



Lloyd's Bayou Nuisance Plant Control Evaluation

Prepared for:

Lloyd's Bayou Lake Board
c/o Village of Spring Lake
102 W Savidge Street
Spring Lake, MI 49456

Prepared by:

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April 2019

Project No: 71880001

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Introduction

Lloyd's Bayou is located within the Village of Spring Lake and Spring Lake Township in Ottawa County, Michigan (T.8N; R.16W). Management activities on Lloyd's Bayou are coordinated by the Lloyd's Bayou Lake Board under provisions of Part 309, Inland Lake Improvements, of Michigan's Natural Resources and Environmental Protection Act, PA 451 of 1994. In 2018, the Lloyd's Bayou Lake Board retained Progressive AE to conduct a study of alternatives to control nuisance aquatic plant growth in Lloyd's Bayou. This report contains an overview of study findings, conclusions and recommendations.

Bayou Physical Characteristics

Lloyd's Bayou is a relatively small body of water that drains to the Grand River approximately 4 miles upstream of the Grand River's confluence with Lake Michigan. Early mapping of the area indicates that much of the land surrounding Lloyd's Bayou was once riverine wetland. Today, most of the bayou's shoreline is developed (Figure 1).

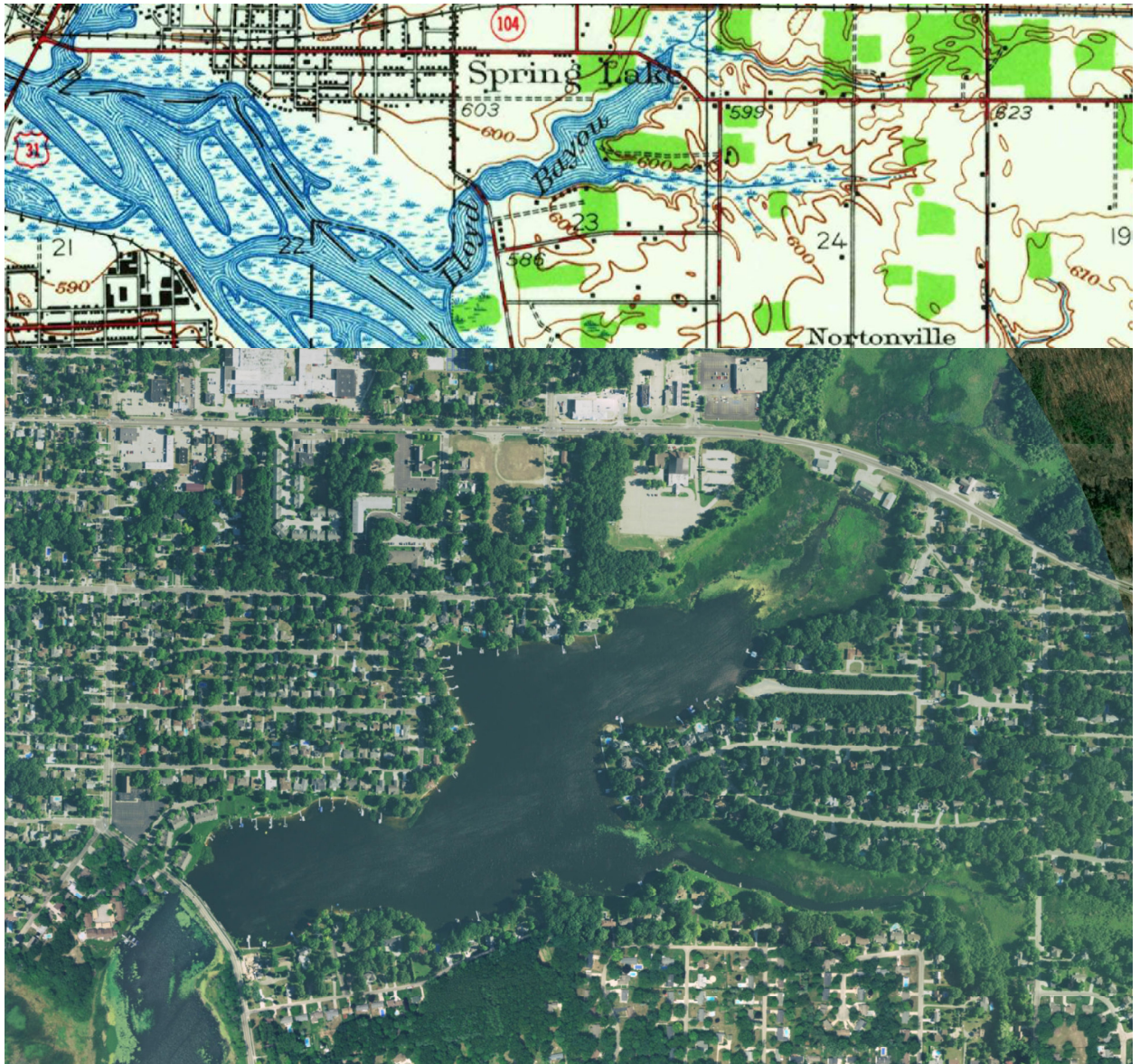


Figure 1. Lloyd's Bayou past (1930) and present (2016).

BAYOU PHYSICAL CHARACTERISTICS

The water level in Lloyd's Bayou fluctuates seasonally and year-to-year, generally mimicking the level of Lake Michigan. Lake level measurements collected by the U.S. Army Corps of Engineers indicate the difference in the level of Lake Michigan between the lowest levels in 1964 and the highest levels in 1986 is approximately 6 feet. Current water levels in Lake Michigan are again approaching historical high levels. Thus, water levels in Lloyd's Bayou are also higher than normal.

As part of the current study, a hydroacoustic survey of Lloyd's Bayou was conducted in October of 2018 to create an updated depth contour map (Figure 2). Currently, Lloyd's Bayou has a surface area of 106 acres (approximately 70 acres upstream of the Leonard Street bridge and 36 downstream of the bridge), a maximum depth of 18 feet and a mean or average depth of 6.7 feet. Much of the lower bayou is shallow, and submerged obstructions such as logs make navigation difficult. The bayou has a long, irregular shaped shoreline typical of other bayou areas along the lower stretches of the Grand River.

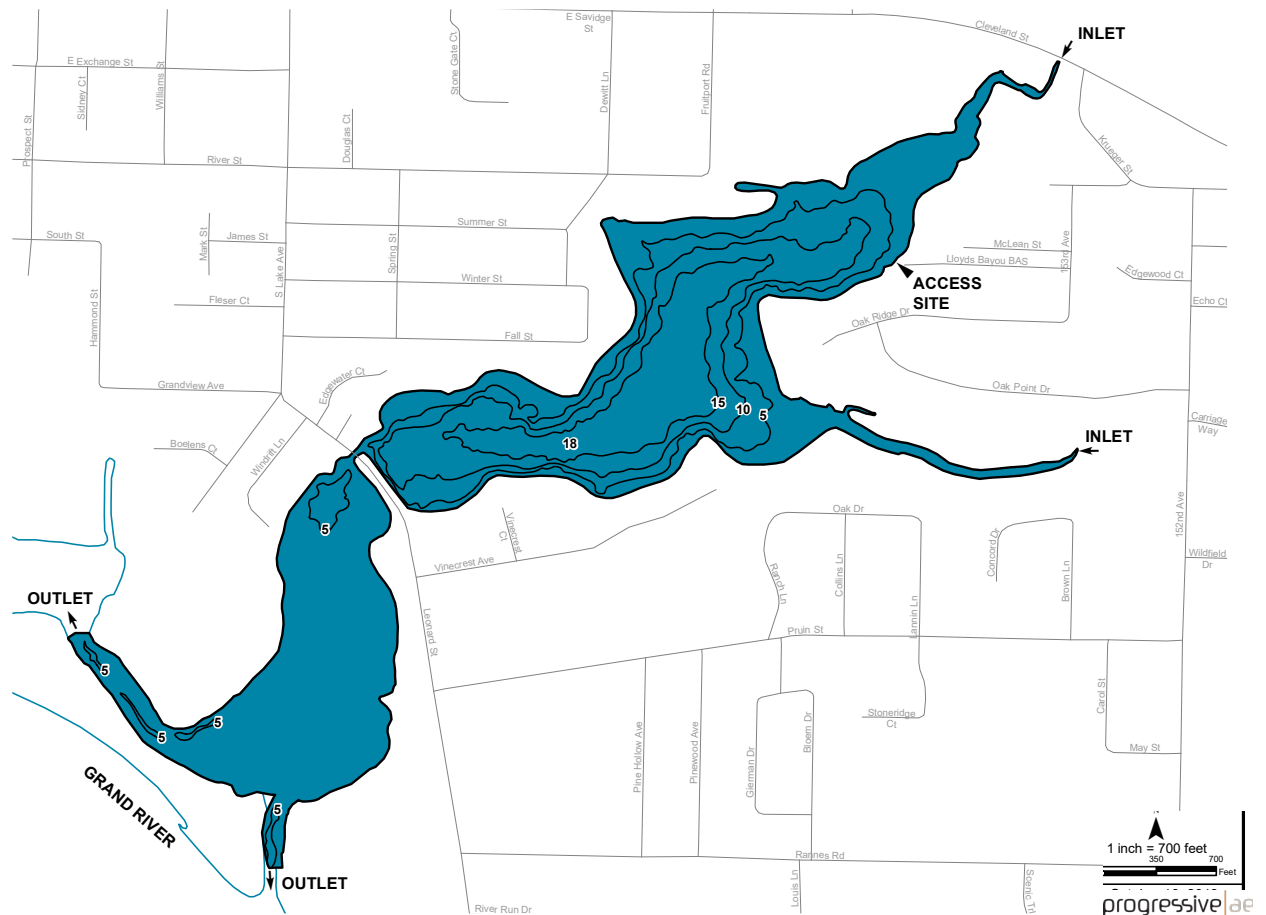


Figure 2. Lloyd's Bayou depth map.

In addition to water depths, the hydroacoustic survey included measurements of plant bio-volume (i.e., the height of plants in the water column) and sediment hardness. Vegetation was growing along most of shoreline in the upper bayou and throughout most of the lower bayou (Figure 3). Sediments throughout the bayou were generally soft and likely composed of organic mucks common in wetland areas (Figure 4). The shallow depths and rich organic sediments in Lloyd's Bayou naturally support abundant aquatic vegetation.

BAYOU PHYSICAL CHARACTERISTICS

Percent Bio-volume

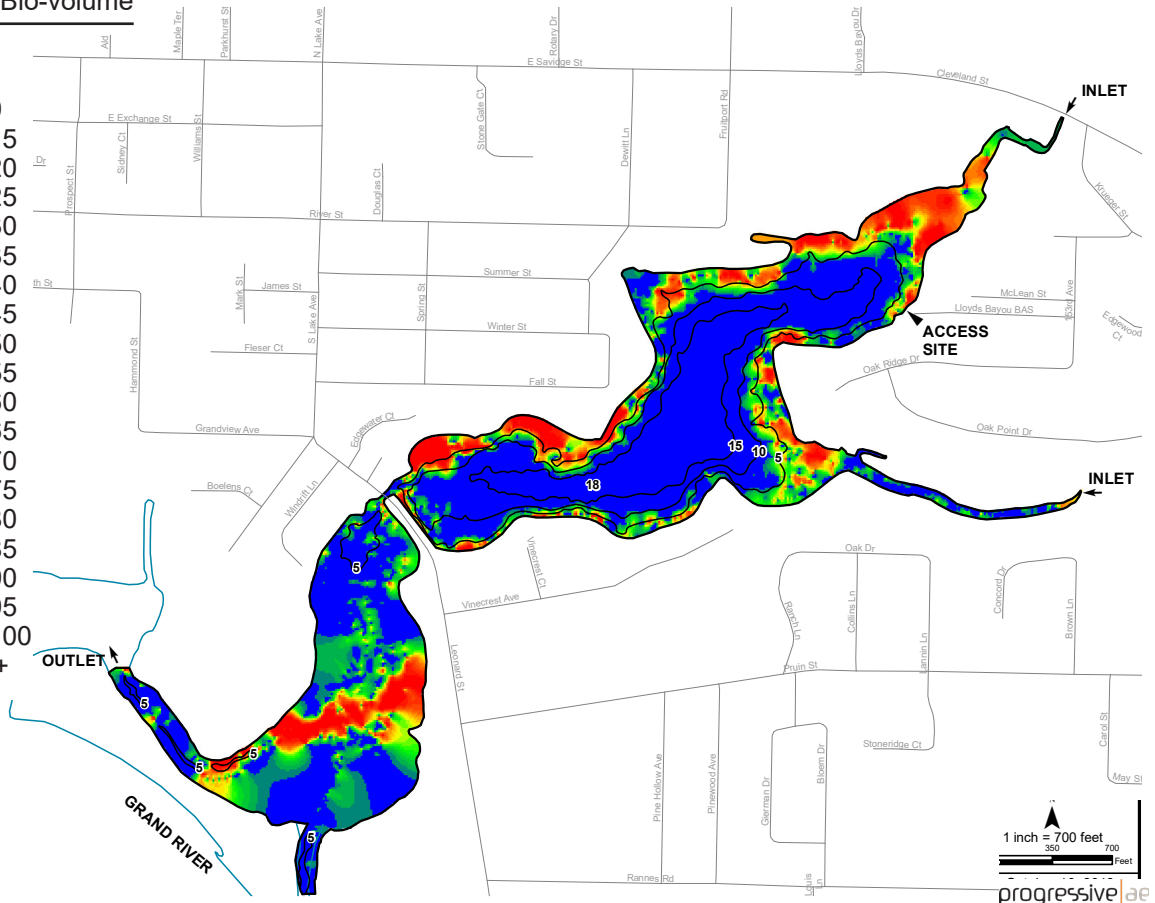
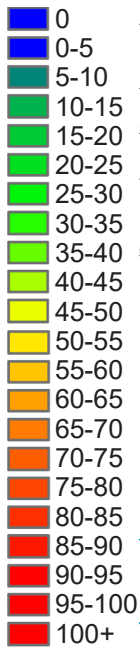


Figure 3. Lloyd's Bayou plant bio-volume map.

BAYOU PHYSICAL CHARACTERISTICS

Sediment Hardness



Figure 4. Lloyd's Bayou sediment hardness map.

Aquatic Plants

In evaluating aquatic plant growth and plant control alternatives, it is important to remember that aquatic plants are an important ecological component of lakes. They produce oxygen from photosynthesis, provide food and habitat for fish, and help stabilize shoreline and bottom sediments (Figure 5).

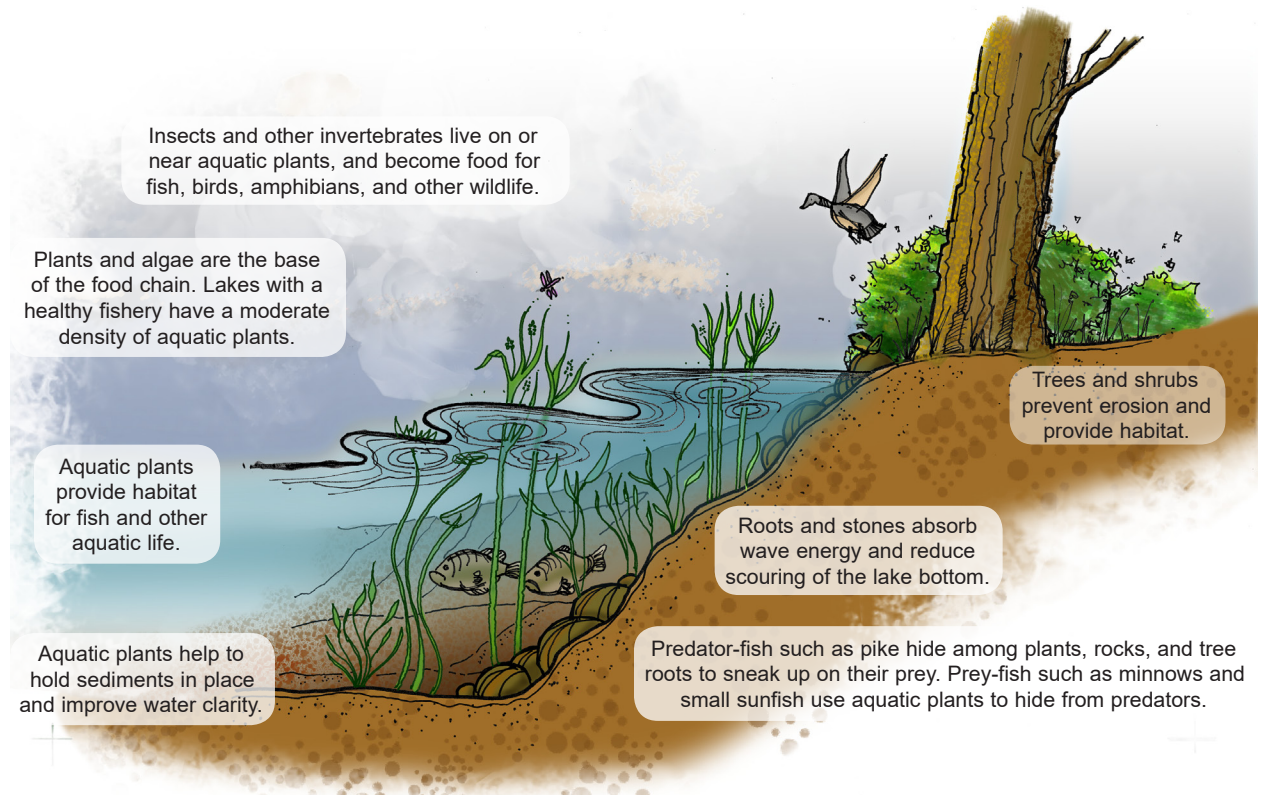


Figure 5. Benefits of aquatic plants.

The distribution and abundance of aquatic plants are dependent on several variables, including light penetration, bottom type, temperature, water levels, and the availability of plant nutrients. The term "aquatic plants" includes both the algae and the larger aquatic plants or macrophytes. The macrophytes can be categorized into four groups: emergent, floating-leaved, submersed, and free-floating (Figure 6). Each plant group provides unique habitat essential for a healthy fishery.

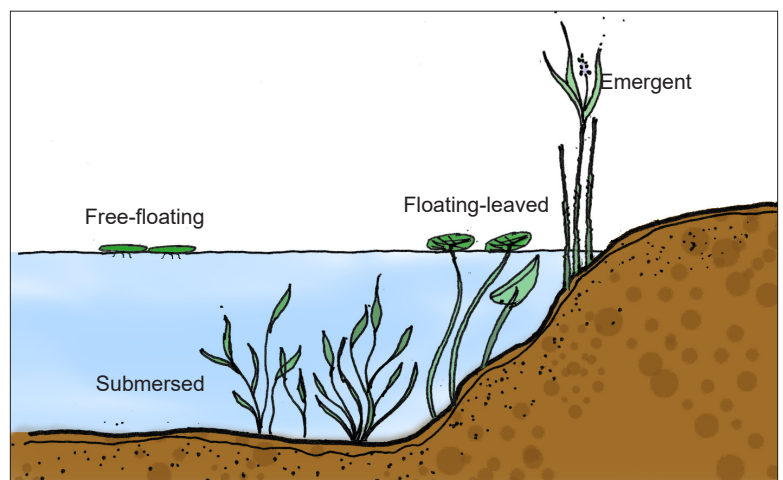


Figure 6. Aquatic plant groups.

AQUATIC PLANTS

However, while most aquatic plants are beneficial, exotic (i.e., non-native) plant species are a problem in many lakes. Exotic aquatic plants often have aggressive and invasive growth tendencies and, in some lakes, they quickly out-compete native plants and gain dominance. In Michigan lakes, exotic plants of primary concern include Eurasian milfoil (*Myriophyllum spicatum*, Figure 7) and starry stonewort (*Nitellopsis obtusa*, Figure 8).

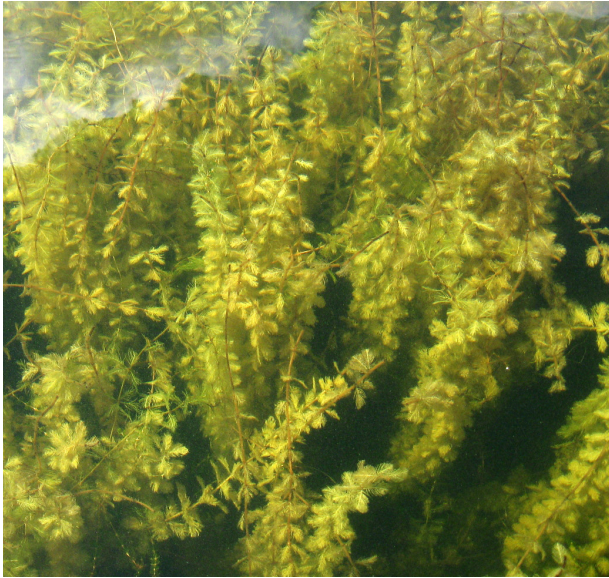


Figure 7. Eurasian milfoil (*Myriophyllum spicatum*).



Figure 8. Starry stonewort (*Nitellopsis obtusa*).

Eurasian milfoil generally becomes established early in the growing season and can grow at greater depths than most plants. Eurasian milfoil often forms a thick canopy at the lake surface that can degrade fish habitat and seriously hinder recreational activity. Once introduced into a lake system, Eurasian milfoil may out-compete and displace more desirable plants and become the dominant species.

Eurasian milfoil is not the only type of milfoil found in Michigan. There are several native milfoil species, such as northern milfoil (*Myriophyllum sibiricum*). Some native species closely resemble Eurasian milfoil and are commonly mistaken for it. However, the native milfoils rarely form dense, impenetrable plant beds like Eurasian milfoil often does. In some lakes, including nearby Spring Lake, hybridization between exotic Eurasian milfoil (*M. spicatum*) and native northern milfoil (*M. sibiricum*) is occurring. Genetic testing has found milfoil hybrids to be widely dispersed across the northern portion of the United States, and hybrid milfoil appears to be widespread in Michigan (Sturtevant et al. 2009, Moody and Les 2007). The presence of hybrid milfoil is important because hybridity in plants is often linked to invasive traits. In fact, hybrid milfoil may be more invasive than Eurasian milfoil (LaRue et al. 2012). There is concern in the scientific community that hybrids could have a competitive advantage over, and ultimately displace both northern milfoil and Eurasian milfoil (LaRue et al. 2012). Recent research indicates that hybrid milfoils may exhibit increased tolerance to some herbicides (LaRue et al. 2012, Thum et al. 2012).

Starry stonewort looks like a rooted plant, but it is actually an alga. It was first found in the Detroit River in the 1980's and has since infested hundreds of inland lakes (Midwest Invasive Species Information Network 2019, Schloesser et al. 1986). Starry stonewort closely resembles the native aquatic plant Chara. However, unlike Chara, which is generally considered to be a beneficial plant, starry stonewort tends to colonize deeper water and can form dense mats several feet thick. Starry stonewort can impede navigation, and quickly displace native plants. Fisheries biologists have expressed concern that starry stonewort may cover valuable fish habitat and spawning areas.

Aquatic Plant Control

The main goal of aquatic plant control in Lloyd's Bayou should be to control the spread of exotic and invasive plants, while maintaining a diversity of beneficial native plant species. Currently, the exotic plant Eurasian milfoil is present in Lloyd's Bayou and the lake experiences periodic algae blooms and nuisance growth of native plant species.

Alternatives for aquatic plant control include mechanical harvesting, diver-assisted suction harvesting, and the application of aquatic herbicides (Figures 9 through 11). Because Eurasian milfoil can spread by vegetative propagation, it is generally ill-advised to attempt control via mechanical harvesting. Diver-assisted suction harvesting can be effective on small infestations of a few acres or less, but on a larger scale this option is cost-prohibitive. A native aquatic insect called the milfoil weevil (*Euhrychiopsis lecontei*) has also been used in an effort to control Eurasian milfoil (Figure 12). However, these attempts have been largely unsuccessful, and milfoil weevils are no longer commercially available.



Figure 9. Mechanical harvester.



Figure 10. Diver-assisted suction harvesting.



Figure 11. Herbicide application.



Figure 12. Milfoil weevil.

AQUATIC PLANT CONTROL

The most common method of aquatic plant control is the application of aquatic herbicides. There are two types of herbicides: systemic and contact. Systemic herbicides are taken up by the plant and translocated to the roots, resulting in more complete control. Contact herbicides only impact the portions of the plant that come into contact with the herbicide. They also tend to be broad-spectrum and can kill desirable, non-target plants. Contact herbicides work relatively quickly while systemic herbicides generally take several weeks to kill the targeted plant. However, control with contact herbicides is often short-lived and some plants can re-grow within a few weeks. For Eurasian milfoil control, systemic herbicides are generally recommended in that they can kill milfoil with little or no impact to desirable native plants.

Copper sulfate and various chelated copper-based products are commonly used to control algae growth. Unlike most aquatic herbicides, copper is persistent in the aquatic environment. Copper deposits rapidly in the soil and does not remain in the water column (Johnson 2015). Although classified as practically non-toxic to moderately toxic, the Environmental Protection Agency (EPA) recommends only partial treatment of a water body and 10-14 days between treatments to reduce risk to aquatic life. Additionally, the EPA has imposed maximum annual rates for treatment (Johnson 2015).

In Michigan, aquatic herbicide use is regulated under Part 33, Aquatic Nuisance Control, of the Natural Resources and Environmental Protection Act, PA 451 of 1994. Prior to herbicide treatments, a permit must be acquired from the Michigan Department of Environmental Quality (MDEQ). MDEQ regulates which herbicides can be applied, dose rates, and areas of the lake where treatments are allowed. If herbicides are applied according to label instructions and permit requirements, they should pose no danger to public health or the environment. In general, herbicides should only be applied to the extent needed to control nuisance plant species. In fact, excessive treatment of aquatic plants, especially with contact herbicides, can cause a number of problems including algal blooms, dissolved oxygen depletion, and loss of valuable fish habitat.

Historically, herbicides have been used in Lloyd's Bayou as the primary means of aquatic plant control. In the future, consideration should be given to expanding the plant control program to include mechanical harvesting of aquatic vegetation (other than Eurasian milfoil). Much of the lower bayou is too shallow for a harvesting machine to operate, but harvesting would be effective in the upper bayou in water depths between about 3 to 10 feet.

Conclusions and Recommendations

Based on the information collected during the study, Lloyd's Bayou is a relatively small and shallow body of water that naturally supports abundant aquatic plant growth. Recent plant control measures have focused on the use of aquatic herbicides to control the spread of invasive exotic plants and nuisance algae growth. In addition to the herbicide treatment program, it is recommended that the Lloyd's Bayou Lake Board consider expanding the program to include mechanical harvesting. With this approach, aquatic herbicides would continue to be used to control nuisance algae growth and Eurasian milfoil (which has the potential to fragment and spread if harvested). Mechanical harvesting would be used to control the growth of nuisance vegetation in the bayou, upstream of the Leonard Street bridge. It is recommended that herbicide treatments for Eurasian milfoil control be conducted in May or June, and that mechanical harvesting be conducted in July or early August to maximize biomass removal. Treatment for algae control would be conducted on a periodic basis throughout the growing season. Given the propensity for copper-based products to accumulate in bayou sediments, it is recommended that algae treatments only be conducted when algae is growing at extreme nuisance levels. In accordance with the statute governing lake boards, competitive bids would need to be received for the harvesting work.

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