

AERATION

Working with nature to improve water quality

an interview with Holman Griffin

There are ponds and lakes on perhaps 9,000 golf courses in the United States. Besides providing water for irrigation and fire protection, these ponds and lakes can substantially enhance the beauty of a course. All too often, however, water quality is poor, especially during the hot summer months.

With the advent of the floating mechanical aerator or "floating fountain," superintendents have an effective tool to keep pond and lake water in good condition, even when temperatures are in the 90's.

Holman Griffin has installed dozens of floating fountains in golf course ponds and lakes during the past 2 years.

GOLF BUSINESS: Mr. Griffin, you visit well over 100 courses per year as a consultant. Do you see many courses that have water quality problems?

GRIFFIN: Yes, practically every course that has ponds or lakes has water quality problems of one kind or another.

What are some of these problems?

The problems vary from course to course, but the most common is algae. During a "bloom" — a period of excess growth — algae may completely cover the surface of a pond or lake. Besides being unsightly, algae may clog irrigation equipment. And when an algal bloom dies, it sinks to the bottom of the pond or lake, forming a bottom sludge. Over the years, the sludge may fill up — and kill — the pond or lake, a process called eutrophication.

What causes algal blooms?

Algae are photosynthetic plants that need nutrients, sunshine, and a

suitable medium — warm water — to grow in. Most golf course ponds and lakes are rich in nutrients from fertilizer runoff and the runoff of other organic wastes in the hot summer months. There's plenty of sunshine for photosynthesis. The water is warm, close to the surface. So conditions are right for the explosive growth of algae.

Is water pollution a problem in golf course ponds and lakes?

All too often it is. Fertilizer runoff, for example, is a form of pollution that upsets the ecology of the pond. And if the pond is fed by a stream, there may be organic wastes in the stream that also pollute the water. These pollutants may be so concentrated that natural pond and lake water cleanup processes can't operate.

How can a golf course superintendent tell if the water in his pond or lake is polluted by organic wastes?

An algal bloom is one indication of pollution by organic wastes. Loss of clarity of the water is an indicator of pollution, too. Even if the water appears to be in fairly good condition, it may have an unpleasant odor due to organic wastes. When the water is in good condition it has a clean, fresh odor. Polluted water stinks.

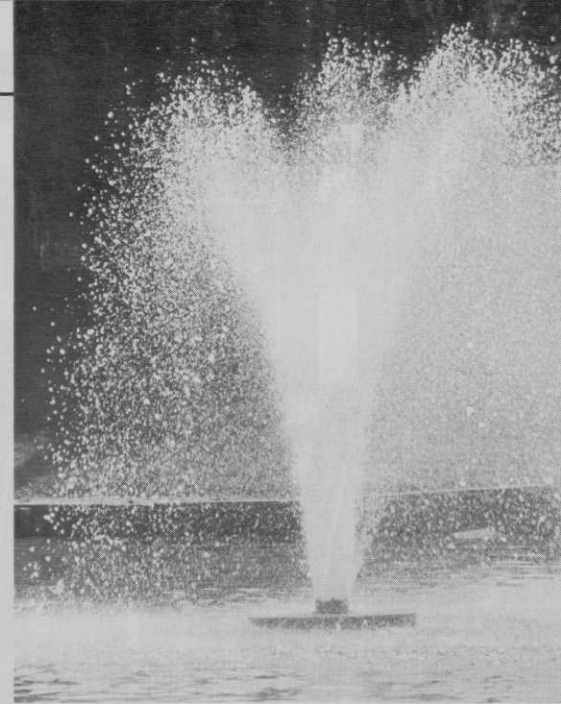
You mentioned natural water cleanup processes. What are they and how do they operate?

The two most important natural water cleanup processes are aerobic digestion, these wastes are biodegraded by aerobic bacteria — bacteria that require oxygen for respiration. In anaerobic digestion, wastes are biodegraded by anaerobic bacteria that do not require oxygen for respiration. Aerobic digestion is quite fast, efficient and odorless.

Anaerobic digestion is slower and less efficient and it creates odors — particularly the "rotten egg" odor produced by hydrogen sulfide, a product of anaerobic waste digestion.

Why don't aerobic digestion processes keep golf course pond and lake water clean in the summer months?

During these months, the supply of dissolved oxygen in the water may not be sufficient to maintain a large population of aerobic bacteria. When there



are large amounts of organic pollutants in the water, the supply of dissolved oxygen is quickly used up. It's replenished to some extent by photosynthetic processes carried out by algae while the sun is shining. It's also replenished by natural transfer of atmospheric oxygen to the water by wind and wave action. But this, too, is a slow process.

Another limiting factor on the amount of dissolved oxygen in the water is water temperature. Warm water can't hold as much dissolved oxygen as cooler water — another reason for hot-weather pond and lake water quality problems.

Are there any other reasons why pond and lake water quality tends to deteriorate?

Lack of circulation of the water — particularly vertical circulation — contributes greatly to algal bloom and pollution problems in the hot summer months. Since warmer water is less dense than cooler water, water heated by the sun tends to float on cooler water below. When this condition — called "stratification" — occurs, there's little mixing between strata of water.

How would better circulation help improve water quality?

With better circulation, algae and pollutants are carried away from the surface and dispersed, reducing the possibility of algae and odor problems. Dissolved oxygen is distributed more uniformly, too, promoting natural cleanup processes.

Many golf courses use chemical algicides to control algae. What are your views on this practice?

There's no question but that copper sulfate or certain trade-named chemicals designed for the job can help to keep algae under control. Chemicals have their place. But they are costly, must be applied repeat-

Holman Griffin, a graduate turf agronomist (Texas A&M), has spent his entire professional life helping golf course superintendents improve the quality of their turf and — lately — helping them improve the quality of pond and lake water used for turf irrigation. Griffin was formerly associated with the United States Golf Association and the National Golf Foundation. He now runs his own consulting firm, GCM Inc., headquartered in Plano, Tex.

edly to maintain control — maybe four times per year in a golf course pond or lake — and really treat symptoms, rather than causes, of algae problems.

If the pond or lake water is used for irrigation, caution must be observed in using chemicals. Some chemicals may kill or damage the turf. Others are designed so treated water can safely be applied to the turf some days after application. If a drought occurs during the waiting period, the water cannot be used and the turf may be damaged by lack of water. Government regulations on the application of chemicals to water are getting stricter, too. In some states permits are required for applications of chemicals, and the superintendent's plans to improve water quality get snarled in red tape.

Some courses dye their pond and lake water as a water quality control measure. Is this effective?

Pond and lake dyes are usually harmless, ecologically speaking. They provide some shade that reduces the photosynthetic activity of algae, thus helping to prevent an algal bloom. Some of these dyes impart an attractive blue color to the water and make it opaque enough to hide just how poor the quality of the water is. And, as with algicides, repeated applications are necessary to maintain the appearance of water quality.

If chemicals and dyes just treat symptoms of poor water quality, what other recourse does the golf course superintendent have?

I think floating mechanical aerators — “floating fountains” — are the answer. Courses such as Winged Foot, The Greenbrier, Camelback Country Club, Las Vegas Country Club, Hershey Country Club, and at least fifty others have been using Otterbine floating aerators for up to 2 years. They report that algae and odors are kept under excellent control through aeration, which is a strictly natural water quality improvement process.

How do these aerators work?

They're actually floating, low-head pumps, anchored or moored in the pond or lake. They're designed to pump the water into the air, creating a spray. The pumping action creates a gentle circulation that mixes the water, preventing stratification. The spray droplets absorb atmospheric oxygen as they travel through the air. As they enter the water, this oxygen is transferred to the pond where it stimulates natural water cleanup pro-

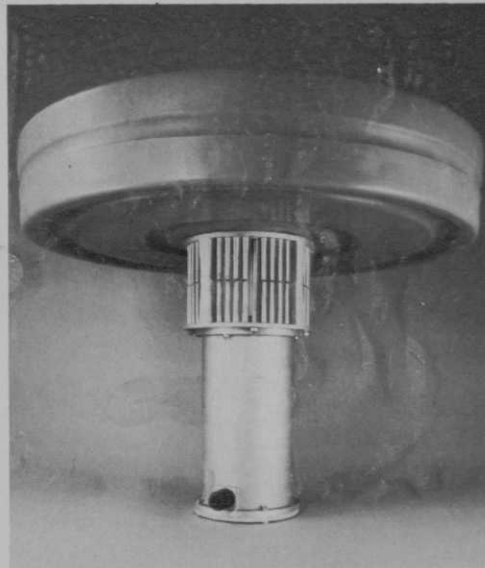
cesses. With better circulation and more dissolved oxygen, algal blooms are prevented and organic wastes in the water are more effectively biodegraded by aerobic bacteria. Result: cleaner-looking water. And no foul odors.

How are the Otterbine aerators powered?

The aerators are electrically powered. Power is carried to the aerators via underwater cables connected to on-shore electrical service.

Isn't it dangerous to have electrical equipment operating in the water?

For safety reasons, the aerators should be properly installed and properly grounded. This is a job for a qualified professional electrician, not an amateur.



Otterbine aerator consists of plastic float and underwater power unit. Water is pumped through 360-degree intake under float. Bar screen prevents debris being sucked into flow chamber.

How many aerators are needed to control water quality in a golf course pond or lake?

Generally 1 to 1½ horsepower of aeration capacity per surface acre of water will provide effective algae and odor control, even in ponds or lakes that historically have suffered from severe algal blooms and water pollution. Otterbine aerators are made in 1, 2, 3, and 5 horsepower sizes.

Are there any “secrets” to controlling water quality with aerators?

The secret of success, if you want to call it that, is to start aerating the water early in the season, even before the hot weather starts. That way, the water will be clean-looking and clean-smelling throughout the season.

Are you saying it wouldn't pay to install an aerator in the middle of the season?

An aerator will improve water quality whenever it is installed. But if an aerator is installed in a pond that's covered with a thick shore-to-shore algal bloom, it may take some time to fully clean up the water. If there is already a thick layer of dead algae, then nothing other than physical removal can eliminate this problem.

What about energy costs?

Energy costs depend on aerator horsepower, the number of hours per year the aerator is run, and the local price of power. When used strictly for water quality control, aerators are usually run only in daylight hours.

Energy cost of water quality control with a 3-horsepower aerator — which is usually more effective than alternative methods of water quality control — may run from \$150 to \$300 per year. Price of an installed 3-horsepower aerator may run \$1,500 or so, including shipping and taxes. When aeration replaces other, less natural water quality improvement methods, the aerator will easily pay for itself in two or three seasons of operation, depending on the severity of the water quality problem. (Severe problems may require more aerators.)

Will aeration help to control aquatic plant growth?

Aeration is only indirectly effective in preventing aquatic weed growth. It helps to minimize bottom sludge buildup. This means less rooting medium for rooted aquatic plants, hence less chance these plants will really take hold.

Use of aeration to improve water quality is quite new to golf courses. Are there other industries where aeration has a longer track record?

Aeration got its start in municipal and industrial waste treatment plant several decades ago, and practically all sewage treatment plants in the country use this principle to clean up waste waters.

Around 1971, some commercial fish farmers began to use aerators to improve water quality for fish production. Hundreds of floating aerators are used by commercial fish farmers today.

Mechanically, the waste treatment and fish farming aerators are identical to the models furnished to golf courses. But the golf course models have more attractive, “sculptured” spray patterns favored by golf course architects, superintendents, and golfers. With these highly ornamental spray patterns, mechanical aerators or floating fountains are a beautiful way to treat water. □