

2025 Aquatic Weed Management Beaver Lake Association



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Introduction

Beaver Lake is a 325-surface-acre lake located five miles south and one mile east of Plattsmouth, Nebraska. It is a man-made impoundment that varies in depth from 0 to 72 feet. The dam was constructed in the early 1970s to create a recreational housing development around a beautiful lake. The filling of the lake in 1976 created an ever-evolving ecosystem. In the early years of the lake, the waters were continually turbid due to erosion on the shorelines and runoff from the surrounding farm ground.

Throughout the 1970s and early '80s, growth in housing around the lake began to promote shoreline stabilization to protect the land as well as the lake.

During the same period the lake froze solid every winter, sometimes to a depth of two to three feet, along with one to two feet of snow on top. Aeration was limited to incoming live tributaries.

As the lake continued to age, management practices changed to improve the lake. Throughout the late '80s and '90s there were many upstream dams (silt ponds) that were erected to prevent flooding and aid in erosion control. During the same period lake front homeowners were required to stabilize their shorefronts to further prevent siltation and turbid waters. By the mid '90s it was becoming evident that the efforts had worked; water clarity in the lake was greatly improving. At certain times of the year, visibility was three to four feet.

Toward the end of the '90s and into the new millennium more efforts were made on flood and erosion control. The two biggest improvements were at Dam Site #1 on Murray Road and another sizeable flood control dam on Young Road. Both structures were erected in cooperation with the Lower Platte South Natural Resource District (LPSNRD). These two projects significantly helped to improve the water clarity within the lake.

During the same time, residents began using aerators (bubblers) to protect their docks and seawalls from damage caused by ice formation and movement. Using aerators allowed large areas of water to remain open all winter long. Many areas of the lake remaining open allowed geese by the thousands to winter over in this area, resulting in pounds of fecal matter being deposited onto the lake bottom. The added nitrogen from these excreta fertilized the growth of aquatic weeds.

From 2000 to 2012, lake clarity increased from eight to 15 feet, allowing sunlight to penetrate deeper which promoted aquatic growth on a greater scale. Zebra mussels were discovered in 2023. Their proliferation has further increased the clarity of the water down to 25 feet.

Problem Statement

As a result of zebra mussels, large goose populations, and the consistent inflow of excess fertilizer runoff from adjacent land, aquatic weed growth has exploded. Aquatic weed over proliferation now interferes with recreational lake usage.

This plan is a guideline to manage profuse aquatic vegetation; the goal is to meet community preferences while preserving the health of the ecosystem. This weed harvesting management strategy balances recreation, recreational boating, lake health, and fish management.

Aquatic Plant Identification

The following will identify the types of aquatic growth (macrophytes) currently present in Beaver Lake, identified and confirmed by professors and analysts that have been contacted for support over the past years. By correctly identifying the plant, we can recommend a course of action for management. Every plant has unique characteristics which enable it to grow in certain locations and conditions.

Pondweeds, coontail, and algae are three of the predominant genera of plants in Beaver Lake. Also present are duckweed and water nymph.

More and different types of aquatic growth may inhabit the lake as time goes on. Therefore, it is important to identify current plants on a regular basis to help prevent the spread around the lake.

Sago Pondweed

Sago pondweed (*Stuckenia pectinata*), a submerged aquatic perennial, thrives in diverse freshwater environments with nutrient-rich waters. It is prevalent in the coves around the lake.

It is often found intermixed with curly leaf pondweed (below), which has a broader leaf than sago pondweed. Both weeds become very dense, which promotes the warming of the water within the area.

Sago pondweed grows from an extensive rhizome system rooted in sediment, producing slender, branching stems up to one to two yards long with narrow, thread-like leaves arranged alternately or in whorls, resembling pine needles.

Its lifecycle starts in spring when rhizomes and tubers sprout, driving rapid growth through summer in optimal conditions (59–86°F). Small, inconspicuous flowers emerge on spikes at the water surface from June to August, producing seeds, though asexual reproduction via tubers and stem fragments dominates. Tubers enable overwintering in sediment. By late summer or early fall, growth typically slows and the plant dies back, with tubers and rhizomes remaining dormant until spring. Sago pondweed forms dense beds, providing vital habitat for aquatic life but can become invasive, clogging waterways if uncontrolled.





Curly-leaf Pondweed



Curly-leaf pondweed (*Potamogeton crispus*), a submerged aquatic perennial, thrives in freshwater environments, often in nutrient-rich, slightly alkaline waters.

It grows from a robust rhizome system anchored in sediment, producing wavy, reddish-green leaves with serrated edges, typically $\frac{1}{2}$ - $1\frac{1}{2}$ inches long, arranged alternately on branching stems that can reach one–two yards. Before our zebra mussel infestation, this plant grew only to depths of 15 feet; now it reaches 25 feet.

Unlike many aquatic plants, curly-leaf pondweed has an unusual lifecycle: it begins growth in late fall or early winter, forming dense mats by spring when most other plants are dormant. Small, inconspicuous flowers emerge on spikes above water from late spring to early summer (May–

July), producing seeds, though reproduction is primarily asexual via rhizomes and turions (hardened, detachable buds).

By mid-summer, often June or July, the plant typically dies back, with turions and rhizomes persisting in sediment through summer heat to sprout again in fall. This early growth and dieback cycle allows curly-leaf pondweed to dominate early-season resources. It can lead to ecological problems, as dense mats may outcompete native plants and alter habitats.



Floating Pondweed



Floating pondweed (*Potamogeton natans*), grows from a perennial rhizome system, anchoring in sediment. It produces both floating and submerged leaves on the same plant. The shape of the floating leaves depends on the speed of the current, with faster current resulting in longer leaves and somewhat less heart-shaped leaf bases.

The floating leaves are dark green, leathery, and opaque, and combined with

duckweed (below), can get dense enough to block sunlight from penetrating the surface.

Submerged grass-like structures are actually modified leaf stalks. Stems are cylindrical, without many branches, and grow from one to two yards long. Flower spikes are dense and cylindrical, pointed at the tip, and rounded at the base. It flowers from May to September.

It reproduces mainly from rhizomes and broken pieces of stem, and less commonly through seeds spread by air, water, or animals. In fall, the plant dies back to its rhizomes, which overwinter in sediment to restart the cycle next spring.



Duckweed

Duckweed (*Lemna spp.*), a tiny, free-floating aquatic plant, thrives in still or slow-moving, nutrient-rich freshwater environments. Each plant consists of small, oval fronds (less than ½ inch) that float on the water surface, often with a single rootlet dangling below for nutrient absorption.

Together with floating pondweed, it forms a light green mass on the surface of the water and becomes dense enough to block the sunlight from penetrating. The mass of duckweed can also increase temperatures on the surface, which promotes conditions for algae growth.



Duckweed prefers warmer temperatures to reproduce. These temperatures are present when the formation of other aquatic growth reaches the surface in a mass.

Duckweed's lifecycle is rapid and prolific, primarily driven by asexual reproduction: fronds bud off new fronds from pouches, forming dense green mats in days under ideal conditions—warm temperatures (68-86°F), high nutrients, and ample sunlight.

Growth peaks in spring and summer, with populations doubling in as little as one to three days.

While duckweed can produce minute flowers and seeds, sexual reproduction is rare. In late fall or colder climates, duckweed forms turions—dense, starchy fronds that sink to the bottom to overwinter, resuming growth in spring. Its ability to tolerate a wide range of pH and nutrient levels makes it resilient but potentially invasive, covering water surfaces and affecting light and oxygen for other aquatic life.



Coontail



Coontail (*Ceratophyllum demersum*), a submerged, free-floating aquatic plant, thrives in still or slow-moving fresh water and is present around the majority of the lake.

Unlike rooted plants, coontail lacks true roots, anchoring loosely in sediment or floating freely, with dense, whorled, needle-like leaves resembling a raccoon's tail; hence its name.

Coontail's lifecycle begins in spring when fragments or overwintering turions (specialized buds) sprout, producing bushy, flexible stems that can grow up to one to three yards long. Coontail grows rapidly through summer, forming dense mats under favorable conditions—nutrient-rich, clear water with temperatures between 68°F and 86°F.

It reproduces primarily asexually, via stem fragmentation or turions, though small, inconspicuous flowers may produce seeds in summer. By late summer or early fall, growth slows and the plant may die back partially, with turions and fragments sinking to the bottom to overwinter in sediment and resuming growth the following spring. Coontail tolerates low light and varying pH, making it resilient but potentially invasive, providing habitat for aquatic life while sometimes outcompeting other plants.



Coontail follows pond weed and will expand as curly leaf disappears. Coontail doesn't have the volume of curly leaf lake wide, but it drifts with the wind and clumps up. In deeper water it isn't a problem but will contribute to problems in shallow water areas. Shallow water with no flow becomes stagnant.

Slender water nymph

This stringy mass is called slender water nymph (*Najas flexilis*). You can see the tangled mass that it can become. These masses are attached to the lake bottom by a small root system. The close-up of the same plant shows a fruit and its spider-like leaves.



Environmental Factors

The continued health of Beaver Lake's ecosystem as our drinking water source is paramount, which is why **chemical treatment of aquatic weeds is unacceptable**.

Maintaining healthy fish populations and supporting recreational use of the lake are also critical factors in our aquatic weed management plan. We need to maintain some plant growth for a balanced, healthy ecosystem.

Aquatic Vegetation

The boom of aquatic growth over the years has been attributed to water clarity, plant food availability, siltation, and water movement. As mentioned in the introduction, the clarity of the lake has improved dramatically over time and will continue to do so as the lakeshore and upstream silt containment are improved. Clarity allows sunlight to penetrate deeper into the water, allowing aquatic growth to thrive in water that was previously too dark.

Another contributing cause of aquatic growth is that plant food or fertilizer is continually added to the lake. The key components that are feeding the growth of the plants are **nitrogen** and **phosphates**. These are added to the lake annually from farm ground runoff during rainstorms and from snowmelt during the winter. The application of fertilizer on lawns around the lake is an additional factor. The more fertilizer added to lawns, the healthier and more abundant aquatic growth will be. Excreta from thousands of overwintering geese add nitrogen and ammonia, which become concentrated wherever the geese congregate in open water or at the edge of the ice.

Siltation (mud) is another component of aquatic growth success. Silt enters the lake during rain events and spreads out across the lake bottom. Silt carries with it the nutrients needed for aquatic growth. To prevent excess siltation, we have installed silt ponds and major upstream dams to catch the silt. Dredging removes unwanted silt too, although it can't remove 100% of it. Removing silt also removes any seeds contained within it that could grow the next season.

Water movement also plays a role in the growth of aquatic plants. When there is little or no movement in the water, temperatures increase more rapidly, which provides an ideal situation to promote plant growth. Increasing water movement by any means will aid in inhibiting plant growth as well as preventing water stagnation.

Finally, zebra mussels clarify lake water by filtering suspended particles of plankton, algae, and other organic matter. A single mussel can filter up to a liter of water a day, and high population densities can process a massive volume of water, removing these particles and leaving the water much clearer. This process also disrupts the food web, and the filtered material is deposited as waste, which can alter the habitat on the lake bottom.

Fish

Fish and other aquatic organisms should be protected. As we plan when and how to harvest excess weeds, we need to consider the needs of fish, which rely on vegetation for shelter and spawning.

Fish species such as bass, crappie, bluegill, and perch, like other fish, spawn in the spring. Weed harvesting timetables must be created with the following in mind.

Bass build nests and spawn at 58°F – 65° F water to 12' deep depending on water clarity.

Crappie build nests and spawn at 56°F – 62°F water to 10' deep depending on water clarity.

Yellow Perch spawn by scattering ribbons of eggs in the vegetation at 45°F – 55°F water from 3' to 20' deep.

Bluegill build nests and spawn at 65°F – 70°F water to 8' deep depending on water clarity.

Water quality is affected by nutrient levels, sunlight, turbidity, flow, erosion, and organisms. Vegetation plays a vital role in the aquatic food chain and continued healthy ecosystem of Beaver Lake.

Solutions

Safety First—No Chemicals!

Beaver Lake is our drinking water source. For the sake of human life and health, treating lake weed growth with chemicals is unacceptable.

Recall of formerly approved substances is all too common. Initial testing or shoddy research may fail to identify long-term and/or catalytic hazards.

In addition to not knowing the true health risks of various agricultural chemicals allowed today, many first-world countries ban substances the U.S. still allows. Following is a partial list of agricultural chemicals still approved here but known to be hazardous and banned elsewhere.

Acephate is a carcinogenic organophosphate with an estimated usage nationwide of four million pounds annually. Acephate is harmful to humans, pets, and birds, and nations such as China, the United Kingdom, and the European Union have long banned its use.

Aldicarb is classified as extremely hazardous, yet the U.S. uses 75,000 pounds of the pesticide annually. It is banned in over 100 countries including China; Brazil; the United Kingdom; Mexico; Japan; and the European Union. Countries such as Canada and Israel have also banned its importation.

Atrazine has an estimated annual usage of 73 million pounds. While there are calls to ban atrazine, it is still being used across the U.S. Countries and regions that have already banned it include the European Union, the United Kingdom, and Turkey.

Chlorethoxyfos is another extremely hazardous organophosphate, with the U.S. using approximately 19,000 pounds annually. It's banned throughout the European Union and United Kingdom.

Ethoprophos is an organophosphate banned in China, the European Union, and United Kingdom. The U.S. uses 138,000 pounds of ethoprophos annually.

Methomyl is extremely toxic to humans, animals, and the environment. The United States applies 636,000 pounds of methomyl annually. It's banned in China, the European Union, United Kingdom, and Turkey, among others.

Paraquat is a fast-acting and poisonous herbicide used in weed and grass control. Highly toxic, 11 million pounds of the herbicide are used annually despite usage restrictions.

Phorate is extremely hazardous and has been banned in Brazil, China, European Union, India, Switzerland, the United Kingdom, and Turkey, among others.

Propanil is hazardous and therefore banned in the United Kingdom and the European Union. The U.S. uses approximately five million pounds of propanil annually.

Terbufos is another extremely hazardous organophosphate. The U.S. uses an estimated 383,000 pounds of terbufos annually despite the known risks it predisposes the population to. Countries and regions that have long banned this carcinogen include the European Union, China, the United Kingdom, and Canada.

Given the known and as-yet-unknown risks of chemicals still allowed nationwide, using any chemical treatment for lake weeds here at Beaver Lake would be reckless. Mechanical harvesters, aeration diffusers, and manual weed tools are the available options.

Three Available Options

Our community's goal is to have property owners and the Association work together to maximize the effectiveness of aquatic weed control.

For Beaver Lake Association, mechanical aquatic weed harvesting equipment is best suited to managing our lake's weeds. See [Mechanical Equipment](#) below.

For individual homeowners who don't want to invest in personal-scale mechanized harvesting equipment, aerators/diffusers are recommended. See [Aeration/Diffusion](#) below.

For confined areas and/or very shallow coves, manual weed tools are an inexpensive choice. See [Weed Tools](#) below.

Alternative weed management solutions may be developed in the future. If you hear of any innovations, please alert the Infrastructure Committee and Board so those suggestions may be thoroughly investigated.

Mechanical Equipment



Aquatic weed harvesters provide an environmentally sound method of controlling nuisance vegetation at Beaver Lake. Somewhat akin to an underwater lawn mower, the harvester cuts aquatic vegetation and collects and stores those cut weeds on board before unloading on shore for disposal.

Removing that top layer of weeds prevents those stems and seeds falling to the lake bed where they would trigger further nuisance vegetation expansion. By efficiently reducing the lake's nutrient levels, the harvester helps to curb the growth of algae on the water surface.

The harvester's cutter head has one horizontal and two vertical cutter bars and a conveyor which collects the cut weeds and transfers them temporarily to onboard storage. When the storage area is full, the harvester returns to shore to unload.

Unloading the harvester is a fairly simple process, providing you have the right location and weather circumstances. There is a shore conveyor that will be placed on land with part of the chute protruding out into the lake where the harvester will connect to, as you can see in the video linked below.



Video 4 Conveyor
in operation.mov

Dried weeds serve as nutrient-rich compost, thus recycling the organic matter for use as fertilizer. This sustainable practice makes the use of a weed harvester environmentally friendly.

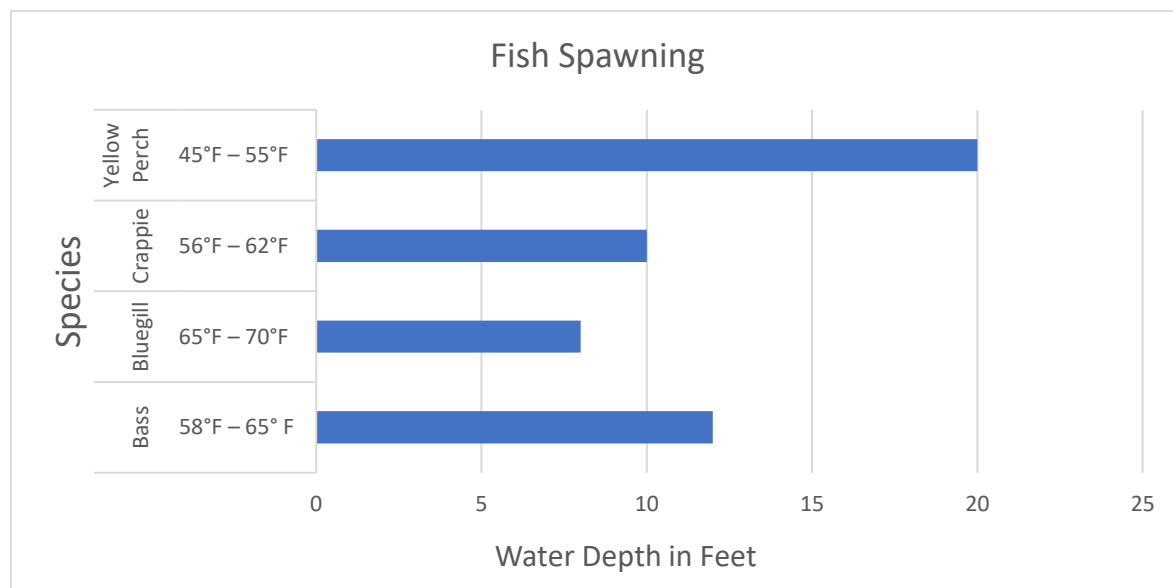
The machine best suited to Beaver Lake's needs will cost approximately \$380K, and will operate with a two-person crew. Our mechanical weed harvesting equipment will be used to maintain open water so that people can navigate above the vegetation outside docks, properties, and identified access areas around the lake.

The aquatic weed cutting machine will be used to achieve the following objectives:

- Open traffic area navigation channels from each cove to open water
- Open water to navigate above the vegetation outside docks, properties, and identified access areas around the lake
- Protect habitat to ensure a healthy ecosystem for fish and wildlife

In order to achieve those objectives, we will:

- Monitor the growth of curly leaf pondweed after ice out; once it grows to nuisance heights, begin operations
- Continue curly leaf removal as needed until early summer
- Mid to late summer monitor the growth of coontail; once it grows to nuisance heights, remove as needed until early fall
- Cut and maintain 20–30-foot-wide channels, up to six feet deep from surface to vegetation along primary boating routes in a lake perimeter (areas around docks and shore stations are the responsibility of homeowners)



Aeration/Diffusion

Beaver Lake Association will not harvest inaccessible or very shallow areas or below six feet deep. We will get as close to docks and shore stations as conditions allow, but docks, shore stations, and the like are the property owner's responsibility. Homeowners can use diffusers and agitators to ease their dock and shore station cleanup and improve aesthetics.

The bottom diffuser aerator uses an air compressor to pump pressurized air down to the diffusers that sit on the lake floor. The diffusers then create tiny air bubbles that rise to the surface. The bubbles dissolve oxygen into the water and agitate that oxygen-infused water toward the surface.

Oxygenation helps decompose organic matter, and agitation prevents the accumulation of nutrients on the lakebed. Seeds and rhizomes die from lack of food, so weeds can't take root. Moving water also prevents the accretion of duckweed and algae on the water's surface.

Diffusers are optimized for depths of eight feet or more.

Mechanical aerators or agitators work at the surface of the water and are meant for depths of six feet or less. Floating aerators are motors suspended under a float with a propeller. The motors pump water from beneath the float up into a churning froth a foot or so above the float.

Operating on the same principle as surface aerators, circulators are mounted horizontally under a float or attached to a dock to create a current. Currents move collected debris and algae away.

Aerating fountains, also intended for depths of six feet or less, aerate and produce a conic fountain on the surface for aesthetic appeal. Fountains aerate less than diffusers and other agitators.

Backs of coves or areas without flow would benefit greatly from owners implementing coordinated strategies.

Using Aerators

There are many different options to choose from when it comes to aeration. Over the past 10 years, the association has implemented two aeration units in different coves. The average depth in those areas is four feet. The system is composed of a small compressor with control valves, 100' of weighted airline, and two fine bubble diffusers. The average cost per complete unit is \$1300. We have found over the years that the operation of the units helps to deplete the nutrients in the sediment which in turn starves the aquatic weeds. The operation of these units

runs from March 1 through September each year. It is important to take the necessary winterization procedures to protect the equipment. Disconnect the hoses and lay them down onto the lake bottom near a dock to prevent damage. Disconnect the compressor and take it inside for the winter for cleaning and necessary maintenance.

Weed Tools

For extremely shallow coves, manual weed rakes, cutters, and rollers might be the realistic solution. Various sizes and styles are available. Manual cleanup is an inexpensive option for those with time and capability.

Report Summary

Excessive weed growth in 2025 and the high probability of its continued overgrowth prompted the Infrastructure Committee to evaluate how to manage our lake's ecosystem and to identify a solution that accommodates recreational use while still preserving the health of the lake and our drinking water source.

The committee began with a report from 2012, and researched details about lake ecosystem history; Beaver Lake's aquatic biota; and how various methods might be used to restrict overproliferation of weeds while leaving the needs of our fish minimally affected.

Infrastructure identified mechanically harvesting weeds along designated areas as the solution for Beaver Lake. Periodic weed harvesting will preserve our drinking water supply; allow recreational use of the lake; and maintain adequate vegetation for fish needs.

The committee researched and then identified the type and size mechanical weed harvesting machine most appropriate for our use. We sent Mr. Weatherby out of state to personally review and test the type of machine we favored. Finally, we developed a plan for approximately when and where to harvest.

Beaver Lake Association will be responsible for managing aquatic weeds in designated common recreation areas. Individual homeowners are encouraged to work with neighbors to help manage aquatic weeds around their docks and shore stations.

This report may be updated as new information arises.

Useful Links

Aquatic weed equipment

Harvesters

<https://aquarius-systems.com/equipment/aquatic-weed-harvester/>

<https://www.dredgeit.com/equip.php>

<https://weedersdigest.com/aquatic-weed-harvesters/?srsId=AfmBOorakZBwbJOCAIfKRzAshAH-DojKHNL7NvN1Y6xaVh3noiOcSya>

<https://www.agriexpo.online/agricultural-manufacturer/aquatic-weed-harvester-machine-3646.html>

<https://aquaticweedharvester.com/wp/used-equipment/>

<https://www.alphaboats.com/>

<https://lakeweederharvester.com/>

Aerators

<https://weedersdigest.com/pond-aerators/>

<https://vertexaquaticsolutions.com/water-quality-product-lines/pond-lake-aeration/>

<https://www.airmaxeco.com/product/power-house-weeds-away-w-shallow-water-stand/>

https://www.rpswaterpumps.com/collections/ponds-and-fountains/products/pond-pride?gad_source=1&gad_campaignid=22796022423&gbraid=0AAAAp4sEdU4gliUmr8b5_aLOYHgrDLsl&gclid=CjwKCAiAlMHIBhAcEiwAZhZBUjEdbqY3kXP-4bb6cMi-UthBr9Ry30VclF9k5y4Xy5reUY8aeG97OhoCx9QQA vD_BwE#gad_source=1

https://pondhaven.com/blogs/guides/does-pond-aeration-kill-weeds-best-weed-management-techniques?srsId=AfmBOor3FfMxiYYzkOSPUFd8kLMSHvx7e8IK4FvTnc6485F_II_j_Ck5

Weed Tools

https://webbsonline.com/Category/lake-rakes-and-weed-rakes?srsId=AfmBOorZ-zSwUJtachdOSLAVHIIZ_b8H2R0Mj2aFz5ZFJS4xHoe6iiFW

<https://scottaerator.com/products/beachroller-weed-eliminator>