2004 SUMMARY REPORT
of
OAK HILLS LAKE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Oak Hills Lake is located in the Village of Long Grove. The lake was created as a detention pond for several subdivisions that surround it. It has a surface area of 11.0 acres and mean and maximum depths of 1.65 feet and 3.3 feet, respectively. Oak Hills Lake is managed by the Long Grove Park District and is used by residents for aesthetics.

Water quality parameters, such as nutrients, suspended solids, oxygen, temperature and water clarity were measured and the plant community was assessed each month from May-September 2004. The average phosphorus concentration was over four times higher than the Lake County median and fluctuated with water levels. Total suspended solids (TSS) concentrations were also high, and were closely related to total phosphorus (TP) concentrations. The main source of TP and TSS to the lake appears to be internal, and is likely resuspended sediment from common carp activities. Additionally, Oak Hills Lake was nitrogen limited all summer, which left a high concentration of unused phosphorus in the water column. Secchi depths (water clarity) were very low throughout the summer, and corresponded with increases and decreases in TSS concentrations. The conductivity level in May was the highest of all the months, indicating that the road salt concentration in spring runoff was high. Conductivity levels decreased dramatically from May to June, but increased gradually from June through September and did not coincide with rainfall amounts. This indicates that the increase throughout the summer was the result of in-lake factors. Conductivity changes can occur seasonally and even with depth, but over the long term, increased conductivity levels can be an indicator of potential watershed or lake problems or an increase in pollutants entering the lake if the trend is noted over a period of years.

Almost no plants are present in Oak Hills Lake. Very small amounts of sago pondweed existed, but were very localized in one small bed in the same area of the lake all summer. A large carp population is likely maintaining the high turbidity that prevents plant growth, and results in easily resuspended sediment.

Although minimal erosion was occurring around Oak Hills Lake, buckthorn, purple loosestrife (dominant) and reed canary grass were present along 95% of the shoreline. These are exotic plant species that out-compete native vegetation and provide poor habitat for wildlife. A moderate number of waterfowl and bird species were observed during the summer, despite the dominance of exotic plant species. However, the treatment on exotic shoreline species will encourage more high quality wildlife to utilize Oak Hills Lake.

LAKE IDENTIFICATION AND LOCATION

Oak Hills Lake is located in theVillage of Long Grove, just north of IL Route 22 and east of IL Route 83. (T 43N, R 11E, S 17, 18). It has a surface area of 11.0 acres, mean and maximum depths of 1.65 feet and 3.3 feet, respectively, and an estimated volume of 18.2 acre-feet. The watershed of Oak Hills Lake encompasses approximately 77.6 acres, draining several residential areas surrounding it (Figure 1). The watershed to lake surface area ratio of less than 7:1 is small. This is positive in that it may help prevent serious water quality problems that often accompany a larger watershed to lake ratio. However, lakes with small ratios often experience more severe water level fluctuations throughout the summer as well as the accumulation of solids and nutrients because lake retention time (the time it takes all the water in the lake to be replaced) is high. It takes approximately one third of a year for all of the water volume of Oak Hills Lake to flush out of the lake and be replenished by new water. This can mean extended periods of poor water quality of water already in the lake even if there are improvements to new water entering the lake. Water level fluctuations during the summer 2004 were not large on Oak Hills Lake, but it is recommended that in the future, staff gauge readings be taken weekly or bi-weekly if possible. This will give lake managers a much better idea of lake level fluctuations relative to rainfall events and can aid in future decisions regarding lake level.

Based on the most recent land use survey of the Oak Hills Lake watershed, conducted in 2000, residential areas dominate the watershed, making up over half of the area (Figure 2). Other land uses that make up equal amounts (approximately 10%) of the watershed include Open Space, Transportation, Utilities and the lake itself (Table 1, Appendix A). The large amount of residential area that makes up the watershed can be good or bad, depending on the activities of homeowners that live around the lake. If homeowners are educated about how their daily activities affect the lake and take steps to prevent additional sediment and nutrients from entering the water, there could be some improvement in water quality over time. However, if residents go about their daily activities with no regard to how it may affect the lake, water quality could be degraded over time. Water exits Oak Hills Lake through a culvert in the small bay on the south end of the lake, flows across Half Day Rd. into Longview Meadow Lake before entering Killdeer Creek, Indian Creek and the Des Plaines River. The lake is located in the Indian Creek sub basin, within the Des Plaines River watershed.

BRIEF HISTORY OF OAK HILLS LAKE

Oak Hills Lake was created sometime between the early 1980's and 1993 as a detention pond for several subdivisions that surround it. It is managed by the Long Grove Park District. However, the District has limited funds and is currently focusing on Longview Meadow Lake management. The lake is mainly used for its aesthetics by shoreline homeowners. There is no formal lake management association at this time.

Figure 1

Figure 2

SUMMARY OF CURRENT AND HISTORICAL LAKE USES

There is no known history of Oak Hills Lake. According to aerial photographs, the lake did not exist in 1939 and the area consisted of a low spot in a farm field. By 1974, the low spot had wetland vegetation growing in and around it. The area around the lake still consisted of farm fields. By 1993, the low spot had been either dug out or dammed to create the lake that exists today and the current subdivisions had been built around the lake. The lake has only been used for aesthetics and ice-skating.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Oak Hills Lake were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected at the water surface from the deepest location in the lake (Figure 3). The surface waters of Oak Hills Lake were well oxygenated during the summer, with dissolved oxygen (DO) concentrations remaining well above 5.0 mg/L (a level below which some aquatic organisms become stressed) at all times during the study period.

Phosphorus (P) is a nutrient that can enter lakes through runoff or be released from lake sediment, and high levels of phosphorus typically trigger algal blooms or produce high plant density. The average surface total phosphorus (TP) concentration in Oak Hills Lake was 0.279 mg/L, over four times higher than most of the lakes in the county studied since 2000 (county median = 0.063 mg/L). TP concentrations remained relatively stable throughout the summer (Table 2, Appendix A). Since the watershed of Oak Hills Lake is small, it is likely that the dominant source of phosphorus to the water column is internal (lake sediment that has been stirred up by carp activity). As mentioned above, retention time is high and decreased water levels can cause nutrient and solids concentrations to become elevated as lake water volume decreases and variables become more concentrated. Lake level decreased by nearly ½ foot throughout the summer. This decrease in lake volume may have caused an increase in TP, as nutrients continued to be released from bottom sediments, but were consolidated into a smaller volume of water.

Another reason for the high TP and soluble reactive phosphorus (SRP) in the water column was that the lake was nitrogen (N) limited throughout the summer. Nitrogen can come from a variety of external sources, but can also be taken from the atmosphere and “fixed”, (transformed from an atmospheric form to an organic form) by blue-green algae. This makes nitrogen input virtually impossible to control. Phosphorus input is typically easier to control, but the level of control largely depends on the phosphorus source. The concentration of phosphorus in the water column was likely dependent on the concentration of available nitrogen. As mentioned above, Oak Hills Lake is nitrogen limited, meaning that there was not enough N in the water column to sustain algal growth. If algae is not growing, it will not take up and utilize either N or P from the water. However, P continued to be released from the sediment, resulting in a build-up of

Figure 3

unused P in the water. Typically, in a nitrogen limited situation, blue green algae will thrive and increase in density because they can take nitrogen from the atmosphere and transform it into a usable form for growth. In Oak Hills Lake, no algal blooms were detected throughout the summer. This is likely the result of the extremely high amount of total suspended solids (see next paragraph) that prevented enough light penetration for algae to grow. As a result, high TP, SRP and TKN concentrations prevailed throughout the summer.

Total suspended solids (TSS) is a measure of the amount of suspended material, such as algae or sediment, in the water column. High TSS values are typically correlated with poor water clarity and can be detrimental to many aspects of the lake ecosystem such as the plant and fish communities. A large amount of material in the water column can inhibit successful predation by sight-feeding fish, such as bass and pike, or settle out and smother fish eggs. High turbidity caused by sediment or algae can shade out native aquatic plants, resulting in their reduction or disappearance from the littoral zone. This eliminates the benefits provided by plants, such as habitat for many fish species and stabilization of the lake bottom. The average epilimnetic TSS concentration (64.1 mg/L) in Oak Hills Lake was eight times higher than the county median (7.9 mg/L) and was highly correlated with TP (Figure 4). As mentioned above, this very high concentration of TSS was the reason that algal blooms did not occur in the lake during the summer. Typically, if high TSS concentrations are the result of resuspended sediment, TSS and total volatile solids (TVS) (a measure of organic solids such as algae) will not be correlated. This was the case in Oak Hills Lake. Additionally, 75% of TSS was made up of non-volatile suspended solids (NVSS) (a measure of non- organic solids, such as sediment and soil particles). This is a strong indication that the TSS in Oak Hills Lake is primarily composed of sediment.

As a result of extremely high TP and TSS concentrations, Secchi depth (water clarity) on Oak Hills Lake was much lower than the county median (3.08 feet) every month during the summer of 2004, and was never over one foot in depth (Figure 5) (Table 1, Appendix A). The combination of high TSS and low Secchi depth resulted in a near absence of aquatic plants in Oak Hills Lake. A diverse community of aquatic plants is beneficial to a lake in many ways, including stabilizing sediment to prevent resuspension, causing soil particles entering the lake through non-point runoff to settle out more quickly, competing with planktonic algae for resources and providing habitat and a food base for a healthy fish community. Without adequate plant coverage, there were likely more sediment particles in the water column during the summer. As a result, Secchi depth and light levels in the lake were very low, and plants were unable to thrive, which then resulted in more resuspension of sediment into the water column, and the cycle continued.

Conductivity is the measure of different chemical ions in solution. As the concentration of these ions increases, conductivity increases. The conductivity of a lake is dependent on the lake and watershed geology, the size of the watershed flowing into the lake, the land uses within that watershed, and evaporation and bacterial activity. Conductivity has been shown to be highly correlated (in urban areas) with chloride ions found in road salt mixtures. Water bodies most subject to the impacts of road salts are streams, wetlands or

Figure 4

Figure 5

lakes draining major roadways. Average 2004 conductivity in Oak Hills Lake (0.8314 mS/cm) was higher than the county median of 0.7652 mS/cm. Conductivity was highest in May, decreased dramatically from May to June, and then increased gradually from June through September. That the highest levels were observed in May, during the greatest amount of rainfall, is an indication that road salt in runoff makes up a major component of the dissolved ions in the lake early in the summer. The gradual increase throughout the rest of the summer after the decrease in conductivity from May to June indicates that other factors are contributing to the conductivity levels in the lake after the initial pulse of road salt in the spring. Other sources of chemical ions could include materials leached from soil, a change in land use within the watershed, algal treatments of copper sulfate, groundwater sources or bacterial activity in the lake.

Conductivity changes can occur seasonally and with depth, but over the long term, increased conductivity can be a good indicator of potential watershed or lake problem or an increase in pollutants entering the lake if the trend is noted over a period of years. High conductivity levels (which often indicate an increase in sodium or potassium chloride) can eventually change the plant community, as more salt tolerant plants take over. Sodium, potassium and chloride ions can bind substances in the sediment, preventing their uptake by plants and reducing native plant densities. Additionally, juvenile aquatic organisms may be more susceptible to high chloride concentrations. Although the high conductivity levels are cause for concern, there may not be much that can be done about it. Non-point runoff, such as that which picks up road salt and enters the lake during rain events, is very difficult to control.

Typically, lakes are either phosphorus (P) or nitrogen (N) limited. This means that one of these nutrients is in short supply relative to the other and that any addition of phosphorus or nitrogen to the lake might result in an increase of plant or algal growth. Other resources necessary for plant and algae growth include light or carbon, but these are typically not limiting. 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. Oak Hills Lake had an average TN:TP ratio of 8:1, indicating nitrogen limitation (explained above). Because of the low water clarity found in Oak Hills Lake, blue-green algal blooms did not result. What this means, however, is that if water clarity were to improve, it is likely that dense blue green algal blooms would dominate the lake. So, it is a matter of having a lake dominated by brown water or green water.

Phosphorus concentrations can also be used to indicate the trophic state (productivity level) of a lake. The Trophic State Index (TSI) uses phosphorus, chlorophyll *a* (algae biomass) and Secchi depth to classify and compare lake trophic states using just one value. The TSI is set up so that an increase in phosphorus concentration is related to an increase in algal biomass and a corresponding decrease in Secchi depth. A moderate TSI value (TSI=40-49) indicates mesotrophic conditions, typically characterized by relatively low nutrient concentrations, low algal biomass, adequate DO concentrations and relatively good water clarity. High TSI values indicate eutrophic (TSI=50-69) to hypereutrophic (TSI ≥70) lake conditions, typically characterized by high nutrient concentrations, high algal biomass, low DO levels, a rough fish population, and low water clarity. Oak Hills Lake had an average phosphorus TSI (TSIp) value of 85, indicating hypereutrophic conditions and highly degraded water quality. When compared to other lakes in the county, Oak Hills Lake ranks 156th out of 161 lakes studied, with regard to total phosphorus concentration (Table 3, Appendix A).

Most of the water quality parameters just discussed can be used to analyze the water quality of Oak Hills Lake based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, Oak Hills Lake provides Partial support of aquatic life and Non-support of swimming and recreation because of its low Secchi depth and high levels of sediment in the water column. The lake has Non-support of overall use.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant surveys were conducted every month for the duration of the study (See Appendix B for methodology). Shoreline plants of interest were also recorded. However, no quantitative surveys were made of these shoreline plant species and these data are purely observational (Table 4). Sago pondweed (*Potamogeton pectinatus*) was the only submersed plant observed, but was extremely sparse and found in only one location. During the study, light level was measured at one-foot intervals from the water surface to the lake bottom. When the light intensity falls below 1% of the level at the water surface, plants are no longer able to grow. Using this information, it can be determined how much of the lake has the potential to support aquatic plant growth. Although water clarity was not high, based on 1% light level, Oak Hills Lake could have supported plants in 100% of the lake area all months except June. The inability of aquatic plants to grow in all areas as determined by percent light level may be explained by the presence of inadequate substrate in parts of the lake, although based on the current data, it is not possible to know the definite reason.

Of the 20 emergent plant and trees species observed along the shoreline of Oak Hills Lake, six (reed canary grass, purple loosestrife, honeysuckle, lamb’s quarter, Canada thistle and buckthorn) are invasive species that do not provide ideal wildlife habitat and out compete native, more beneficial species.

FQI (Floristic Quality Index) is a rapid assessment tool designed to evaluate the closeness of the flora of an area to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term floristic trends, and 4) monitor habitat restoration efforts (Nichols, 1999). Each floating or submersed aquatic plant is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). An FQI is calculated by multiplying the average of these numbers by the square root of the number of plant species found in the lake. A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake. Non-native species were also included in the FQI calculations for Lake County lakes. The average FQI for 2000-2004 Lake County lakes is 14.3. Oak Hills Lake has an FQI of 5.0, which is far below the county average. The lake ranks 141st out of 150 lakes that we have studied since 2000.

Table 4. Aquatic and shoreline plants on Oak Hills Lake, May-September 2004.

Aquatic Plants	
Sago Pondweed	*Potamogeton pectinatus*
Shoreline Plants	
Swamp Milkweed	*Asclepias incarnata*
Common Milkweed	*Asclepias syriaca*
Deadly Nightshade	*Atropa belladonna*
Lamb's Quarters^	*Chenopodium album*
Canada Thistle^	*Cirsium arvense*
Spikerush species	*Eleocharis* sp.
Joe-Pye Weed	*Eupatorium maculatum*
Jewelweed	*Impatiens pallida*
Purple Loosestrife^	*Lythrum salicaria*
Reed Canary Grass^	*Phalaris arundinacea*
Canada Bluegrass	*Poa compressa*
Green Bulrush	*Scirupus atrovirens*
Softstem Bulrush	*Scirpus validus*
Narrow-Leaved Cattail	*Typha angustifolia*
Common Cattail	*Typha latifolia*
Wild Grape	*Vitis* sp.
Trees/Shrubs	
Honeysuckle^	*Lonicera* sp.
Common Buckthorn^	*Rhamnus cathartica*
Staghorn Sumac	*Rhus typhina*
Willow	*Salix* sp.

^Exotic species

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at Oak Hills Lake in June 2004. The shoreline was assessed for a variety of criteria (See Appendix B for methods), and based on these assessments, several important generalizations could be made. Approximately 91% of Oak Hills Lake's shoreline is developed (meaning that a residential building exists on the parcel of land adjacent to the lake). However, the majority of the developed shoreline is comprised of wetland buffer (64.7%) and buffer (15.4%) (Figure 6). The remainder consists of beach (5.3%), lawn (4.4%) and rip rap (1.0%). Because most of the "developed" shoreline consists of natural vegetation, no erosion was occurring on Oak Hills Lake. Efforts should be made to maintain the shoreline in this natural condition. However, some changes to the shoreline should be made as invasive plant species, including reed canary grass, purple loosestrife, Canada thistle and buckthorn were present along 95% of the shoreline. Purple loosestrife, which was the most abundant of all the exotic plants was found primarily along wetland areas. All of these plants are extremely invasive and exclude native plants from the areas they inhabit. Buckthorn and honeysuckle provide very poor stabilization along buffered shorelines. Reed canary grass and purple loosestrife inhabit mostly wet areas and can easily outcompete native plants. Additionally, they do not provide the quality wildlife habitat or shoreline stabilization that native plants provide. Steps to eliminate these plants should be carried out as soon as possible, as their density has already become high.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See Appendix B for methodology). Although wildlife habitat in the form of wetland and buffer areas was quite abundant around Oak Hills Lake, a relatively small number of species of waterfowl and songbirds were observed (Table 6). It is important that the current wetland and buffer areas around the lake be maintained, and that additional buffered areas are encouraged to provide the appropriate habitat for a diversity of bird species into the future.

Figure 6

Table 5. Wildlife species observed at Oak Hills Lake, April-September 2004.

<u>Birds</u>	
Double crested Cormorant	*Phalacroxorax auritus*
Mute Swan	*Cygnus olor*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Great Egret	*Bubulcus ibis*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Belted Kingfisher	*Megaceryle alcyon*
Barn Swallow	*Hirundo rustica*
Blue Jay	*Cyanocitta cristata*
Ruby-crowned Kinglet	*Regulus calendula*
Catbird	*Dumetella carolinensis*
American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Yellow warbler	*Dendroica petechia*
Red-winged Blackbird	*Agelaius phoeniceus*
Starling	*Sturnus vulgaris*
Northern Cardinal	*Cardinalis cardinalis*
<u>Amphibians</u>	
Bull Frog	*Rana catesbeiana*
Green Frog	*Rana clamitans melanota*
<u>Reptiles</u>	
Painted Turtle	*Chrysemys picta*

EXISTING LAKE QUALITY PROBLEMS

- *Lack of Participation in the Volunteer Lake Monitoring Program (VLMP)*

  In 1981, the Illinois Volunteer Lake Monitoring Program (VLMP) was established by the Illinois Environmental Protection agency (Illinois EPA) to gather fundamental information on Illinois inland lakes, and to provide an educational program for citizens. Annually, 150-200 lakes (out of 3,041 lakes in Illinois) are sampled by approximately 250 citizen volunteers. The volunteers are primarily lake shore residents, lake owners/managers, members of environmental groups, public water supply personnel, and citizens with interest in a particular lake. The establishment of a VLMP on Oak Hills Lake would provide valuable historical data and enable lake managers to create baseline information and then track the improvement or decline of lake water quality over time.

- *Lack of Aquatic Vegetation*

  One key to a healthy lake is a healthy plant community. Oak Hills Lake had virtually no aquatic vegetation present in much of the lake. It is not known if substantial plant beds have ever existed in Oak Hills Lake, but high turbidity is currently preventing adequate growth of plants. A carp population is likely maintaining the high turbidity, which prevents plant growth and results in easily resuspended sediment.

- *Invasive Shoreline Plant 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. The outcome is a loss of plant and animal diversity. Reed canary grass and purple loosestrife are exotic plants found in wetland habitat. They spread very quickly and are not well utilized by wildlife. Buckthorn and honeysuckle are aggressive shrub species that grow along lake shorelines as well as most upland habitats. They shade out other plants and are quick to become established on disturbed soils. Six exotic shoreline plants species are present along the shoreline of Oak Hills Lake, and attempts should be made to control their spread.

POTENTIAL OBJECTIVES FOR THE OAK HILLS LAKE MANAGEMENT PLAN

I. Participate in the Volunteer Lake Monitoring Program
II. Eliminate or Control Invasive Species

OPTIONS FOR ACHIEVING THE LAKE MANEMENT PLAN OBJECTIVES

Objective I: Participate in the Volunteer Lake Monitoring Program

In 1981, the Illinois Volunteer Lake Monitoring Program (VLMP) was established by the Illinois Environmental Protection agency (Illinois EPA) to gather fundamental information on Illinois inland lakes, and to provide an educational program for citizens. Annually, 150-200 lakes (out of 3,041 lakes in Illinois) are sampled by approximately 250 citizen volunteers. The volunteers are primarily lake shore residents, lake owners/managers, members of environmental groups, public water supply personnel, and citizens with interest in a particular lake.

The VLMP relies on volunteers to gather a variety of information on their chosen lake. The primary measurement is Secchi disk transparency or Secchi depth. Analysis of the Secchi disk measurement provides an indication of the general water quality condition of the lake, as well as the amount of usable habitat available for fish and other aquatic life.

Microscopic plants and animals, water color, and suspended sediments are factors that interfere with light penetration through the water column and lessen the Secchi disk depth. As a rule, one to three times the Secchi depth is considered the lighted or photic zone of the lake. In this region of the lake there is enough light to allow plants to survive and produce oxygen. Water below the lighted zone can be expected to have little or no dissolved oxygen. Other observations such as water color, suspended algae and sediment, aquatic plants, and odor are also recorded. The sampling season is May through October with volunteer measurements taken twice a month. After volunteers have completed one year of the basic monitoring program, they are qualified to participate in the Expanded Monitoring Program. In the expanded program, selected volunteers are trained to collect water samples that are shipped to the Illinois EPA laboratory for analysis of total and volatile suspended solids, total phosphorus, nitrate-nitrite nitrogen and ammonia-nitrogen. Other parameters that are part of the expanded program include dissolved oxygen, temperature, and zebra mussel monitoring. Additionally, chlorophyll *a* monitoring has been added to the regiment of selected lakes. These water quality parameters are routinely measured by lake scientists to help determine the general health of the lake ecosystem.

For more information about the VLMP contact:

> VLMP Regional Coordinator:
> Holly Hudson
> Northeastern Illinois Planning Commission
> 222 S. Riverside Plaza, Suite 1800
> Chicago, IL 60606
> (312) 454-0400

Objective II: Eliminate or Control Invasive Species

Numerous exotic plant species have been introduced into our local ecosystems. Some of these plants are aggressive, quickly out-competing native vegetation and flourishing in an environment where few natural predators exist. Plants such as purple loosestrife (*Lythrum salicaria*), buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera* sp.) and reed canary grass (*Phalaris arundinacea*) are four examples. The outcome is a loss of plant and animal diversity. This section will address terrestrial shoreline exotic species.

Buckthorn and honeysuckle are aggressive shrub species that grow along lake shorelines as well as most upland habitats. They shade out other plants and are quick to become established on disturbed soils. Reed canary grass is an aggressive plant that if left unchecked will dominate an area, particularly a wetland or shoreline, in a short period of time. Since it begins growing early in the spring, it quickly out-competes native vegetation that begins growth later in the year. Control of purple loosestrife, buckthorn, and reed canary grass are discussed below. However, these control measures can be similarly applied to other exotic species such as garlic mustard (*Allilaria officianalis*) or honeysuckle (*Lonicera* spp.) as well as some aggressive native species, such as box elder (*Acer negundo*).

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

Option 1: No Action

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

> ***Pros***
>
> There are few advantages with this option. Some of the reasons exotics were brought into this country are no longer used or have limited use. However, in some cases having an exotic species growing along a shoreline may actually be preferable if the alternative plant is commercial turfgrass. Since turfgrass has shallow roots and is prone to erosion along shorelines, exotics like reed canary grass or common reed (*Phragmites australis*) will control erosion more

effectively. Native plants should take precedent over exotics when possible. Table 6, Appendix A lists several native plants that can be planted along shorelines.

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

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

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

Option 2: Biological Control

Biological control (bio-control) is a means of using natural relationships already in place to limit, stop, or reverse an exotic species' expansion. In most cases, insects that prey upon the exotic plants in its native ecosystem are imported. Since there is a danger of bringing another exotic species into the ecosystem, state and federal agencies require testing before any bio-control species are released or made available for purchase.

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

Pros

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

Cons

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

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

Costs

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

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 removed. Spring or summer is the best time to cut or mow before seed heads appear, 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. Due to the low density of exotic plants, this option is probably the most cost effective.

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 unless it is a monocrop of a specific plant species. 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

Two common herbicides, triclopyr (sold as Garlon ™) and glyphosate (sold as Rodeo®, Round-up™, Eagre™, or AquaPro™), are sold in 2.5 gallon jugs, and cost approximately $200 and $350, respectively. Only Rodeo® is approved for water use. A Hydrohatchet®, a hatchet that injects herbicide through the bark, is about $300.00. Another injecting device, E-Z Ject® is $450.00. Hand-held and backpack sprayers costs from $25-$45 and $80-150, respectively. Wicking devices are $30-40. A girdling tool costs about $150.