2003 SUMMARY REPORT
of
PULASKI POND

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Pulaski Pond, located in Waukegan Township, is a borrow pit created in 1976 for construction of the 14th Street overpass. It is currently owned and maintained by the Lake County Forest Preserve District. The lake has a surface area of 7.95 acres, a maximum depth of 21.0 feet and a mean depth of 10.5 feet. It is located entirely within Forest Preserve District property and is used by the public for fishing.

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 2003. Pulaski Pond was thermally stratified from May-September, but oxygen concentrations remained relatively high in the hypolimnion and peaked in August due to a metalimnetic algae bloom. Phosphorus levels were low throughout the summer, as were TSS concentrations. As a result, Secchi depth was high all summer and reached a maximum of 16.21 feet in June. Despite being surrounded by large roadways, conductivity levels in Pulaski Pond have remained low. This is likely due to the borrow pit origin of the lake. Pulaski Pond had a TSIp value of 45.9 and ranked 5th out of 130 lakes studied in Lake County since 1999.

Eurasian watermilfoil (EWM) dominated the plant community in 2003. Very small amounts of *Elodea*, small pondweed, sago pondweed, white water crowsfoot and *Chara* were also observed. The milfoil weevil was found in the pond in 2003 and had caused moderate damage to the EWM. Qualitative surveys suggest that weevil density may not be high enough to have a huge impact on the EWM at this time. However, because there are no other plant management techniques being employed in Pulaski Pond and because it is a relatively undisturbed system with a high amount of native shoreline, it is possible that in the future, the weevil population may increase to the point of severely reducing the EWM population.

The shoreline of Pulaski Pond is completely undeveloped and is dominated by buffer, shrub and low maintenance manicured lawn. Very little erosion was occurring around the pond, all of which was observed along shoreline composed of manicured lawn. Exotic species (buckthorn, purple loosestrife, reed canary grass, Queen Anne’s lace and white sweet clover) were present along 98.5% of the shoreline. These are exotic plant species that out-compete native vegetation and provide poor habitat for wildlife. A good mix of waterfowl, song bird and amphibian species were observed on and around the pond throughout the summer.

Lake Name: Pulaski Pond

State: IL

County: Lake

Nearest Municipality: Waukegan

Township/Range: T 45N, R 12E, S 31

Basin Name: Chicago River Watershed

Subbasin Name: Skokie River Watershed

Major Tributaries: Skokie River

Receiving Water Bodies: None

Surface Area: 7.95 acres

Shoreline Length: 0.59 miles

Maximum Depth: 21.0 feet

Mean Depth: 10.5 feet (estimated LCHD)

Storage Capacity: 83.48 acre-feet (estimated LCHD)

Lake Type: Borrow Pit

Pulaski Pond lies completely within Forest Preserve property and is solely owned by the Lake County Forest Preserve District. The pond is a borrow pit built for the 14th Street overpass in 1976. The Skokie River occasionally floods into Pulaski Pond, bringing goldfish and carp with it. As is true on nearly all Forest Preserve lakes, no boating (i.e., canoes, etc.) is permitted on Pulaski Pond and only bank fishing is allowed.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Pulaski Pond were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected at 3 foot and 15-16 foot depths from the deep hole location in the lake (Figure 1). Pulaski Pond was thermally stratified in the deepest area of the lake from May-September. 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 in nutrient-enriched lakes.
In nutrient poor lakes, oxygen concentrations may not be depleted in bottom waters because bacterial activity is not as high. Oxygen is typically depleted as a result of high respiration rates associated with the decomposition of organic matter by bacteria. Near surface dissolved oxygen (DO) concentrations remained above 5.0 mg/l (a level below which aquatic organisms become stressed) through the summer. Because Pulaski Pond is a nutrient poor lake, near-bottom DO concentrations also remained above 5.0 mg/l during May, June and August, and only became anoxic in July (Table 1, Appendix A). The high DO concentration at 16 feet in August (6.15 mg/l) is unusual and is indicative of a deep-water algae bloom. An elevation in other parameters (discussed below) at this same depth also supports the presence of an algae bloom just below the thermocline.

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 Pulaski Pond was 0.018 mg/l, dramatically lower than most of the lakes in the county studied since 1999 (county median = 0.059 mg/l). The average hypolimnetic TP concentration was 0.043 mg/l. This was also much lower than the hypolimnetic county median of 0.186 mg/l. The hypolimnetic concentration in Pulaski Pond was so much lower than most lakes in the county because the hypolimnion remained oxygenated throughout most of the summer. During stratification, TP concentrations typically increase dramatically in the hypolimnion due to chemical reactions that occur when oxygen is depleted. The hypolimnion of Pulaski Pond was hypoxic (DO< 1.0 mg/l) below 12 feet in July and below 16 feet in August and September. This likely encompassed very little of the total water volume and resulted in little phosphorus release from the sediment. As a result, TP concentrations near the sediment were not as high as they might have been in an anoxic environment. Additionally, the origin of Pulaski Pond as a borrow pit means that the sediment may contain a smaller amount of organic matter than other types of lakes and, therefore a smaller amount of phosphorus and nitrogen to be released. Although the average hypolimnetic TP concentration was very low, there was a high spike of phosphorus to the hypolimnion in August. This coincided with the spike in DO mentioned above and was the result of an algae bloom occurring at a depth of approximately 16 feet. Algae cells store phosphorus, which was detected in at a high level (0.106 mg/l) during analysis of the water sample.

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 (1.9 mg/l) in Pulaski Pond was almost four times less than the county median (7.5 mg/l). Typically, in eutrophic lakes, TP and TSS concentrations are correlated because high TP levels lead to an increase in planktonic algae, and TSS levels rise as a result of the algae bloom. Additionally, if high TSS concentrations result from planktonic algae, TSS and total volatile solids (TVS- a measure of organic solids such as algae) will be correlated as well. Neither of these relationships (TP vs. TSS and TVS vs. TSS) were very strong in Pulaski Pond. This may be because the pond is not eutrophic and these relationships are not as apparent in low-nutrient lakes. Or, the relationships may not have been apparent due to the very low concentrations of TSS in the epilimnion and hypolimnion. When TSS concentrations are at very low levels, it can often become difficult to detect relationships between TSS and other variables. As with DO and TP, an unusually high TSS concentration (11.0 mg/l) was detected in August at 16 feet (Figure 2). The high density of algae cells collected in the water sample was the cause of this spike.

Secchi depth (water clarity) in Pulaski Pond was high throughout the summer, reaching a maximum of 16.21 feet in June and a minimum of 7.15 feet in September. The average Secchi depth of Pulaski Pond (11.69 feet) was over three times as high as the county median (3.41 feet). Decreases in Secchi depth coincided with increases in TSS as the summer progressed (Figure 3). The metalimnetic algae bloom mentioned above was able to occur largely because Secchi depth was so high throughout the summer. Without adequate light penetration, the algae would not have been able to establish a population at a depth of 16 feet.

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 lakes draining major roadways. Average 2003 epilimnetic and hypolimnetic conductivities (0.4489 mS/cm and 0.5167 mS/cm, respectively) in Pulaski Pond were much lower than the county medians (0.7503 mS/cm and 0.7919 mS/cm, respectively) (Table 1, Appendix A). The average epilimnetic total dissolved solids (TDS) concentration, which has also been shown to be correlated with conductivity, was half the county average (451 mg/l) in Pulaski Pond (Table 1, Appendix A). These low conductivities and TDS concentrations are likely linked to the borrow pit origin of Pulaski Pond and it's small watershed.

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. Pulaski Pond had an average TN:TP ratio of 32.8. This indicates that the lake is phosphorus limited and that a small increase in the phosphorus concentration could result in heavier algae density in the future. In highly nutrient-enriched lakes, phosphorus levels have often 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, such as Pulaski Pond, are typically more sensitive to increases or decreases in phosphorus, and planktonic or filamentous algae could become a problem with relatively small increases in TP. Care should be taken to ensure that no unnecessary sources of P are created around the lake.

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 algae 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. Pulaski Pond had an average phosphorus TSI (TSIp) value of 45.9, indicating mesotrophic conditions. This classification is typical for borrow pits and flooded gravel pits in the county that do not have large stormwater inputs. Pulaski Pond ranks 5th out of 130 lakes studied in Lake County since 1999, and 6 of the top 10 lakes are either old gravel pits or borrow pits (Table 2, Appendix A).

Most of the water quality parameters just discussed can be used to analyze the water quality of Pulaski Pond based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, Pulaski Pond provides *Full* support of aquatic life and swimming, and *Partial* support of recreation due to the relatively high density of aquatic plants. The pond has *Full* 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 the shoreline plant species and these data are purely observational. In 2003, Eurasian watermilfoil (EWM) dominated the plant community. Small amounts of *Elodea*, sago pondweed, small pondweed, white water crowsfoot and *Chara* were also observed throughout the summer (Tables 3 & 4). During the study, light level was measured at two-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. Based on 1% light level, Pulaski Pond could have supported plants to a minimum of 16 feet throughout the summer. Because no bathymetric map exists for the lake, it is impossible to know what percentage of the surface area this encompasses. However, based on personal observations of lake bathymetry, it is probable that up to 95% of the lake area could have supported plant growth. Maximum plant depth in 2003 was found to be 12.5 feet and EWM was typically the plant growing in the deepest portions of the lake. EWM and *Elodea* grew to nuisance levels only in small areas on the south and north sides of the lake.

As mentioned above, EWM was the dominant plant in the lake in 2003, occurring at 83% of the plant sampling sites throughout the summer. The milfoil weevil (*Euhrychiopsis lecontei*) was first observed in the pond this year. This very tiny insect serves as a biological control for EWM, and when present in large enough numbers, can cause significant damage to milfoil beds. This summer, the weevil had caused moderate damage to the EWM in Pulaski Pond. Adult weevils were observed in May and June. The reasons for weevil success or failure in controlling EWM are still being researched and there are no definite answers at this time. Research has shown that approximately 1-2 weevils per stem are needed in order to see significant damage and decline of a EWM bed. Weevil density in Pulaski Pond has not been quantitatively analyzed, but qualitative surveys suggest that weevil density may not be at this level. However, because there are no other plant management techniques being employed in Pulaski Pond and because it is a relatively undisturbed system with a high amount of native shoreline, it is possible that in the future, the weevil population may increase to the point of severely reducing the EWM population.

Of the 16 emergent plant and trees species observed along the shoreline of Pulaski Pond, five (purple loosestrife, reed canary grass, queen anne's lace, white sweet clover and buckthorn) are invasive species that do not provide ideal wildlife habitat.

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 2000-2003 Lake County lakes is 14.4. Pulaski Pond has an FQI of 11.2, which is below the county average, but relatively high for a man-made lake.

Table 3. Aquatic and shoreline plants on Pulaski Pond, May-September 2003.

<u>*Aquatic Plants*</u>	
Chara	*Chara* sp.
Elodea	*Elodea canadensis*
Eurasian Watermilfoil^	*Myriophyllum spicatum*
Small Pondweed	*Potamogeton pusillus*
White Water Crowsfoot	*Ranunculus longirostris*
Sago Pondweed	*Potamogeton pectinatus*
<u>*Shoreline Plants*</u>	
Marsh Milkweed	*Asclepaias incarnuta*
Queen Anne's Lace^	*Daucus carota*
Water Spikerush	*Eleocharis elongata*
Purple Loosestrife^	*Lythrum salicaria*
White Sweet Clover^	*Melilotus alba*
Reed Canary Grass^	*Phalaris arundinacea*
Common Arrowhead	*Sagittaria latifolia*
Softstem Bulrush	*Scirpus validus*
Common Cattail	*Typha latifolia*
Wild Grape	*Vitis* sp.
<u>*Trees/Shrubs*</u>	
Silver Maple	*Acer saccharinum*
Redosier Dogwood	*Cornus sericea*
Ash	*Fraxinus* sp.
Cottonwood	*Populus deltoides*
Common Buckthorn^	*Rhamnus cathartica*
Sandbar Willow	*Salix interior*

^Exotic plant or tree species

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at Pulaski Pond on July 31, 2003. 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. One hundred percent of Pulaski Pond's shoreline is undeveloped. The majority of the shoreline is comprised of buffer (53.9%) and a nearly equal amount of shrub (22.4%) and lawn (23.7%) (Figure 4). Buffer and shrub are two of the most desirable shoreline types, providing wildlife habitat and, typically, protecting the shore from excessive erosion. As a result of the dominance of these two shoreline types around Pulaski Pond, 90.3% of the shoreline exhibited no erosion, and the erosion that was occurring was only slight (Figure 5). The type of shoreline exhibiting erosion was manicured lawn (41% of lawn shoreline). Manicured lawn is considered undesirable because it provides a poor shoreline-water interface due to the poor root structure of turf grasses. These grasses are incapable of stabilizing the shoreline and typically lead to erosion on most lakes.

Dramatic water level fluctuation can increase shoreline erosion, especially if the fluctuations occur over short periods of time. The water level in Pulaski Pond dropped no more than one quarter of a foot 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. The low water fluctuation in Pulaski Pond helped to reduce the likelihood of shoreline erosion, as evidenced by the relatively small amount of erosion around the lake.

Although very little erosion was occurring around Pulaski Pond, invasive plant species, including reed canary grass, buckthorn and purple loosestrife were present along 98.5% of the shoreline. This does not mean that every inch of 98.5% of the shoreline was covered with these plants. Rather, it indicates that one or more individual plants of these species were present along 98.5% of the shoreline parcels (Figure 6). 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 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 in order to preserve the quality of the pond and its surrounding shoreline.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Recent fish survey on Pulaski Pond, conducted by the Illinois Department of Natural Resources, date back to 1990. In 1990, 115 fish from 7 species were caught during 30 minutes of electrofishing. Bluegill dominated the fishery (59.1%), followed by largemouth bass, carp and black crappie. Also present were green sunfish, golden shiner and emerald shiner. The number of species had increased since the 1988 survey, suggesting that contamination/migration from the Skokie River continues during flooding. In 1993, Pulaski Pond was electrofished in an effort to salvage largemouth bass prior to a scheduled rotenone treatment due to the presence of carp and other undesirable species. Only three small bass were collected and no carp were observed. It was concluded that significant movement of the fishery into the Skokie River had occurred during extreme flooding in 1993, and the rotenone treatment was cancelled. Forty-one bass from the Countryside Golf Course Pond were stocked to facilitate reestablishment of the bass population and an additional 550 bass fingerlings were stocked in 1994. In 1996 a survey was conducted to determine the status of the fishery after the 1993 survey and management efforts. This survey revealed the return of carp and goldfish, as well as a white sucker. This indicates that the lake is vulnerable to relatively frequent periods of species contamination and that intensive effort to manage the sport fishery is considered futile. It was recommended that a "put and take" channel catfish program e established. In 1999, 64 fish from eight different species were collected. Largemouth bass dominated the sample, followed by blue gill and white and black crappie. Other fish species found were green sunfish, sunfish hybrid, channel catfish, and goldfish. The combination of fish species present was acceptable; however, their small size was cause for some concern. Fishing harvest is probably impacting the size distribution and IDNR recommendations include continuing annual stocking of catfish to provide predatory pressure, and limiting harvest of largemouth bass.

Fish stocking records dating back to 1985 indicate that bluegill were stocked in 1985, largemouth bass were stocked in 1985, 1993 and 2000, and 8"-9" channel catfish were stocked in 1991 and from 1994-2003 by the Illinois Department of Natural Resources (IDNR).

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See Appendix B for methodology). As a result of the high percentage of buffer and shrub areas around the Pulaski Pond, a good mix of wetland birds and waterfowl as well as several species of songbirds and amphibians were observed (Table 5). It is, therefore, very important that the shrub and buffer areas around the pond be maintained and that manicured lawn be converted to buffer in order to provide the appropriate habitat for birds and other animals that can be enjoyed by lake users for many years to come. Narrow mowed paths could be established in order for the LCFPD to continue to provide access to the lake to shoreline fishermen.

Table 5. Wildlife species observed at Pulaski Pond, May-September 2003.

Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Tree Swallow	*Iridoprocne bicolor*
Blue Jay	*Cyanocitta cristata*
Catbird	*Dumetella carolinensis*
American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quiscalus quiscula*
Northern Oriole	*Icterus galbula*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*
Song Sparrow	*Melospiza melodia*
Mammals	
Muskrat	*Ondatra zibethicus*
Insects	
Milfoil Weevil	*Euhrychiopsis lecontii*
Amphibians	
American Toad	*Bufo americanus*
Bull Frog	*Rana catesbeiana*
Western Chorus Frog	*Pseudacris triseriata triseriata*

EXISTING LAKE QUALITY PROBLEMS

Highpoints of the pond:

A. Low TP and TSS concentrations
B. High water clarity
C. Moderate plant density
D. Milfoil weevil present in the lake
E. Buffer areas dominate the shoreline
F. Little erosion present along shoreline

- *Lack of a Quality Bathymetric Map*

A bathymetric (depth contour) map is an essential tool in effective lake management, especially if the long term lake management plan includes intensive treatments, such as fish stocking, dredging, chemical application or aeration. Morphometric data, such as depth, surface area, volume, etc., obtained in the creation of a bathymetric map are necessary for calculation of equations for correct application of these types of techniques. Maps can be created by the Lake County Health Department – Lake Management Unit or other agencies for costs that vary from $3,000-$10,000, depending on lake size.

- *Exotic Aquatic Vegetation*

One key to a healthy lake is a healthy aquatic plant community. Although it has not reached nuisance levels, Eurasian watermilfoil (EWM) dominates the plant community in Pulaski Pond. The presence of the milfoil weevil (*Euhrychiopsis lecontei*) in Pulaski Pond may be keeping the EWM in check. However, the density of EWM should be monitored closely in order to determine if intervention is necessary to reduce the plant's density. At this time, no action is recommended regarding the removal of EWM from Pulaski Pond. As mentioned above, the plant has not reached nuisance levels. The Forest Preserve District may want to consider supplementing the existing weevil population with additional weevils. However, it may be worthwhile to wait and see if the population increases on its own before adding more. *E. lecontei*, a native weevil, is a biological control organism used to control EWM. It feeds exclusively on milfoil species. It was originally discovered while investigating declines of EWM in a Vermont lake in the early 1990's and was discovered in northeastern Illinois lakes by 1995.

Weevils are stocked in known quantities to achieve a density of 1-4 weevils per stem. As weevil populations expand, EWM populations may decline. After EWM declines, weevil populations decline and do not feed on any other aquatic plants. When EWM starts to grow again in the spring, the weevil populations respond by keeping the increasing milfoil under control before it becomes a problem. Once the weevil is established, EWM should no longer reach nuisance proportions and begins to become more sparse. Best results are achieved in lakes that have shallow EWM infestations in areas where it is undisturbed by recreational and management actives. Weevils need proper overwintering habitat such as leaf litter and mud, which are typically found on naturalized shorelines or shores with good buffer strips. Additionally, water temperatures need to be 68-70^{o}F for maximum weevil activity. For this reason, weevils are typically stocked in late spring/early summer. Currently only one company, EnviroScience Inc., has a stocking program (called the MiddFoil® process). The program includes evaluation of EWM densities, of current weevil populations (if any), stocking, monitoring, and restocking as needed. One prohibitive aspect to weevil use is price. Typically weevils are stocked to achieve a density of 1-4 weevils per stem. This translates to 500-3000 weevils per acre of EWM. At a cost of $1 per weevil plus labor, a EWM management program using weevils can be expensive. The cost of the weevils does not include the labor involved in initial surveys, stocking, and monitoring, which typically run an additionally $3,500-$4,500. Additionally, there is no guarantee that weevils will provide long term control or even produce any results at all. The weevils can be obtained from:

EnviroScience, Inc.
3781 Darrow Road
Stow, Ohio 44224
1(800) 940-4025

- *Invasive Shoreline Plant 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, its roots exude a chemical that discourages other plant growth, and it is quick to become established on disturbed soils. Reed canary grass is an aggressive plant species that was introduced as a shoreline stabilizer. It is found on lakeshores, stream banks, marshes and exposed moist ground. Although it does serve to stabilize shorelines to some extent, it has low food value and does not provide winter habitat for wildlife. It is very successful in taking over disturbed areas and, 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. Purple loosestrife, buckthorn and reed canary grass are present along the shoreline of Pulaski Pond. The presence of exotic species along a lakeshore is by no means a death sentence for the lake or other plant and animal life. If controlled, exotic species can perform many of the original functions that they were brought here for. 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.

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. The Lake County Forest Preserve District has taken steps to address the purple loosestrife problem in several areas of the county by introducing the bio-control beetle and may want to consider this action around Pulaski Pond. No costs were associated with purchase of the beetles for other projects, as the Forest Preserve District obtained the beetles from the Illinois Natural History Survey at no charge.

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 impractical (i.e., large expanses of a wetland or woodland), chemical treatments may not be an option because in order to chemically treat the area, a broadcast application would be needed. Because many of the herbicides are not selective, this may be unacceptable if native plants are found in the proposed treatment area. Herbicides are often used in conjunction with other methods, such as cutting or mowing, to achieve the best results.

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.