2001 SUMMARY REPORT
of
SLOCUM LAKE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Slocum Lake, located in unincorporated Wauconda Township, just south of Route 176, near the border of Lake and McHenry Counties, is a natural pothole slough of glacial origin. Slocum Lake is a shallow, oval shaped lake with a surface area of 225.4 acres and mean and maximum depths of 4.1 and 7.3 feet, respectively. The lake receives water via the Bangs Lake Drain which enters from the east, and water leaves the lake over a dam on the south shore, eventually emptying into the Fox River. The Wauconda Wastewater Treatment Plant, built in the early 1900's, discharged effluent into the Bangs Lake Drain for most of the century, often discharging raw sewage when flow exceeded the plant's maximum capacity. Many years of this effluent emptying into Slocum Lake continues to result in severely degraded water quality.

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 2001. The water column of Slocum Lake was mixed and oxygenated all summer. Phosphorus concentrations were four times as high as the County median. The source of phosphorus to Slocum Lake appears to be resuspended sediment as a result of carp activity and wind and wave action. The sediment of Slocum Lake is very rich in phosphorus from decades of treated and untreated sewage discharge. The shallow nature of the lake makes it susceptible to wind and wave action and the large European carp population, along with the lack of rooted aquatic plants gives rise to frequent sediment resuspension. The high levels of phosphorus resulted in dense, persistent blue-green algae blooms, high TSS concentrations and low Secchi depths throughout the summer. The Phosphorus Trophic State Index (TSIp) of Slocum Lake was 79.2, indicating hypereutrophic conditions and placing it 96th out of 102 on the ranking of Lake County lakes since 1988.

Aquatic plants in Slocum Lake were virtually absent. Of the plants present, Eurasian watermilfoil and coontail dominated, while small amounts of sago pondweed and curly leaf pondweed were also observed. Eurasian watermilfoil and coontail were able to become weakly established in the lake because their growth patterns allow them to float on the water surface, where they could compete with the dense planktonic algae for light.

Approximately 67% of Slocum Lake's shoreline is developed. However, since most of the shoreline (including developed shoreline) is dominated by buffer and wetland, virtually none of the shoreline along Slocum Lake was exhibiting erosion. This type of shoreline provides good wildlife habitat and, as a result, a large number of bird and waterfowl species were observed on the lake. Wetland, buffer and woodland shorelines should be maintained as much as possible, and the addition of manicured lawns, seawalls and rip rap should be discouraged. Buckthorn, purple loosestrife and reed canary grass were present along 70.9% of the shoreline of Slocum Lake and steps to eliminate these plants should be carried out before they completely take over these areas.

Recommendations and options for lake management techniques to address these problems are described in the report.

LAKE IDENTIFICATION AND LOCATION

Slocum Lake is located in unincorporated Wauconda Township, just south of Route 176, near the border of Lake and McHenry Counties (T 44N, R 9E, S 28). Slocum Lake is a relatively oval-shaped lake with a surface area of 225.4 acres and mean and maximum depths of 5.1 feet and 7.3 feet, respectively. It has a volume of 1141.98 acre-feet and a shoreline length of 3.5 miles. Slocum Lake receives water via the Bangs Lake Drain which enters from the east. Water exits the lake over a dam on the south shore and eventually empties into the Fox River.

BRIEF HISTORY OF SLOCUM LAKE

Slocum Lake is a natural pothole slough of glacial origin, which was dammed in the early 1900's. Because of its very shallow nature, Slocum Lake has probably always been relatively turbid. However, eutrophication of the lake was accelerated by years of discharge from the Wauconda Wastewater Treatment Plant (WTP). The treatment plant was built in the early part of the 20th century and discharged treated effluent into the Bangs Lake Drain, which empties into Slocum Lake. There have, historically, been many problems with discharge of raw sewage into the Bangs Lake Drain when flow exceeded the plant's maximum capacity. In 1986, the Bangs Lake Drain Bypass was built, and treated effluent was to be diverted into Fiddle Marsh and eventually enter the Slocum Lake Drain, downstream of the lake. From 1986-1996, the Wauconda WTP illegally bypassed the Bangs Lake Drain Bypass, continuing to discharge raw sewage into Slocum Lake. By 1997, the Illinois Environmental Protection Agency (IEPA) required the treatment plant to address the problems occurring. Since then, very little raw effluent has been discharged into the Bangs Lake Drain by the Wauconda WTP, and they must report any discharge event to the IEPA and the Lake County Health Department. Regardless of the improvements that have come about over the past decade, much of the damage to the lake has already been done.

Eighty of the 180 homes in the Williams Park subdivision, located on the southern shore of Slocum Lake, were built in the floodplain of the lake. As a result, the subdivision has been flood-prone for decades. Beginning in 1999, the Lake County Storm Water Management Commission (SMC) and the Federal Emergency Management Agency (FEMA) pooled grant funding to initiate a voluntary buyout of the flood-prone homes. Twenty-four homes were purchased and demolished during the initial $2 million phase from 1999-2000, and the demolition of 23 additional homes for $1,780,000 occurred in 2001. Under terms of the grant funding obtained for the project, vacant properties must remain deed-restricted as open space in order to alleviate some of the flood problems for the remaining properties.

In 1999, Slocum Lake was restored from an elevation of 734 feet to its original elevation of 735 feet. It was argued that the loss of water storage as a result of the elevation increase would create even more flood problems for Williams Park. However, after several years of observation, it has been determined that Williams Park would have flooded, regardless of the lake elevation, and that the lake has been able to successfully store incoming water without the water level breaching the shoreline.

The lake is owned by the Mylith Park Association, the Williams Park Improvement Association, the Water's Edge Homeowners Association and numerous private homeowners along the shore.

SUMMARY OF CURRENT AND HISTORICAL LAKE USES

Access to Slocum Lake is limited to members of the various Associations and private homeowners around the lake. The lake is used for fishing and boating. Currently, the biggest management concerns on Slocum Lake include incoming sediment and pollution and shoreline erosion.

On several occasions in 2001, water samples were collected from the Bangs Lake Drain, Williams Park and Mylith Park by a lake resident to test for the presence of high fecal coliform (FC) counts. Fecal coliform is found everywhere warm blooded animals are present, but is in very high numbers in the feces of animals and humans. FC, which includes *E. coli* bacteria, may indicate the presence of other pathogens such as *Giardia*, which can cause serious illness in humans. During the summer of 2001, fecal coliform counts greatly exceeded the safe swimming standard limit of 500 colonies FC/100 ml at least one time at each sampling location. This indicates that water at these locations can be highly contaminated with FC during rain events. There was also a concern that a horse farm on Beech Street was contributing large amounts of FC to the lake via a storm pipe that empties into the lake at Mylith Park. On October 24, 2001, LMU staff collected water samples from the pool of water entering the storm pipe adjacent to the horse farm and from the pipe discharging into the lake. The FC concentration adjacent to the horse farm was very high (900,000 colonies FC/100 ml) and the water running off of the horse farm is certainly contributing FC to the lake. However, the FC concentration in the water discharging into the lake (970,000 colonies FC/100 ml) was higher than the source concentration. If no other sources were contributing to the FC concentration in the water from the horse farm, the FC at the discharge pipe would have been much lower due to additional dilution between the horse farm and the lake. A higher FC concentration at the discharge pipe indicates that another source of FC is entering the storm pipe before the water empties into the lake. The additional water entering the storm pipe runs off the land surrounding houses in the Mylith Park Subdivision, and it is likely that either failing septic systems located on this land or illegal septic hookups to the storm sewer are contributing the additional FC to the water entering Slocum Lake via the Beech Street Drain. Residents of this subdivision can voluntarily check their septic systems by flushing a type of dye (which can be provided by the Health Department) through their systems. This dye will show up on the grass covering their leach field if the system is failing. The dye can also be used to determine if a septic system is illegally hooked up to the storm sewer, but it may be more difficult to convince the owner of this septic system to volunteer for this activity. If anyone suspects or has knowledge that a neighboring property may be experiencing a septic failure, this should be reported to our Wauconda satellite office at 847-526-1125.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Slocum Lake were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected at 3 foot and 5 foot depths from a location near the center of the lake (Figure 1). Slocum Lake did not thermally stratify in 2001. Thermal stratification occurs when a lake divides into an upper, warm water layer (epilimnion) and a lower, cold water layer (hypolimnion). When stratified, the epilimnetic and hypolimnetic waters do not mix, and the hypolimnion typically becomes anoxic (dissolved oxygen=0 mg/l) by mid-summer. This phenomenon is a natural occurrence in deep lakes and is not necessarily a bad thing if enough of the lake volume remains oxygenated. Slocum Lake is simply too shallow to stratify and remained well oxygenated from surface to the sediment throughout the summer. Average dissolved oxygen (DO) concentrations for the near surface and near bottom waters were well above 5.0 mg/l (concentration below which aquatic organisms become stressed). Because Slocum Lake did not stratify, most of the water quality parameters measured were very similar between "epilimnetic" and "hypolimnetic" samples. Therefore, only "epilimnetic" results will be mentioned, but will apply to the entire water column.

Phosphorus is a nutrient that can enter lakes through runoff or be released/resuspended from lake sediment, and high levels of phosphorus typically trigger algal blooms or produce high plant density. The average total phosphorus (TP) concentration in Slocum Lake was 0.182 mg/l (Table 1, Appendix A). This concentration was four times higher than most of the lakes studied in Lake County since 1995, and resulted in dense blue-green algae blooms throughout the summer. Once the Wauconda WTP discontinued effluent and raw sewage discharge into Bangs Lake Drain in 1997, external point sources ceased to be a major contributor of phosphorus to the lake, and may actually be diluting the phosphorus concentrations in Slocum Lake. The average epilimnetic TP concentrations in Bangs Lake in 1990, 1995, and 1997 were 0.028 mg/l, 0.021 mg/l and 0.026 mg/l, respectively. These concentrations are obviously much lower than those found in Slocum Lake and are twice as low as the County median concentration (0.047 mg/l), indicating that Bangs Lake is not the source of Slocum Lake's high TP concentrations.

The main source of phosphorus to the lake appears to be resuspended sediment as a result of carp activity and wind and wave action. The sediment of Slocum Lake is very rich in phosphorus from decades of treated and untreated sewage discharge to the lake by the Wauconda WTP. A fish survey conducted in 1995 found that European carp dominate the fish community of Slocum Lake. Carp are bottom-feeding fish that plow through the sediment with their snouts looking for invertebrates. Additionally, their spawning activity can become violent and typically occurs in shallow water. Through these two activities, carp stir up phosphorus-rich lake sediment, which can release phosphorus

bound to the sediment into the water column and creating very turbid conditions throughout the lake. The depth of Slocum Lake is very shallow relative to its surface area and the lake has a relatively long fetch (nearly one mile). Fetch is defined as the farthest distance across the water which wind blows unobstructed by land, and a long fetch across a shallow lake typically leads to high sediment resuspension. As wind blows across or waves move across Slocum Lake, sediment is pulled into the water column, where phosphorus may be released from the sediment particles and made available to algae and plants. The average phosphorus concentration has changed little since 1995 (the last study performed by the Lakes Management Unit-LMU), when average TP was 0.190 mg/l (Table 1, Appendix A).

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. A continuous blue-green algae bloom and sediment resuspension throughout the lake resulted in an average TSS concentration nearly seven times higher than the County median concentration (5.7 mg/l) (Table 1, Appendix A). TSS and TP concentrations were very closely related, supporting the hypothesis that resuspended sediment is the likely source of phosphorus to the water column (Figure 2). The 1995 TSS concentration (29 mg/l) was lower than the 2001 concentration, but was still well above most other lakes in the County.

The high TSS concentrations from algae blooms and resuspended sediment resulted in low water clarity throughout the summer of 2001, which was illustrated by lower than average Secchi depth measurements that coincided with high TSS concentrations (Figure 3). Secchi depth (water clarity) on Slocum Lake was very poor. It was much lower than the County average (5.12 feet) every month during the summer of 2001, and reached a minimum of 0.79 feet in August. Very low Secchi depths are the reason that more plants have not become established in Slocum Lake. Without light penetration, many native plants, which grow relatively low in the water column, cannot thrive. Since the benefits of an aquatic plant community (sediment stabilization, competition with algae for resources, habitat for fish) are not provided, sediment resuspension and algae problems are exacerbated. Unless Secchi depth can be increased, there is little chance that a healthy plant community will exist in Slocum Lake.

A volunteer lake monitoring program (VLMP) has been in place on Slocum Lake since 1996. This Illinois Environmental Protection Agency (IEPA) program, organized and run by the Northeastern Illinois Planning Commission (NIPC), involves the collection of data by a volunteer in the same place and along the same time scale each year. Although the amount of data collected is often limited, it can provide valuable historical information on water clarity and, therefore, water quality on many Lake County lakes. Average Secchi depth has remained relatively consistent each year since 1995 (Figure 4).

Due to the lack of any other data in 1996, the reason for the slight increase in Secchi depth that year is not known. Additional water quality data collected between 1995 and 2001 by the VLMP and the Lakes Management Unit are listed in Table 8, Appendix A.

Although ammonia nitrogen (NH_3-N) and nitrate nitrogen (NO_3-N) were below detection limits every month except May, the average Total Kjeldahl Nitrogen (TKN) concentration (2.26 mg/l) of Slocum Lake was double the County median (1.12 mg/l). This can be explained by understanding what each nitrogen form represents. NH_3-N and NO_3-N are inorganic forms of nitrogen. NH_3-N is usually found under anaerobic conditions (which did not occur in Slocum Lake), and any NO_3-N produced would have been immediately taken up by algae and would not have been detectable in water samples. TKN is a measure of organic nitrogen, which includes nitrogen taken up and stored in algae cells. An analysis of TKN concentrations would, therefore, have revealed this large amount of nitrogen present, but being utilized by the millions of algae cells living in Slocum Lake.

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. Slocum Lake had an average TN:TP ratio of 13:1. This indicates that the lake is neither phosphorus nor nitrogen limited and that both nutrients are already present in adequate amounts to produce algae blooms. Additional inputs of phosphorus or nitrogen to the lake would not likely have any observable impact in the form of more plants or algae until the inputs reached a very high level. This is common in nutrient-enriched lakes, where high phosphorus levels have reached the point where either very large increases or very large decreases in phosphorus would be necessary to trigger changes in algae density. On the other hand, less enriched lakes are often more sensitive to increases or decreases in phosphorus. As a result of relatively higher nitrogen concentrations in 1995 as compared to 2001, the average TN:TP ratio in 1995 was 16.5:1, but this is a slight change and could have been the result of many uncontrollable or unseen variables.

Phosphorus levels 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. High TSI values indicate eutrophic (TSI=50-69) to hypereutrophic (TSI $\geq$70) lake conditions, typically characterized by high nutrient concentrations, high algal biomass, low DO levels, a rough fish population, and low water clarity. Slocum Lake had an average phosphorus TSI

(TSIp) value of 79.2, indicating hypereutrophic conditions. This means that the lake is a highly enriched system with poor water quality. The lake ranked 96th out of 102 lakes in Lake County and had a much lower ranking than nearly all of the glacial lakes in the County (Table 2, Appendix A). This was mostly due to the discharge of treated and untreated wastewater from the Wauconda Wastewater Treatment Plant into the lake throughout most of the past century.

Most of the water quality parameters just discussed can be used to analyze the water quality of Slocum Lake based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, Slocum Lake provides *Full* support of aquatic life (which is measured by average trophic state, % plant coverage, and nonvolatile suspended solids (NVSS) concentrations) and *Nonsupport* of swimming (which is measured by average trophic state) and recreational activities (which is measured by average trophic state, % plant coverage and NVSS). The lake provides *Partial* 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. Light level was measured at one-foot intervals from the water surface to the lake bottom. When the light level falls below 1% of the level at the water surface, plants are no longer able to grow. Using this information, along with a bathymetric map and morphometric table (Appendix A), it was determined that approximately 33% of the lake was able to support aquatic plant growth based on light levels alone. Plants only grew across 23% of the surface area of the lake, and did not achieve coverage of the potential maximum surface area in 2001. The inability of aquatic plants to grow in all areas they could have, as determined by percent light level (1.5-3.5 feet), may be explained by the presence of inadequate substrate in various parts of the lake or disturbance by carp activity.

Eurasian watermilfoil (EWM) and coontail dominated the plant community in Slocum Lake during the summer of 2001, but were present in relatively small amounts (observed in less than 16% of all sampling sites) (Tables 3 & 4). Curly leaf pondweed and sago pondweed were also present in very small amounts (each was observed in less than 7% of the sampling sites). The reason for the higher density of EWM and coontail can be explained by the growth pattern of these two plants. Eurasian watermilfoil is an exotic plant species that begins growing very early in the season and grows to the water surface, forming a canopy. This enables it to begin growth before algae blooms become dense in the spring and to compete for light at the water surface when the algae becomes so dense that it shades out other plants lower in the water column. Coontail is a native plant that does not root, but can float on the water surface and obtains its nutrients from the water column. This plant's ability to float also enables it to compete for much needed light when algae blooms become too dense to allow plants to grow far below the water surface.

As a result of the high turbidity and dense algae blooms throughout the summer in Slocum Lake, few submerged native plants were able to become established and, unless water clarity can be increased, it is unlikely that the plant community will change from what is now observed.

Of the eight emergent plant and trees species observed along the shoreline of Slocum Lake, three (purple loosestrife, reed canary grass, and buckthorn) are invasive species that do not provide ideal wildlife habitat and have the potential to dominate the emergent plant community.

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 submerged 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 these 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 2000-2001 Lake County lakes is 14.0. Slocum Lake had an FQI of 5.0, well below the County average, as a result of its low plant density and diversity.

Table 3. Aquatic and shoreline plants on Slocum Lake, May-September 2001.

<u>*Aquatic Plants*</u>	
Coontail	*Ceratophyllum demersum*
American Elodea	*Elodea canadensis*
Eurasian Watermilfoil	*Myriophyllum spicatum*
Curlyleaf Pondweed	*Potamogeton crispus*
Sago Pondweed	*Stuckenia pectinatus*
<u>*Shoreline Plants*</u>	
Bur-Marigold	*Bidens laevis*
Blue Flag Iris	*Iris hexagona*
Purple Loosestrife	*Lythrum salicaria*
Reed Canary Grass	*Phalaris arundinacea*
Common Reed	*Phragmites australis*
Common Buckthorn	*Rhamnus cathartica*
Common Cattail	*Typha latifolia*
Swamp Smartweed	*Polygonum coccineum*

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at Slocum Lake on July 31, 2001. 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 66.7% of Slocum Lake's shoreline is developed. Most of this developed shoreline consists of buffer (44.4%) and wetland (24.6%). The rest of the developed shoreline is comprised of rip rap (14.5%), lawn (13.2%), seawall (2.7%), and beach (0.6%). The undeveloped portions of the lake are comprised of wetland (63%), woodland (4.2%) and prairie (1.3%) (Figure 5). Prairie, woodland and wetland are very desirable shoreline types, providing wildlife habitat and, typically, protecting the shore from excessive erosion. As a result of the dominance of wetland shoreline, 64.1% of Slocum Lake's shoreline exhibited no erosion at the current lake level. Moderate undercutting of the shoreline along Williams Park is known to be present, as represented in Figure 6, but it is below the water surface at the current lake level and is not visually apparent. Slight erosion was occurring on 7.0% of shoreline bordered entirely by manicured lawn. Moderate erosion was occurring on 29.0% of shoreline bordered primarily by narrow, poorly maintained buffer strips (Figure 6). Manicured lawns provide a less than ideal shoreline-water interface due to the poor root structure of turf grasses. These grasses are incapable of stabilizing shorelines and typically lead to erosion. Although woodland and/or buffer-dominated lots may seem to provide the ideal shoreline, if the slope is steep or if these lots are not maintained, erosion can occur. Deciduous trees present along these shorelines have very large roots that are unable to stabilize soil as well as native grasses and plants. If these trees become so large that they shade out all understory plants (whose roots provide the best stabilization) beneath them, the shoreline will become eroded. The erosion occurring along the woodland and buffered shore should be addressed, while efforts should be made to ensure that wetland dominated shorelines remain intact.

Dramatic water level fluctuation can increase shoreline erosion, especially if the fluctuations occur over short periods of time. The water level in Slocum Lake dropped no more than 0.3 feet between May and September. Erosion occurs when water levels drop and newly exposed soil, which may not support emergent plant growth, is subjected to wave action. Water level fluctuations were insignificant on Slocum Lake during the summer of 2001, resulting in little observed erosion around the lake.

Although a relatively small amount of erosion was occurring around Slocum Lake, invasive plant species, including reed canary grass, buckthorn and purple loosestrife were present along 70.9% of the shoreline. These plants are extremely invasive and exclude native plants from the areas they inhabit. Buckthorn provides very poor shoreline stabilization and may lead to increasing erosion problems in the future. Reed canary grass and purple loosestrife inhabit mostly wetland areas and can easily outcompete native plants. Additionally, they do not provide the quality wildlife habitat or shoreline stabilization that native plants provide. The relative densities of purple loosestrife and reed canary grass were high along the wetland areas of Slocum Lake and steps to eliminate these plants should be carried out before they take over these areas.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

During the 1960's and 1970's, winter and summer fish kills were almost a yearly occurrence in Slocum Lake and the Illinois Department of Natural Resources (IDNR) performed numerous fish surveys throughout those years. They always found that the lake was dominated by fish tolerant of low DO conditions, such as carp, green sunfish, bullheads and golden shiners. The most recent survey was in 1995. During 60 minutes of electrofishing and with an overnight set of one gill net, 265 fish were collected, comprising 14 species. Carp and yellow bass dominated the fish community, comprising 55.1% and 29.4% of the fishery, respectively. The rest of the fish community consisted of carpsucker (4.5%), channel catfish (3.4%), and a small number of bullheads, white sucker and sport fish species. Only one largemouth bass, one walleye, two northern pike and four bluegill were collected. From a fisheries management perspective, yellow bass are considered very undesirable due to their prolific nature and propensity to overpopulate, suppressing and impeding the development of sport fish populations. Yellow bass can also thrive relatively well in systems adversely altered by large carp populations. Both the yellow bass and carp populations appeared to be successfully reproducing and recruitment was high. Carp are also a very undesirable fish species because of their prolific nature and foraging activities. Carp are bottom feeders, plowing through the sediment with their snouts to feed on invertebrates and small fish. Through this feeding activity, they stir up bottom sediment, creating turbid water conditions. Their spawning activities can also contribute to turbid conditions, as they can become quite violent and often take place in very shallow water. The resultant low water clarity and lack of submersed aquatic vegetation prevents a healthy sport fish population from becoming established or reproducing successfully.

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See Appendix B for methodology). Because wildlife habitat in the form of wetland and woodland areas was relatively abundant around Slocum Lake, a large number of wildlife species were observed, predominantly in May (Table 5). A beaver was not actually observed by Lakes Management Staff, but was included in the species list because of the observation of a beaver lodge. Because of the large number of wildlife species observed, it is very important that the wetland, woodland and buffer areas around the lake be maintained to provide the appropriate habitat for birds and other animals that can be enjoyed by residents and other lake users for many years to come.

Additional wildlife observations were made from February 2002 through early April 2002 by a resident living on Slocum Lake. These observations were shared with the Lakes Management Unit and any additional wildlife not observed during the 2001 study are included as an appendix to Table 5 below.

Table 5. Wildlife species observed at Slocum Lake, May-September 2001.

Birds	
Double Crested Cormorant	*Phalacrocorax auritus*
Canada Goose	*Branta canadensis*
Mallards	*Anas platyrhnchos*
Wood Duck	*Aix sponsa*
Ring-billed Gull	*Larus delawarensis*
Great Egret	*Casmerodius albus*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Red-tailed Hawk	*Buteo jamaicensis*
Common Flicker	*Colaptes auratus*
Barn Swallow	*Hirundo rustica*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Marsh Wren	*Cistothorus palustris*
American Robin	*Turdus migratorius*
Red-winged Blackbird	*Agelaius phoeniceus*
American Goldfinch	*Carduelis tristis*
Mammals	
Beaver	*Castor canadens*
Muskrat	*Ondarta zibethicus*
Reptiles	
Painted Turtle	*Chrysemys picta*

Appendix to Table 5. Wildlife species observed at Slocum Lake, Feb.-April 2002.

Birds	
Horned Grebe	*Podiceps auritus*
Pied-billed Grebe+	*Podilymbus podiceps*
Mute Swan	*Cygnus olor*
Northern Shoveler	*Anas clypeata*
Bufflehead	*Bucephala albeola*
Common Merganser	*Mergus merganser*
Hooded Merganser	*Lophodytes cucullatus*
American Coot	*Fulica americana*
Sandhill Crane+	*Grus canadensis*

+Threatened in Illinois

EXISTING LAKE QUALITY PROBLEMS

- *High Nutrient Levels and Excessive Algae Blooms*

  Algae blooms were wide-spread and continuous in Slocum Lake throughout the summer. The blooms largely consisted of planktonic blue-green algae and were caused by high phosphorus levels. It was determined that phosphorus is probably originating from internal sources (resuspended sediment via European carp activities and wind and wave action). The occurrence of algal blooms and sediment resuspension over the course of the summer lead to very low water clarity, low light penetration, and extremely high TSS concentrations. Each of these factors prevented the establishment of native plant species, most of which grow low in the water column. As a result, the benefits provided by native plants, such as sediment stabilization and fish habitat, were not realized in Slocum Lake.

- *Carp*

  Common carp dominate the fish community in Slocum Lake. This fish species reproduces at a high rate and its spawning and feeding activities disturb bottom sediment. The presence of these fish in Slocum Lake is contributing to very high TSS and TP levels, as well as very low Secchi depths.

- *Poor Water Clarity*

  As a result of the dense algae blooms and turbid water conditions that occurred throughout the summer, water clarity was very low and limited the growth of aquatic plants. As mentioned before, high algae densities were the result of high nutrient levels entering the water column through the resuspension of bottom sediment. Poor water clarity reduces the aesthetics of recreational activities such as swimming and fishing. Swimming becomes unsafe and sport fish species decrease in size and number as it becomes more difficult to find prey in murky waters.

- *Lack of Aquatic Vegetation*

  One key to a healthy lake is a healthy aquatic plant community. Because of very low water clarity, Slocum Lake, a lake that should be covered with plants based on its depth and substrate type, has virtually no aquatic plants. The absence of plants, in turn, reduces the water clarity even further because sediment stabilization is not provided. Plants provide many benefits to a lake ecosystem, including stabilizing bottom sediment, providing habitat for fish, and competing with algae for resources. Without plants, Slocum Lake is algae-dominated, is very turbid and does not support a sport fish population. However, until water clarity can be increased, native plants will not become established in the lake.

- *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. 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. Purple loosestrife, buckthorn and reed canary grass (another exotic species) are present along 70.9% of the shoreline of Slocum Lake and attempts should be made to control their spread.

POTENTIAL OBJECTIVES FOR THE SLOCUM LAKE MANAGEMENT PLAN

I. Continue Participation in the Volunteer Lake Monitoring Program
II. Control Excessive Number of Carp
III. Eliminate or Control Invasive Species
IV. Deepen the Lake

Objective I: Continue Participation 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 euphotic 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.

Slocum Lake has participated in this program since 1996 and should continue to do so for as long as a volunteer is available.

Objective II: Control Excessive Number of Carp

A frequent problem that plagues many of the lakes in the County is the presence of common carp (*Cyprinus carpio*). Common carp were first introduced into the United States from Europe in the early 1870's, and were first introduced into Illinois river systems in 1885 to improve commercial fishing. The carp eventually made their way into many inland lakes and are now so wide spread that many people do not realize that they are not native to the U.S.

Carp prefer warm waters in lakes, streams, ponds, and sloughs that contain high levels of organic matter. This is indicative of many lakes in Lake County. Carp feed on insect larvae, crustaceans, mollusks, and even small fish by rooting through the sediment. Immature carp feed mainly on small crustaceans. Because their feeding habits cause a variety of water quality problems, carp are very undesirable in lakes. Rooting around for food causes resuspension of sediment and nutrients, which can both lead to increased turbidity. Additionally, spawning, which occurs near shore in shallow water, can occur from late April until June. The spawning activities of carp can be violent, further contributing to turbidity problems. Adult carp can lay between 100,000 –500,000 eggs, which hatch in 5-8 days. Initial growth is rapid with young growing 4 ¾" to 5" in the first year. Adults normally range in size from 1-10 lbs., with some as large as 60 lbs. Average carp lifespan is 7-10 years, but they may live up to 15 years.

There are several techniques to remove carp from a lake. However, rarely does any technique completely eradicate carp from a lake. Commonly, once a lake has carp, it has carp forever. However, it is up to the management entity to dictate how big the problem is allowed to become. Rotenone is the only reliable piscicide (fish poison) on the market at this time, but it kills all fish that is comes into contact with. Currently, there is a rotenone laced baiting system that can selectively remove carp. While the process is a step in the right direction, several factors still need to be worked out in order for it to be a viable alternative to the whole lake treatment. Until this baiting technique is further developed and produces consistent results, it is not being recommended by the LMU.

Option 1: No Action

By following a no action management approach, nothing would be done to control the carp population of the lake. Populations will continue to expand and reach epidemic proportions if they do not already exist.

Pros

There are very few positive aspects to following a no action plan for excessive carp populations. The only real advantage would be the money saved by taking no action.

Cons

There are many negative aspects to a no action management plan for carp management. The feeding habits of carp cause most of the associated problems. As carp feed they root around in the lake sediment. This causes resuspension of sediment and nutrients. Increased nutrient levels can lead to increased algal blooms, which, combined with resuspended sediment, lead to increased turbidity (reduced clarity). As a result there is a decrease in light penetration, negatively impacting aquatic plants. Additionally, the rooting action of the carp causes the direct disruption of aquatic plants. Loss of aquatic plants can further aggravate sediment and nutrient loads in the water column due to loss of sediment stabilization provided by the plants. Additionally, the fishery of the lake may decline and/or become stunted due to predation issues related to decreased water clarity and loss of habitat. Other wildlife, such as waterfowl, which commonly forage on aquatic plants and fish, would also be negatively impacted by the decrease in vegetation.

The loss of aquatic plants and an increase in algae will drastically impair recreational use of the lake. Swimming could be adversely affected due to the increased likelihood of algal blooms. Swimmers may become entangled in large mats of filamentous algae, and blooms of planktonic species, such as blue-green algae, can produce harmful toxins and noxious odors. Fishing would also be negatively affected due to the decreased health of the lake's fishery. The overall appearance of the lake would also suffer from an increase in unsightly algal blooms, having an unwanted effect on property values.

Costs

There is no cost associated with the no action option.

Option 2: Rotenone

Rotenone is a piscicide that is naturally derived from the stems and roots of several tropical plants. Rotenone is approved for use as a piscicide by the USEPA and has been used in the U.S. since the 1930's. It is biodegradable (breaks down into CO_2 and H_2O) and there is no bioaccumulation. Because rotenone kills fish by chemically inhibiting the use of oxygen in biochemical pathways, adult fish are much more susceptible than fish eggs (carp eggs are 50 times more resistant). Other aquatic organisms are less sensitive to rotenone. However, some organisms are effected enough to reduce populations for several months. In the aquatic environment, fish come into contact with the rotenone by a different method than other organisms. With fish, the rotenone comes into direct contact with the exposed respiratory surfaces (gills), which is the route of entry. In other organisms this type of contact is minimal. More sensitive nonfish species include frogs and mollusks but these organisms typically recover to pretreatment levels within a few months. Rotenone has low mammalian and avian toxicity. For example, if a human consumed fish treated with normal concentrations of rotenone, approximately 8,816 lbs. of fish would need to be eaten at one sitting in order to produce toxic effects. Furthermore, due to its unstable nature, it is unlikely that the rotenone would still be active at the time of consumption. Additionally, warm-blooded mammals have natural enzymes that would break down the toxin before it had any effects.

Rotenone is available in 5% and 2.5% concentrations. Both concentrations are available as synergized formulations. The synergist (piperonal butoxide) is an additive that inhibits fish detoxification of rotenone, making the rotenone more effective. Rotenone has varying levels of toxicity on different fish species. Some species of fish can detoxify rotenone quicker than it can build up in their systems. Unfortunately, concentrations to remove undesirable fish, such as carp, bullhead and green sunfish, are high enough to kill more desirable species such as bass, bluegill, crappie, walleye, and northern pike. Therefore, it is difficult to selectively remove undesirable fish while leaving desirable ones. Typically, rotenone is used at concentrations from 2 ppm (parts per million) – 12 ppm. For removal of undesirable fish (carp, bullhead and green sunfish) in lakes with alkalinities in the range found in Lake County, the target concentration should be 6 ppm. Sometimes concentrations will need to be increased based on high alkalinity and/or high turbidity. Rotenone is most effectively used when waters are cooling down (fall) not warming up (spring) and is most effective when water temperatures are $<50^{o}$F. Under these conditions, rotenone is not as toxic as in warmer waters but it breaks down slower and provides a longer exposure time. If treatments are done in warmer weather they should be done before spawn or after hatch as fish eggs are highly tolerant to rotenone.

Rotenone rarely kills every fish (normally 99-100% effective). Some fish can escape removal and rotenone retreatment needs to occur about every 10 years. At this point in time, carp populations will have become reestablished due to reintroduction and reproduction by fish that were not removed during previous treatment. To ensure the best results, precautions can be taken to assure a higher longevity. These precautions include banning live bait fishing (minnows bought from bait stores can contain carp) and making sure every part of the lake is treated (i.e., cattails, inlets, and harbored shallow areas). Restocking of desirable fish species may occur about 30-50 days after treatment when the rotenone concentrations have dropped to sub-lethal levels. Since it is best to treat in the fall, restocking may not be possible until the following spring. To use rotenone in a body of water over 6 acres a *Permit to Remove Undesirable Fish* must be obtained from the Illinois Department of Natural Resources (IDNR), Natural Heritage Division, Endangered and Threatened Species Program. Furthermore, only an IDNR fisheries biologist licensed to apply aquatic pesticides can apply rotenone in the state of Illinois as it is a restricted use pesticide.

Pros

Rotenone is one of the only ways to effectively remove undesirable fish species. This allows for rehabilitation of the lake's fishery, which will allow for improvement of the aquatic plant community, and overall water quality. By removing carp, sediment will be left largely undisturbed. This will allow aquatic plants to grow and help further stabilize the sediment. As a result of decreased carp activity and increased aquatic plant coverage, fewer nutrients will be resuspended, greatly reducing the likelihood of nuisance algae blooms and associated dissolved oxygen problems. Additionally, reestablishment of aquatic plants will have other positive effects on lake health and water quality, and will increase fish habitat and food source availability for wildlife such as waterfowl.

Cons

There are no negative impacts associated with removing excessive numbers of carp from a lake. However, in the process of removing carp with rotenone, other desirable fish species will also be removed. The fishery can be replenished with restocking and quality sport fishing normally returns within 2-3 years. Other aquatic organisms, such as mollusks, frogs, and invertebrates (insects, zooplankton, etc.), are also negatively impacted. However, this disruption is temporary and studies show that recovery occurs within a few months. Furthermore, the IDNR will not approve application of rotenone to waters known to contain threatened and endangered fish species. Another drawback to rotenone is the cost. Since the whole lake is treated and costs per gallon range from $50.00 - $75.00, total costs can quickly add up. This can be off-set with lake draw down to reduce treatment volume. Unfortunately, draw down is not an option on all lakes. An additional problem for Slocum Lake is the likely reinvasion of carp from the Bangs Lake Drain.

Costs

As with most intensive lake management techniques, a good bathymetric map is needed so that an accurate lake volume can be determined. To achieve a concentration of 6 ppm, which is the rate needed for most total rehabilitation projects (remove carp, bullhead and green sunfish), 2.022 gal/AF is required.

(Lake volume in Acre Feet)(2.022 gallons) = Gallons needed to treat lake
(1141.98 acre feet)(2.022 gallons) = 2309.1 gallons

(Gallons needed)(Cost/gallon*) = Total cost
(2309.1 gallons)($50-$75) = $115,455-$173,183

*Cost/gallon = $50-75 range

In waters with high turbidity and/or planktonic algae blooms, such as Slocum Lake, the ppm may have to be higher. An IDNR fisheries biologist will be able to determine if higher concentrations will be needed.

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

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

Option 1: No Action

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

Pros

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

Two common herbicides, triclopyr (sold as Garlon™) and glyphosate (sold as Rodeo® or Round-up™), cost approximately $100 and $65 per gallon, 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.

Objective IV: Deepen the Lake

Many of the problems occurring on Slocum Lake are the result of the shallow morphometry of the lake and the build-up of phosphorus-rich sediment. Sediment resuspension, high phosphorus concentrations and turbid water conditions could be reduced if the lake was deepened. Discharge from the Wauconda WTP throughout the 1900's was probably very high in total suspended solids and, most likely, resulted in high sediment deposition in Slocum Lake for many years. This probably decreased the lake depth over the years and increased the total phosphorus concentration in lake sediment by a substantial amount. With a current average depth of just over five feet, Slocum Lake is susceptible to wind and wave generated resuspension on a regular basis. The large number of carp in the lake also contribute to this resuspension through their feeding and spawning activities. Since much of the lake volume is exposed to the sediment, resuspension lead to high phosphorus concentrations and very low water clarity during the summer of 2001. If the lake was deepened, the surface water would be less influenced by sediment resuspension and water clarity would increase. This would allow for the establishment of several plant species. Additionally, deepening of the lake could result in the establishment of thermal stratification in the deepest areas, isolating phosphorus in the hypolimnion during the summer and preventing phosphorus from reaching the upper, sunlit waters where it can result in algae blooms. In order for Slocum Lake to reduce the threat of winter fishkill and establish and sustain a healthy, diverse fish community, at least 25% of the lake volume must be below a depth of 10 feet. At the lake's current elevation, this would involve removing approximately 140 acre-feet or 225,820 cubic yards of sediment. At a cost of $5-$15 per cubic yard, it would cost $1,130,000-$3,375,000 just to remove the sediment. Transport of the dredge material to the dewatering site and other additional costs could double those figures.