Weed and Algae Management Program at Coes Reservoir in Worcester, MA

NOI Filed: 2/14/18
Filed to: Worcester Conservation Commission
Expected Hearing Date: March 16, 2018 at 5:50 pm in the Levi Lincoln Chamber at Worcester City Hall (455 Main Street, Worcester, MA 01608)

Copies of the Notice of Intent may be examined at the Worcester Conservation Commission office located at Division of Planning & Regulatory Services, City Hall Room 404, 455 Main Street, Worcester, MA 01608 between the hours of 8:30 am and 5:00 pm, Monday-Friday.

Introduction

At about 90 acres, Coes Reservoir is the second largest lake fully inside of the City's boarders, located between the Columbus Park and Webster Square neighborhoods of Worcester. It is well used for recreational purposes, such as swimming, non-motorized boating, and fishing. Coes Reservoir was created when Tatnuck Brook was dammed in the mid 1800's in order to supply water power to the Coes Knife Factory. It is 16 feet deep at the deepest point, located in the southern portion. Coes Reservoir is boarded on the west side by Mill Street, a highly trafficked roadway.

Current Management

Coes Reservoir is on the 2014 Massachusetts Impaired Waters 303d list for having a Category 4c impairment for non-native plants. Native aquatic plants are vital parts of any lake ecosystem, providing food, shelter and oxygen to aquatic organisms. Their uptake of nutrients reduces the likelihood of algal blooms, and their root systems stabilize sediments. An invasive plant is a plant that is not native, or did not originally come from the area. These plants become nuisances because their natural constraints, such as predators or environmental limitations, do not exist in their new home, allowing them to multiply very quickly, usually to the exclusion of native plants. When aquatic plants become too numerous, they can reduce our ability to enjoy our lakes and ponds. Invasive aquatic plants can arrive by hitching rides on boats, pets, or boots to get from place to place. Some are released with good intentions as a beautiful addition to a landscape.

One plant, the water chestnut (*Trapa natans*), has long been a problem in the northern portion of the Reservoir. Over the past years, the City has funded the mechanical removal of these weeds periodically, and has recently dedicated itself to annual removal to prevent reseeding, and remove biomass from the lake to prevent anoxic conditions from occurring when the plants die off in the winter months. At the beginning of 2017, there were 1.8 acres of sparse density, 9.1 acres of dense patches, and 1.7 acres of dense water chestnut growth in the Reservoir. Of these, only 7 acres were removed due to time constraints. Eurasian milfoil (*Myriophyllum spicatum*) has become an increasing problem as well, affecting the shallow areas in and around the public beach, making it difficult to swim and boat in the area. On November 6, 2017, a lake management company performed a weed survey to map the location and density of the milfoil, and found the invasive to densely cover a total of 70 acres and sparsely cover a total of 20 acres. Starting in the fall of 2016, a 3-foot drawdown was implemented to manage these weeds. Drawdown efficacy that winter was hindered by the mild weather, which prevented the thorough freezing of the sediments and root systems. To see the most recent surveys and work reports on Coes Reservoir, see *Attachment D*.

In addition to aquatic weeds, water quality testing over the past year has suggested that Coes Reservoir is at risk for harmful algal blooms, which cause the closure of the waterbody in order to reduce the risk of human exposure to cyanotoxins, which can cause skin irritation, tumors, liver toxicity and death in pets. In order to prevent this possibility, the City of Worcester will be contracting the analysis of lake water for cyanobacteria density and character. One potential indicator of an eminent bloom is an elevated concentration of total phosphorus (TP), and reduced water clarity in the water column. The City of Worcester will be monitoring TP concentrations and water clarity as part of its regular Lakes and Ponds Water Quality Monitoring Program. Additionally, the City will contract the monitoring of the density of cyanobacteria present. If cyanobacteria or TP concentrations become too high, water treatment with aluminum sulfate or copper sulfate may be necessary to prevent a bloom.

Proposed Management

In order to preserve native ecology and maintain recreational value, the City of Worcester will contract activities to prevent the excessive growth of invasive weeds, algae and cyanobacteria. The following are a description of potential elements of the management plan.

Weed Management. In 2018, we hope to remove invasive aquatic vegetation via mechanical harvesting or the application of herbicides. Several options are presented below, all of which are approved by the United States Environmental Protection Agency and Massachusetts Department of Environmental Protection. Use of one method over the other depends primarily on the plant's life history, density of the infestation, and the current year's budget.

(1) *Drawdown*. Given the low cost and low negative impacts, the City will continue to perform the drawdown to control Eurasian milfoil (*Myriophyllum spicatum*) around the water's edge. In the best case scenario, the drawdown will help control the density of the plants that are exposed to the freezing temperatures. The drawdown is achieved when the low level outlet below the dam is opened. Drawdowns cost nothing to implement and pose little threat to a healthy lake ecosystem, if implemented correctly. They are a common technique outlined in "The Practical Guide to Lake Management in Massachusetts" (excerpts found in *Attachment C*). We perform the drawdown slowly over the course of several weeks to a week to ensure that lake fauna are able to retreat to deeper water. The drawdown at Coes Reservoir is three feet, the maximum permissible without further permitting.

(2) *Chemical treatment with diquat dibromide and/or fluridone.* In order to address the milfoil growth that will not be affected by the drawdown, chemical treatment with diquat (trade name: Reward) or fluridone (trade name: Sonar) is necessary and recommended by a local lake management company for Coes Reservoir (See *Attachment D*). The USEPA/DEP registered herbicide Reward® (Diquat dibromide) will be applied to the area at or below the permissible label dose for control of the submersed watermilfoil. Reward is a widely used herbicide, applied to >500 lakes and ponds annually, throughout the northeast, to control nuisance submersed aquatic plants. Reward would be applied to control nuisance growth at the application rate of 1 .0- 1 .5 gal/acre. Temporary water use restrictions for Reward are now (1) No drinking or cooking for 3 days, (2) No irrigation of turf/food crops for 5 days, and (3) No livestock watering for 1 day. The are no restrictions on swimming, boating or fishing, but prudent herbicide/algaecide management, suggest that we close the pond to swimming at least on the day of treatment. The entire shoreline of the treatment area would be posted with signs warning of these temporally water uses restrictions, prior to treatment.

Reward is translocated to some extent within the plant. Its rapid action tends to disrupt the leaf cuticle of plants and acts by interfering with photosynthesis. Upon contact with the soil, it is adsorbed immediately and thereby biologically inactivated. The concentration of Reward in treated water, after application at the 2 gallon/surface acre use rate is approximately 0.37 ppm ion immediately after application. Residual Levels of Reward in water decline very rapidly and their reduction is due to the uptake by the weeds and adsorption to suspended soil particles in the water or on the bottom mud. Photochemical degradation accounts for some loss under conditions of high sunlight and clear water. Usually residues decline to 0.01 ppm or below with 3-14 days after treatment.

Sonar is a broad-spectrum, systemic herbicide works well on Eurasian milfoil at relatively low doses. The active ingredient in Sonar is fluridone. It works by targeting a protective pigment in the plant which, when absent, allows the sun to degrade the chlorophyll. With photosynthesis disrupted, the plant starves. Sonar works slowly and requires a minimum 30-day retention time in the pond to work effectively. In some situations, when this retention time may be difficult to achieve, we apply lower concentrations over two or three applications. This method allows us to keep a sufficient concentration for a longer time.

Sonar will be applied to the pond to control the floating vegetation at or below 90 parts per billion (PPB). The only temporary water use restriction for the use of Sonar is that the water may not be used for irrigation purposes for a period of30 days following treatment. The City will close the Reservoir of all use on the day of treatment and will warn of the above restrictions.

(3) *Mechanical harvesting, hydro raking and hand pulling.* Mechanical harvesting is the removal of aquatic vegetation via the cutting and pulling up of the material with a specially designed small water vessel. Hydro raking is the use of a rake-like tool to pull in weeds in the shallower portions of a water body from the shore. Hand pulling is the pulling of weeds by hand from shallower portions of the lake or pond. These techniques are natural and the most effective on plants that do not reproduce via fragmentation (such as milfoil). They are the best recommended techniques to treat water chestnut (*Trapa natans*) since they remove the nut that is produced by the plant for reproduction, and that would otherwise be deposited in the lake sediments, where is could lie dormant for 8-10 years. Another advantage of these techniques is that the organic material is removed from the waterbody, reducing the amount of material that decomposes in the fall when the plants die off, thereby reducing the possibility of decomposition associated hypoxia and sedimentation. At Coes Reservoir, water chestnuts will be removed in June, when the plants have produced leaves at the surface, but have not yet grown their nuts. Organic material produced through these activities will be sent to a local composter after being dewatered on land (at least 25 ft from the water's edge) for several days.

(4) *Chemical treatment with imazamox.* While mechanical harvesting, hydro raking, and hand pulling are the preferred methods for treating infestations of water chestnut, there are a certain amount of logistical considerations that may make it difficult to implement on any given year. As missing a year of treatment would lead to reseeding and essentially undo previous year's progress in containing the infestation, having a chemical treatment on hand is a good measure. Imazamax (trade name: Clearcast), is a systemic herbicide that is effective at treating water chestnut before seeding has been registered with EPA since 2008. It is a liquid formulation that is applied to submerged vegetation by broadcast spray or underwater hose application and to emergent or floating leaf vegetation by broadcast spray or foliar application. The chemical

affects the essential plant enzyme acetolalactate synthase, which is not found in animals. Laboratory tests using rainbow trout, bluegill, and water fleas (*Daphnia magna*) indicate that imazamox is not toxic to these species at label application rates. Imazamox is rated practically non-toxic to fish and aquatic invertebrates and does not bioaccumulate in fish. Additional studies on birds indicate toxicity only at dosages that exceed approved application rates. However, honeybees are affected at application rates so steps to reduce drift during application should be observed. Based on its low acute toxicity to mammals, and its rapid disappearance from the water column due to light and microbial degradation and binding to soil, imazamox is not considered to pose a risk to recreational water users, although we would close the lake on the day of treatment for good measure.

Algae and Cyanobacteria Management. In 2018, we hope to reduce the risk of exposure of the public to cyanobacteria and their toxins, as well as reduce the negative ecological effects of the decomposition that occurs after an algae or cyanobacteria bloom. The City will conduct routine tests measuring TP, water clarity, and cyanobacteria density, and treat the lake according to its needs.

(1) *Application of Aluminum sulfate ("alum").* Aluminum sulfate is a commonly used coagulant that effectively strips phosphorus out of the water column and makes it unavailable to algae as a nutrient source, thereby reducing their ability to grow and reproduce. It is commonly used in drinking water filtration plants. Alum is generally considered safe for local ecology and human contact at recommended doses. If TP and water clarity tests suggest that Reservoir conditions may promote high algal and cyanobacterial reproduction rates, we will contract the application of alum at a concentration of 1 part per million (ppm). Alum will be applied in liquid form from a boat. There are no water-use restrictions for the use of aluminum sulfate, however, we would likely close the take on the day of treatment for swimming.

(2) *Application of Copper sulfate*. The most common technique for controlling nuisance algae blooms is to apply a copper-based algaecide to the pond. In fact, many drinking water reservoirs are treated several times per year with copper-based algaecides. Copper Sulfate would be used in Coes Reservoir if algae reached problematic levels sometime during the summer. The application rate for control of most algae is 0.3 PPM or 0.8 pounds per acre-foot. There are no water-use restrictions for the use of Copper Sulfate, however, we would close the lake on the day of treatment for swimming.

Alternatives. We believe that the above course of action is the best in terms of long term ecological health, human safety, and cost. Below are the alternative approaches to algae and weed control at Coes Reservoir, as well as their predicted effects.

(1) *Do nothing*. As an urban waterbody, Coes Reservoir is at high risk for cultural eutrophication, or expedited aging and filling due to increased external nutrient additions. Coes show symptoms of this process already, including excessive weed growth and high TP concentrations. These symptoms will only continue to get worse, and will render the waterbody incapable of supporting recreational activity and local species, which is an undesirable outcome.

(2) *Best management practices.* Cultural eutrophication is cause by the increased addition of nutrients from the landscape via runoff on impervious surfaces. By intercepting and removing these contaminants before they enter the waterways, we can reduce the speed at which eutrophication occurs. Best management practices ("BMPs") are structural or engineered

control devices to reduce the harmful effects that runoff and stormwater has on surface water. Examples include retention ponds, rain gardens, tree boxes, and hydrodynamic separators. The implementation of these devices is the best method for the long term reduction of pollution into a waterbody. However, their design and construction requires money, time, permits, and land, and would not address the current problems faced by Coes Reservoir. Without a doubt, BMPs should be a long term solution to nutrient loading at Coes, but will do little to preserve the recreational value today.