may have negative impacts throughout the ecosystem from zooplankton to higher organisms such as waterfowl.

Excess plant removal (and possible regrowth of nuisance vegetation that may follow) may drastically impair recreational uses of the lake. Swimming will be adversely affected due to the likelihood of increased algal blooms. Swimmers may become entangled in large mats of filamentous algae. Blooms of planktonic species, such as blue-green algae, can produce harmful toxins as well produce noxious odors, which can make swimming an unpleasant experience. If regrowth of nuisance vegetation were to occur, motors could become entangled, making boating difficult. Fishing will also be negatively impacted due to the decreased health of the lake's fishery. The overall appearance of the lake would also suffer due to an increase in unsightly algal blooms.

As stated previously, aquatic plant management with grass carp is rarely a partial task. Over time, grass carp commonly remove all vegetation from a lake whether or not that was the intent of the original management plan. Once vegetation is removed, there is little chance for vegetation to grow back due to continuous feeding by the carp. Once in a lake, with an expected life span of 15-20 years, grass carp may keep a lake free of all vegetation for years after they have served their purpose. To remove grass carp, they either have to die naturally or be physically removed. Physical removal can include rotenone baiting, bow fishing, and, although not recommended, employing the use of firearms. If infestations are extensive and consist of plants that are less preferred by grass carp, costs can be quite high. The high costs combined with the other negative aspects of using grass carp make other management options more appealing and ecologically sound. So far, carp do not appear to be eating C*hara* or causing extensive clarity problems. However, the plan to reduce herbicide concentrations in order to create a more diverse plant community may be foiled by the grass carp in Lake Fairfield. The higher quality native plants that would probably appear in the lake after a

reduction of herbicides might be eaten by the carp before they had a chance to become established.

Option 4: Hand Removal

Hand removal of excessive aquatic vegetation is a commonly used management technique. Hand removal is normally used in limited areas for selective vegetation removal. Areas surrounding piers and beaches are commonly targeted areas. Typically, tools such as rakes and cutting bars are used to remove vegetation. These are easily obtainable through many outdoor supply catalogs or over the internet. Some rakes are equipped with tines as well as cutting edges. Tools can also be hand made by drilling a hole in the handle of a heavy-duty garden rake and tying it to a length of rope. Weights may be needed in order to provide forceful contact with the plants. In many instances, homeowners on lakes with near shore vegetation problems simply cut paths through the weeds to create pathways to open water.

Pros

Hand removal is a quick, inexpensive, and selective way to remove nuisance vegetation, and is an activity in which all lake residents could participate. The work involved in removing plants can provide a rewarding sense of accomplishment. By removing excess vegetation, use of beaches and piers would be improved. Wildlife habitat, such as fish spawning beds, could be greatly improved, benefiting other portions of the lake's ecosystem. Additionally, harvested plant material is often used as fertilizer and compost in gardens.

Cons

There are few negative attributes to hand removal. One negative implication is labor. Depending on the extent of infestation, removal of large amount, of vegetation can be quite tiresome. Another drawback can be disposal. Finding a site for numerous residents to dispose of large quantities of harvested vegetation can sometimes be problematic. An additional drawback is possible nonselective removal by hand harvesting. By throwing a rake blindly into the depths, it is impossible to determine what plants are removed and which ones are not until the rake is pulled up. Even in shallow depths, untrained persons might mistakenly remove desirable vegetation and/or disrupt valuable habitat (fish spawning beds).

Costs

Plant removal rakes can range in price from $50-150 and cutting tools commonly range in price from $50-200. Both are available from numerous catalogs and from the internet. A homemade rake would cost about $20-40.

Option 5: Reestablishing Native Aquatic Vegetation

Revegetation should only be done when existing nuisance vegetation, such as curly leaf pondweed, are under control using one of the above management options. If the lake has poor clarity due to excessive algal growth or turbidity, these problems must be addressed before a revegetation plan is undertaken. Without adequate light penetration,

revegetation will not work. At maximum, planting depth light levels must be greater than 1-5% of the surface light levels for plant growth and photosynthesis.

There are two methods by which reestablishment can be accomplished. The first is use of existing plant populations to revegetate other areas within the lake. Plants from one part of the lake are allowed to naturally expand into adjacent areas thereby filling the niche left by the nuisance plants. Another technique utilizing existing plants is to transplant vegetation from one area to another. The second method of reestablishment is to import native plants from an outside source. A variety of plants can be ordered from nurseries that specialize in native aquatic plants. These plants are available in several forms such as seeds, roots, and small plants. These two methods can be used in conjunction with one another in order to increase both quantity and biodiversity of plant populations. Additionally, plantings must be protected from herbivory by waterfowl and other wildlife. Simple cages made out of wooden or metal stakes and chicken wire are erected around planted areas for at least one season. The cages are removed once the plants are established and less vulnerable. If large-scale revegetation is needed it would be best to use a consultant to plan and conduct the restoration. Table 5 lists common, native plants that should be considered when developing a revegetation plan. Included in this list are aquatic shoreline vegetation (rushes, cattails, etc) and deeper water plants (pondweeds, *Vallisneria*, etc). Prices, planting depths, and planting densities are included and vary depending on plant species.

Pros

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

Cons

There are few negative impacts to revegetating a lake. One drawback is the possibility of new vegetation expanding to nuisance levels and needing control. However, this is an unlikely outcome. Another drawback could be high costs if extensive revegetation is needed using imported plants. If a consultant is used costs would be substantially higher. Additional costs could be associated with constructing proper herbivory protection measures.

Costs
Refer to Table 5 for costs

Objective II: Shoreline Erosion Control

Erosion is a potentially serious problem to lake shorelines and occurs as a result of wind, wave, or ice action or from overland rainwater runoff. While some erosion to shorelines is natural, human alteration of the environment can accelerate and exasperate the problem. Erosion not only results in loss of shoreline, but negatively influences the lake's overall water quality by contributing nutrients, sediment, and pollutants into the water. This effect is felt throughout the food chain since poor water quality negatively affects everything from microbial life to sight feeding fish and birds to people who want to use the lake for recreational purposes. The resulting increased amount of sediment will begin to fill in the lake, decreasing overall lake depth and volume, and potentially impairing various recreational uses.

Option 1: No Action

Pros
There are no short-term costs to this option. However, extended periods of erosion may result in substantially higher costs to repair the shoreline in the future.

Eroding banks on steep slopes can provide habitat for wildlife, particularly bird species (e.g. kingfishers and bank swallows) that need to burrow into exposed banks to nest. In addition, certain minerals and salts in the soils, utilized by various wildlife species, are exposed during the erosion process.

Cons
Taking no action will most likely cause erosion to continue and subsequently may cause poor water quality due to high levels of sediment or nutrients entering a lake. This in turn may retard plant growth and provide additional nutrients for algal growth. A continual loss of shoreline is both aesthetically unpleasing and may potentially reduce property values. Since a shoreline is easier to protect than it is to rehabilitate, it is in the interest of the property owner to address the erosion issue immediately.

Costs
In the short-term, cost of this option is zero. However, long-term implications can be severe since prolonged erosion problems may be more costly to repair than if the problems were addressed earlier. As mentioned previously, long-term erosion may cause serious damage to shoreline property and in some cases lower property values.

Option 2: Create a Buffer Strip

Another effective method of controlling shoreline erosion is to create a buffer strip with existing or native vegetation. Native plants have deeper root systems than turfgrass and thus hold soil more effectively. Native plants also provide positive aesthetics and good wildlife habitat. Cost of creating a buffer strip is quite variable, depending on the current state of the vegetation and shoreline and whether vegetation is allowed to become established naturally or if the area needs to be graded and replanted. Allowing vegetation to naturally propagate the shoreline would be the most cost effective, depending on the severity of erosion and the composition of the current vegetation. Non-native plants or noxious weedy species may be present and should be controlled or eliminated.

Stabilizing the shoreline with vegetation is most effective on slopes no less than 2:1 to 3:1, horizontal to vertical, or flatter. Usually a buffer strip of at least 25 feet is recommended, however, wider strips (50 or even 100 feet) are recommended on steeper slopes or areas with severe erosion problems. In areas where erosion is severe or where slopes are greater than 3:1, additional erosion control techniques may have to be incorporated, such as biologs, A-Jacks®, or rip-rap. This should not be necessary along Lake Fairfield.

Buffer strips can be constructed in a variety of ways with various plant species. Generally, buffer strip vegetation consists of native terrestrial (land) species and emergent (at the land and water interface) species. Terrestrial vegetation such as native grasses and wildflowers can be used to create a buffer strip along lake shorelines. Table 5 gives some examples, seeding rates and costs of grasses and seed mixes that can be used to create buffer strips. Native plants and seeds can be purchased at regional nurseries or from catalogs. When purchasing seed mixes, care should be taken that native plant seeds are used. Some commercial seed mixes contain non-native or weedy species or may contain annual wildflowers that will have to be reseeded every year. If purchasing plants from a nursery or if a licensed contractor is installing plants, inquire about any guarantees they may have on plant survival. Finally, new plants should be protected from herbivory (e.g., muskrats) by placing a wire cage over the plants for at least one year.

A technique that is sometimes implemented along shorelines is the use of willow posts, or live stakes, which are harvested cuttings from live willows (*Salix* spp.). They can be planted along the shoreline along with a cover crop or native seed mix. The willows will resprout and begin establishing a deep root structure that secures the soil.

Emergent vegetation, or those plants that grow in shallow water and wet areas, can be used to control erosion more naturally than seawalls or rip-rap. Native emergent vegetation can be either hand planted or allowed to become established on its own over time. Some plants, such as native cattails (*Typha* sp.), quickly spread and help stabilize shorelines, however they can be aggressive and may pose a problem later. Other species, such as those listed in Table 5 should be considered for native plantings. Buffer strips would be the most cost effective and lake-friendly treatment for shoreline erosion among Lake Fairfield homeowners and is highly recommended by the LCHD-Lake Management Unit.

Pros

Buffer strips can be one of the least expensive means to stabilize shorelines. If no permits or heavy equipment are needed (i.e. no significant earthmoving or filling is planned), the property owner can complete the work without the need of professional contractors. Once established (typically within 3 years), a buffer strip of native vegetation will require little maintenance and may actually reduce the overall maintenance of the property, since the buffer strip will not have to be continuously mowed, watered, or fertilized. Occasional high mowing (1-2 times per year) for specific plants or physically removing other weedy species may be needed.

The buffer strip will stabilize the soil with its deep root structure and 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.

Another benefit of a buffer strip is potential flood control protection. Buffer strips may slow the velocity of flood waters, thus preventing shoreline erosion. Native plants also can withstand fluctuating water levels more effectively than commercial turfgrass. Many plants can survive after being under water for several days, even weeks, while turfgrass is intolerant of wet conditions and usually dies after several days under water. This contributes to increased maintenance costs, since the turfgrass has to be either replanted or replaced with sod. 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 results in potential improvements in water quality.

Many fish and wildlife species prefer the native shoreline vegetation habitat. This habitat is an asset to the lake's fishery since the emergent vegetation cover may be used for spawning, foraging, and hiding. Various wildlife species are even dependent upon shoreline vegetation for their existence. Certain birds, such as marsh wrens (*Cistothorus palustris*) and endangered yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) nest exclusively in emergent vegetation like cattails and bulrushes. Hosts of other wildlife like waterfowl, rails, herons, mink, and frogs benefit from healthy stands of shoreline vegetation. Dragonflies, damselflies, and other beneficial invertebrates can be found thriving in vegetation along the shoreline as well. Two invertebrates of particular importance for lake management, the water-milfoil weevils (*Euhrychiopsis lecontei* and *Phytobius leucogaster*), which have been shown to naturally reduce stands of exotic Eurasian water-milfoil (*Myriophyllum spicatum*), need proper over wintering habitat such as leaf litter and mud which are typically found on naturalized shorelines or shores with good buffer strips. Many species of amphibians, birds, fish, mammals, reptiles, and invertebrates have suffered precipitous declines in

recent years primarily due to habitat loss. Buffer strips may help many of these species and preserve the important diversity of life in and around lakes.

In addition to the benefits of increased fish and wildlife use, a buffer strip planted with a variety of native plants may provide a season long show of various colors from flowers, leaves, seeds, and stems. This is not only aesthetically pleasing to people, but also benefits wildlife and the overall health of the lake's ecosystem.

Cons

There are few disadvantages to native shoreline vegetation. Certain species (i.e. cattails) can be aggressive and may need to be controlled occasionally. If stands of shoreline vegetation become dense enough, access and visibility to the lake may be compromised to some degree. However, small paths could be cleared to provide lake access or smaller plants could be planted in these areas.

Costs

If minimal amount of site preparation is needed, costs can be approximately $10 per linear foot, plus labor. Cost of installing willow posts is approximately $15-20 per linear foot. The labor that is needed can be completed by the property owner in most cases, although consultants can be used to provide technical advice where needed. This cost will be higher if the area needs to be graded. If grading is necessary, appropriate permits and surveys are needed. If filling is required, additional costs will be incurred if compensatory storage is needed. The permitting process is costly, running as high as $1,000-2,000 depending on the types of permits needed.

Option 3: Install Biolog, Fiber Roll, or Straw Blanket with Plantings

These products are long cylinders of compacted synthetic or natural fibers wrapped in mesh. The rolls are staked into shallow water. Once established, a buffer strip of native plants can be planted along side or on top of the roll (depending if rolls are made of synthetic or natural fibers). They are most effective in areas where plantings alone are not effective due to already severe erosion. In areas of severe erosion, other techniques may need to be employed or incorporated with these products.

Pros

Biologs, fiber rolls, and straw blankets provide erosion control that secures the shoreline in the short-term and allows native plants to establish to eventually provide long-term shoreline stabilization. They are most often made of bio-degradable materials, which break down by the time the natural vegetation becomes established (generally within 3 years). They provide additional strength to the shoreline, absorb wave energy, and effectively filter run-off from terrestrial sources. These factors help improve water quality in the lake by reducing the amount of nutrients available for algae growth and by reducing the sediment that flows into a lake.

Cons

These products may not be as effective on highly erodible shorelines or in areas with steep slopes, as wave action may be severe enough to displace or undercut these products. On steep shorelines grading may be necessary to obtain a 2:1 or 3:1 slope or additional erosion control products may be needed. If grading or filling is needed, the appropriate permits and surveys will have to be obtained.

Costs

Costs range from $25 to $35 per linear foot of shoreline, including plantings. This does not include the necessary permits and surveys, which may cost $1,000 – 2,000 depending on the type of earthmoving that is being done. Additional costs may be incurred if compensatory storage is needed.

Objective III: Wildlife Habitat Improvement

The key to increasing wildlife species in and around a lake can be summed up in one word: habitat. 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 *Objective IV: Eliminate or Control Exotic Species* (p. 27).

Option 1: No Action

This option means that the current land use activities will continue. No additional techniques will be implemented. 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 effects 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 5 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 outcompete 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 place 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 benefit wildlife by harboring food and providing cover for many 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. Water quality may be improved by the filtering of nutrients, sediment, and pollutants in run-off. 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.

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 does not include labor that would be needed to prepare the site for planting and follow-up maintenance. 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 5 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 is 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.

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 where 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 has 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. Purple martin houses can cost $50-150. Bat boxes range in price from $15-50. These prices do not include mounting poles or installation.

Objective IV: Eliminate or Control Exotic 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. 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*).

The 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.

<u>Option 1: No Action</u>
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 5 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 effected.

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: 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 beetles (*Galerucella pusilla* and *G. calmariensis*) and two weevils (*Hylobius transversovittatus* and *Nanophyes marmoratus*) have offered some hope to control purple loosestrife by natural means. These insects feed on either the leaves or juices of purple loosestrife, eventually weakening or killing the plant. In large stands of loosestrife, the beetles and weevils naturally reproduce and in many locations, significantly retard 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 (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 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 Department of Natural Resources at Cornell University (607-255-2821) sells overwintering adult beetles (which will lay eggs the year of release) for $2 per beetle and new generation beetles (which will lay eggs beginning the following year) at $0.25 per beetle. Some beetles may be available for free by contacting the Illinois Natural History Survey (217-333-6846).

Option 3: Control by Hand
Controlling exotic plants by hand removal is most effective on small areas (< 1 acre) and if done prior to heavy infestation. Some exotics, such as purple loosestrife and reed canary grass, can be controlled to some degree by digging, cutting, or mowing if done early and often during the year. Digging may be required to ensure the entire root mass is excavated. 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 4: Herbicide Treatment
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.

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

Glyphosate (Eagre™, Rodeo®) is commonly used to treat purple loosestrife at an application rate of 1 gallon/acre for a cost of $200-$220/gallon. Only a slight amount of purple loosestrife was observed on several properties around Lake Fairfield. One to two gallons, shared among homeowners, would be sufficient to treat around Lake Fairfield. Hand-held and backpack sprayers costs from $25-$45 and $80-150, respectively. Wicking devices are $30-40.

Objective V: Alleviate Excessive Numbers of Canada Geese (*Branta canadensis*)

Canada geese are migratory waterfowl common throughout North America. Geese in urban areas can be undesirable primarily due to the large amount of feces they leave behind. Recreational activities on lawns and parks are impeded due to goose feces. Large amounts of feces may end up in the water, either directly from geese on the water or rainwater runoff from lawns where feces have accumulated. Goose feces is high in organic phosphorus. High nutrient levels, particularly phosphorus, can contribute to excessive algae growth. This will inhibit other recreational activities such as boating or swimming, as well as create poor habitat for fish and wildlife, and possibly bad odors when the algae decays.

Geese become problematic for many reasons. They seek locations that have open water, adequate food supplies, and safety from predators. If these factors are present, geese may not migrate. Since geese exhibit a high level of site fidelity, they return to (or stay at) the same area each year. Thus, adults will likely come back to the same area year after year to nest. If conditions remain optimal, one pair of geese can quickly multiply, causing additional problems. Increased development in Lake County has inadvertently created ideal habitat for goose populations. Manicured lawns mowed to the edge of lakes and detention ponds provide geese with open areas with ample food and security. Other conditions that encourage goose residency include open water during winter (primarily the result of aerators in lakes and ponds), mild winters, and people feeding birds with bread or similar human food.

Large populations of geese pose a potential disease threat both to resident and wild populations of waterfowl. This problem may be more serious in residential populations since these birds stay in one area for long periods of time and are more likely to transmit disease to neighboring groups of geese. There is no threat of disease transmission to humans or domestic dogs and cats since most of the diseases are specific to birds.

Option 1: No Action

Pros

This option has no costs; however, increasing numbers of geese will most likely exasperate existing problems and probably create new ones, which in the future may cost more than if the problems are addressed immediately.

Cons

If current conditions continue and no action is taken, numbers of Canada geese and problems associated with them will likely increase. An increase of goose feces washed into a lake will increase the lake's nutrient load and eventually may have a detrimental impact on water quality through excessive algae growth. One study (Manny et al., 1975) documented that each goose excretes 0.072 lbs of feces per day. This may not seem like a significant amount, but if 100 geese are present (many lakes in the county can experience 1,000 or more at a time), that equates to over 7 lbs of feces per day! Algae blooms may negatively impact recreational uses such as swimming, boating, and fishing. In addition, when algae dies, odor problems and depleted oxygen levels in the water occur. Increased numbers of geese may also result in overgrazed areas of grass.

Costs

There are a few short-term financial costs associated with this option. Costs of cleaning feces off lawns or piers are probably more psychological or physical than financial. Long-term costs may be more indirect, including increased nutrient deposition into lakes which may promote excessive algae and plants. Costs incurred may include money needed to control algae with algaecides.

Option 2: Removal

Since Canada geese are considered migratory waterfowl, both state and federal laws restrict taking or harassing geese. Under the federal Migratory Bird Treaty Act, it is illegal to kill or capture geese outside a legal hunting season or to harass their nests without a permit. If removal of problematic geese is warranted or if nest and egg destruction is an option, permits need to be obtained from the Illinois Department of Natural Resources (217- 782-6384) and the U.S. Fish and Wildlife Service (217-241-6700).

Hunting is one of the most effective techniques used in goose management. However, since many municipalities have ordinances prohibiting the discharge of firearms, reduction of goose numbers by hunting in urban areas (i.e., lakes, ponds, and parks) may not be an option. Hunting does occur on many lakes in the county, but certain regulations apply (e.g., 100 yard minimum distance from any residential property). Contact the Illinois Department of Natural Resources for dates and regulations regarding the waterfowl hunting seasons. Also, contact local and county law enforcement agencies regarding any ordinances concerning hunting within municipal boundries.

Egg addling, or destroying the egg by shaking, piercing, or freezing, can be used to reduce or eliminate a successful clutch. Eggs should be returned to the nest so the hen goose does not re-lay another clutch. However, if no eggs hatch, she may still lay another clutch. Leaving one or two eggs unaltered and allowing them to hatch may prevent another clutch from being laid and reduces the year's total reproduction. Egg addling requires a state and federal permit.

The capture and relocation of geese is no longer a desirable option. First, relocated geese can return to the same location where they were captured. Second, there is a concern over potential disease transmission from relocated geese to other goose populations. Finally, since goose numbers in Illinois are already high there is no need to supplement other populations in the area.

Pros

Removing a significant portion of a problem goose population can have a positive effect on the overall health of a lake. Reduction of feces on lawns and parks is beneficial to recreation users of all types. Less feces in the water means less phosphorus available for nuisance plant and algae growth. Thus, the overall water quality of the lake may be improved by this reduction in phosphorus.

Cons

If the habitat conditions still exist, more geese will likely replace any that were removed. Thus, money and time used removing geese may not be well spent unless there is a change in habitat conditions.

Costs

A Illinois residential waterfowl hunting license (including state and federal waterfowl stamps) is $33.00 for the 2000-2001 hunting season. For depredation permits, there is a $25 fee for the federal permit. Once the federal permit is issued, the state permit can be obtained at no charge.

Option 3: Dispersal/Repellent Techniques

Several techniques and products are on the market that claim to disperse or deter geese from using an area. These techniques can be divided into two categories: harassment and chemical. With both types of techniques, it is important to implement any action early in the season, before geese establish territories and begin nesting. Once established, the dispersal/repellant techniques may be less effective and geese more difficult to coerce into leaving.

The goal with harassment techniques is to frighten geese from an area using sounds or objects. Various products are available that simulate natural predators (i.e., plastic hawks and owls) or otherwise make geese nervous (i.e., balloons, shiny tape, and flags). Other products emit noises, such as propane cannons, which can be set on a timer to go off at programmed intervals (e.g., every 20-30 seconds), or recorded goose distress calls which can be played back over a loudspeaker or tape player. Over time these techniques may be

ineffective, since geese become acclimated to these devices. Most of these products are more effective when used in combination with other techniques.

Another technique that has become popular is using dogs or swans to harass geese. Dogs can be used primarily in the spring and fall to keep birds from using an area by herding or chasing geese away from a particular area. Any dogs used for this purpose should be well trained and under the owners control at all times. Professional trainers can be contracted to use their dogs for this purpose. Dogs should not be used during the summer when geese are unable to fly due to molting. Swans are used because they are naturally aggressive in defending their territory, including chasing other waterfowl away from their nesting area. Since wild swans cannot be used for this technique, non-native mute swans are used. However, mute swans are not as aggressive and in some cases are permissive of geese. Again, using a combination of techniques would be most effective.

Chemical repellents can be used with some effectiveness. New products are continually coming out that claim to rid an area of nuisance geese. Several products (ReJeX-iT® and GooseChase™) are made from methyl-anthranilate, a natural occurring compound, and can be sprayed on areas where geese are feeding. The spray makes the grass distasteful and forces geese to move elsewhere to feed. Another product, Flight Control™, works similarly, but has the additional benefit of absorbing ultra violet light, making the grass appear as if it was not a food source. The sprays need to be reapplied every 14-30 days, depending upon weather conditions or mowing frequency.

Pros

With persistence, harassment and/or use of repellants can result in reduced or minimal usage of an area by geese. Fewer geese may mean less feces and cleaner yards and parks, which may increase recreational uses along shorelines. If large numbers of geese were once present, the reduction of fecal deposits into the lake may help minimize the amount of phosphorus entering the water. Less phosphorus in the water means less "food" available for plant and algae growth, which may have a positive effect of water quality. Finally, any areas overgrazed by geese may have a chance to recover.

Cons

The effectiveness of harassment techniques is reduced over time since geese will adapt to the devices. However, their effectiveness can be extended if the devices are moved to different locations periodically, or used in conjunction with other techniques.

Use of dogs can be time consuming, since the dog must be trained and taken care of. Dogs must also be used frequently in the beginning of the season to be effective at deterring geese. This requires time of the dog owner as well. Dogs (frequently herding dogs, like border collies) that are effective at harassing or herding geese are typically not for the average homeowner. They are bred as working dogs and consequently have high levels of energy that requires the owner's attention.

Repelling or chasing away geese from an area only solves the goose problem for that area and most likely moves the geese (and the problem) to another area. As long as there is suitable habitat nearby, the geese will not wander very far.

Costs

Costs for the propane cannons are approximately $660 ($360 for the cannon, $300 for a timer), not including the propane tank. The cost of ReJeX-iT® is $70/gallon, GooseChase™ is $92/gallon, and Flight Control™ costs $200/gallon. One gallon covers one acre of turf using ReJeX-iT® and, GooseChase™, and two acres using Flight Control™.

Option 4: Exclusion

Erecting a barrier to exclude geese is another option. In addition to a traditional wood or wire fence, an effective exclusion control is to suspend netting over the area where geese are unwanted. Geese are reluctant to fly or walk into the area. A similar deterrent that is often used is a single string or wire suspended a foot or so above the ground along the length of the shoreline.

Pros

Depending on the type of barrier used, areas of exclusion will have less fecal mess and may have higher recreational uses. Vegetation that was overgrazed by geese may also be able to recover.

Cons

This technique will not be very effective if the geese are using a large area. Also, use of the area by people is severely limited if netting is installed. Fences can also limit recreational uses. The single string or wire method may be effective at first, but geese often learn to go around, over, or under the string after a short period of time. Finally, excluding geese from one area will force them to another area on a different part of the same lake or another nearby lake. While this solves one property owners problem, it creates one (or makes one worse) for another. Also, problems associated with excess feces entering the lake (i.e., increased phosphorus levels) will continue.

Costs

The costs of these techniques are minimal, unless a wood or wire fence is constructed. String, wire, or netting can be purchased or made from materials at local stores.

Option 5: Habitat Alteration

One of the best methods to deter geese from using an area is through habitat alteration. Habitats that consist of mowed turfgrass to the edge of the shoreline are ideal for geese. Low vegetation near the water allows geese to feed and provides a wide view with which to see potential predators. In general, geese do not favor habitats with tall vegetation. To achieve this, create a buffer strip (approximately 10-20 feet wide) between the shoreline and any mowed lawn. Planting natural shoreline vegetation (i.e., bulrushes, cattails,

rushes, grasses, shrubs, and trees, etc.) or allowing the vegetation to establish naturally can create buffer strips. Table 5 has a list of native plants, seeding rates, and approximate costs that can be used when creating buffer strips.

Geese prefer ponds and lakes that have shorelines with gentle slopes to ones with steep slopes. While this alone will not prevent geese from using an area, steeper slopes used along with other techniques will be more effective. This option may not be practical for existing lake shorelines since any grading and/or filling would require permits and surveys, which would drive up the costs of redoing the shoreline considerably.

Aeration systems that run into the fall and winter prevent the lake from freezing, and do not force geese to migrate elsewhere. To alleviate this problem, turn aerators off during fall and early winter. Once the lake freezes over and the geese have left, wait a few weeks before turning the aerators on again if needed.

Pros

Altering the habitat in an area can not only make the habitat less desirable for geese, but may be more desirable for many other species of wildlife. See *Objective III: Wildlife Habitat Improvement*, (p. 22). A buffer strip has additional benefits by filtering run-off of nutrients, sediments, and pollutants and protecting the shoreline from erosion from wind, wave, or ice action. Finally, the more of the area that is in natural vegetation, the less turfgrass that needs to be constantly manicured and maintained.

Cons

Converting a portion or all of an area to tall grass or shrub habitat may reduce the lake access or visibility. However, if this occurs, a small path can be made to the lake or shorter plants may be used at the access location in the buffer strip.

Costs

If minimal amount of site preparation is needed to create a buffer strip, costs can be approximately $10 per linear foot, plus labor. The labor that is needed can be completed by the property owner in most cases, although consultants can be used to provide technical advice where needed. This cost will be higher if the area needs to be graded. If grading is necessary, appropriate permits and surveys are needed. If filling is required, additional costs will be incurred if compensatory storage is needed. Compensatory storage is the process of excavating in a portion of a property or floodplain to compensate for the filling in of another portion of the floodplain. The permitting process is costly, running as high as $1,000-2,000 depending on the types of permits needed.

Once established, a buffer strip of native plants needs little maintenance. If aerators are not run for several months, there will be a reduction in electrical costs.

Option 6: Do Not Feed Waterfowl!

There are few "good things", if any, that come from feeding waterfowl. Birds become dependent on handouts, become semi-domesticated, and do not migrate. This causes populations to increase and concentrate, which may create additional problems such as diseases within waterfowl populations. The nutritional value in many of the "foods" (i.e., white bread) given to geese and other waterfowl are quite low. Since geese are physiologically adapted to eat a variety of foods, they can actually be harmed by filling-up on human food. Geese that are accustomed to hand feeding may become aggressive toward other geese or even the people feeding the geese.

Costs

There are no costs to this option, except the public education that is needed to encourage people not to feed waterfowl. In some cases, signs could be posted to discourage waterfowl feeding.

References

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