



LAKE MONTAUK WATERSHED MANAGEMENT PLAN



Appendix K-3 Septic System Inspection/Replacement Case Studies



Lake Restoration

The Problem / Concern:

Why do lakes decrease in water quality and depth?

Development within watersheds has increased greatly in recent years and many lakes have been subjected to an ever-increasing load of nutrients and sediments, resulting in decreased lake water quality, thereby interfering with lake restoration efforts. Increased nutrient loadings are most commonly due to excessive use of fertilizers, malfunctioning septic systems, poor erosion control and improper waste disposal within the watershed. As development continues to increase, the amount of total hard-surfaced area also increases and the volume and velocity of the water moving through the watershed into surface waters is increased. This run-off erodes soils and transports organic materials and nutrients from surface soils. Inorganic materials, in the form of sand, silt, and clay are also transported to receiving waters, resulting in decreased lake water quality and depth.

The US EPA classifies nutrient pollution as one of America's most widespread, costly and challenging environmental problems, and is caused by excess nitrogen and phosphorus in the air and water. As nutrients continue to accumulate, excessive aquatic weed and harmful algae growth starts taking over faster than the ecosystem can handle. Excessive weed growth reduces navigation by boats, limits activities such as water skiing, creates stagnant zones, and reduces natural oxygen transfer due to lack of wave action and circulation. Increases in algae can worsen water quality and aquatic habitats, and decrease the oxygen that fish and other aquatic life need to survive. Large algal blooms can significantly reduce oxygen in the water, leading to increases in bacteria, odors and fish kills. Some blue green algae blooms produce elevated toxins and bacterial growth that in turn can make pets, kids and even adults very sick if they come into contact with

polluted water or eat tainted shellfish or fish.

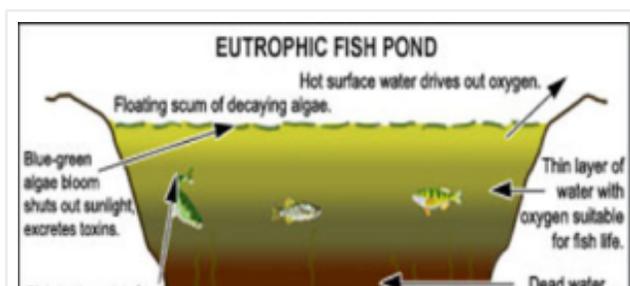
As these plants die either through herbicide applications or season ending die-off, they drop to the bottom of the lake where they decay and add to the organic sediment or muck layer on the bottom. Muck accumulates year after year, increasing available nutrients, reducing the depth of water which increases sunlight penetration, and the cycle continues until the lake favors plant life more than aquatic life.

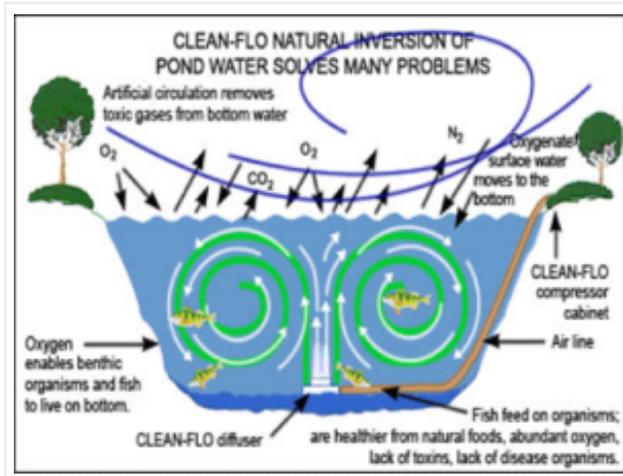
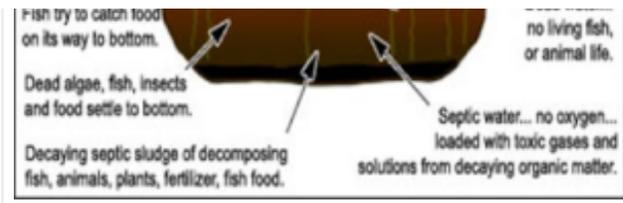
Also in warmer climates, *Naegleria fowleri* (also known as the “brain-eating amoeba”) can be found. In contrast with most pathogenic bacteria, *Naegleria fowleri* is not adversely affected by the presence of oxygen. This organism thrives on the nutrients in the organic sediment. The level of phosphorus and nitrogen in organic sediment is typically about a thousand times the level found in the water column. When stirred, *Naegleria fowleri* can invade through the nose and attack the human nervous system and brain, causing primary amoebic meningoencephalitis.

The Solution and Benefits of Lake Restoration

Excessive weeds and algae, lack of dissolved oxygen, odors, fish kills, increased coliform bacteria and *Naegleria fowleri* are all symptoms of the problem. The cause of these problems is nutrient overloading or eutrophication. The USGS provides this definition of eutrophication “The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the process. – Art, 1993”

The keystones of our solution are our inversion systems which produce laminar non-turbulent flow in the water and increase oxygen levels throughout the entire water column. Numerous studies have shown that high stable oxygen levels reduce nutrients and minerals in the water column and can keep phosphorus locked into the organic sediments. Here is a simple comparison of a eutrophic lake to a lake with our inversion system operating in it.





Our inversion systems are designed using various sized compressors (based on the application and size – see Custom Design and Build), along with self-sinking airline and micro-porous ceramic diffusers that supply a steady stream of micro bubbles from the bottom to the surface of the water. This non-turbulent flow is capable of moving and circulating large quantities of water, and quickly oxygenates a lake.

Increasing oxygen throughout the water column allows us to start a sequence of events that provide aquatic weed control, improve water quality, reduce organic muck, nutrients, odor, harmful gases, coliform bacteria, nuisance algae growth and at the same time improve the fish growth and health. Natural aerobic bacteria and micro-organisms begin to consume the organic muck and nutrients, aquatic insects feed on the bacteria and increase the natural food source for fish, and water quality improvements provide safer swimming conditions. Reduced organic sediments help aquatic weed control by reducing the nutrient mix they are growing in.

The second step in bringing the proper balance back to a lake is bioaugmentation. This involves the use of aerobic beneficial bacteria and enzymes which break down organic muck similar to a compost pile in your backyard, denitrifying bacteria to reduce nitrogen availability and a blend of minerals which promote healthy diatom growth to clean the water. Consistent use of these products over time will reduce nutrient availability and help keep the water clean and healthy.

A third and final step that can be deployed is our nutrient sponge. Our **nutrient sponge** is formulated to reduce phosphorus and nitrogen as water passes through the material. Nutrient sponges can be used wherever water flows into the lake to reduce incoming

nutrients and can also be used in the lake to help reduce available nutrients. Our staff will recommend a product or combination of products based on the conditions of the lake.

CLEAN-FLO delivers cost effective solutions for your lake, with greater operating efficiency than other aeration providers. We do not pull something off the shelf to try to fit the requirements. We work with you before and after the sale to provide not only the solution to your problems, but results that meet your goals. We look forward to working with you every step of the way.

Successes and Examples of Restored Lakes

Let's hear from a few of our customers:

Village of Scotia, NY – “As you know last summer we were forced to close our lake for swimming due to high fecal bacteria levels. . . Lake Collins is a 55 acre lake with an average depth of 12 feet that has been suffering from the effects of eutrophication for the past three decades. . . A CLEAN-FLO inversion and oxygenation system was installed . . . a significant drop in bacteria levels was observed after a week of operation. The system was turned off a few weeks after installation and bacteria levels rose. When the system was restarted a decrease in bacteria levels was again recorded, suggesting that the CLEAN-FLO system was directly affecting bacteria levels in the lake. . . Thanks for all your guidance and expertise over the past year, the system has performed exactly as we had hoped.

CLE Engineering about a project in Novato, CA – “CLE has completed the pilot study within the Paddleboat Lagoon of the South Lagoon and is reporting that the study was a great success. The water quality has dramatically improved in the past three (3) months since the system was activated. Aeration can dramatically improve the aesthetics of the water quality and reduce the possibility of an algae bloom. By targeting the ‘root problem’ of the low level of dissolved oxygen due to stratification in the South Lagoon, the beneficial use of the waterways can continue to be a valuable source to the BMK Community.”