

Water Quality Solutions

AERATION RESEARCH

15+ Years of Aeration Research and Testing



Vertex introduced the lake aeration industry's first CoActive MicronBubble™ membrane disk technology in 1998. Since then, our rugged aeration systems have performed reliably under the worst natural conditions around the globe.

From our first installations in 1980 to our technology leading AirStations™ of today, Vertex continuously pushes the science of bottom aeration technology forward.



Field testing a prototype for the PondLyfe system.

How do we know our systems work?

We test them. Our scientists perform ongoing field and lab research on ponds and lakes like yours to determine the reliability, efficiency and effectiveness of existing components and prototypes under development. And, if that isn't enough, we ask others to test them too.



Vertex's Dr. Josette La Hée testing water samples from a lake before aeration systems are started.

Why Vertex?

GREAT CUSTOMER SERVICE

- ◆ Free aerial mapping, system design and aeration turnover calculations
- ◆ A nationwide network of authorized Dealers
- ◆ Factory direct assistance from start to finish

CONTINUOUS RESEARCH

- ◆ *Independent aeration performance testing has proven that adding millions of bubbles from the bottom up is the most effective form of aeration*
- ◆ Staff PhD biologists conduct ongoing testing of the effects of aeration on a wide range of issues in a variety of waterways
- ◆ Ongoing testing of aeration performance and efficiency for oxygen transfer
- ◆ Product research, testing and development for quality control and improvement

QUALITY MANUFACTURING

- ◆ ETL and CE International electrical safety certification
- ◆ Made in USA - Pompano Beach, FL
- ◆ LEAN Manufacturing processes - all products are built with strict quality control
- ◆ Highest quality components in the industry for rugged construction and dependability
- ◆ Member South Florida Manufacturers Association

INDUSTRY BEST WARRANTIES

- ◆ Diffuser Assembly: 5 years
- ◆ Compressors: 2 years
- ◆ Cabinets: Lifetime protection against rust
- ◆ Tubing: 15 years



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Aeration Helps Restore Lakes Naturally

Ponds and lakes without enough oxygen have a difficult time handling nutrient overloads, especially phosphorus. Dissolved oxygen, critical for water quality, is naturally added by aquatic plants and algae through photosynthesis; and by diffusion at the surface from wind. Animal, plant and bacteria respiration deplete oxygen. Problems occur when oxygen demand is greater than supply.

What You Notice Symptoms

- | | |
|----------------------|--|
| ◆ Fish kills | ◆ Low oxygen |
| ◆ Algal blooms | ◆ Bad water chemistry |
| ◆ Poor water clarity | ◆ Suspended sediments |
| ◆ Swarming Insects | ◆ Stagnant stratified water |
| ◆ Foul odors | ◆ Hydrogen sulfide/carbon dioxide gas build up |
| ◆ Muck accumulation | ◆ Low levels of beneficial bacteria |



Independent research shows that Vertex bottom diffused aeration “turns the lake over”, adding oxygen at all levels, in the most efficient and cost effective way to achieve a healthy balance. Aeration also *improves the effectiveness of biological and chemical treatments* so you use less over time - better for you, better for the water and better for the environment.

Vertex Aeration Chosen for Bahia Del Mar Lake Restoration

Bahia Del Mar is a 14 acre lake located in St. Petersburg, FL. This lake was severely stratified, with large amounts of organic material in bottom waters, high nutrient levels and concentrations of hydrogen sulfide causing a “rotten egg” odor, high biological oxygen demand and very low oxygen levels. The system was unsuitable for fish and other aquatic organisms and posed a health risk to residents. Due to the extreme conditions of the lake a two-pronged approach was undertaken to bring it back to a healthy state.



Treatment

- ◆ Aeration: Bathymetric Mapping provided accurate detail about the depths and volume. Two Vertex Systems, an LL 4XL5 Aeration System and a HF 4XL5 Aeration System with sound reduction kits were installed in April, 2012 to provide adequate turnover rates
- ◆ Alum application: Our sister company, Aquatic Systems, applied two treatments of Alum to quickly improve water clarity and color, reduce water phosphorus levels and drop out the suspended solids

Results Highlights

- ◆ BOD at the bottom of the lake showed a 99% reduction
- ◆ The “rotten egg” odor was eliminated
- ◆ Oxygen at bottom of the lake increased from 0 to 8 mg/L
- ◆ Turbidity went from 113 NTU to 8 NTU – a 92% reduction
- ◆ Bottom water Phosphate and Nitrogen Ammonia were reduced by 99%
- ◆ Chlorophyll a went down 72%
- ◆ Clarity increased 150%

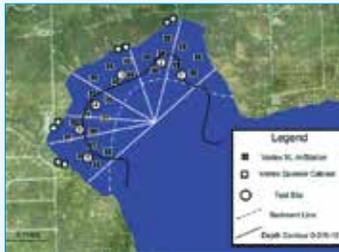
Muck Reduced 2.4' in 3 Yrs

Independent report shows the reduction of organic lake bottom sediments.

East Twin Lake is a shallow lake in Montmorency County Michigan. Depths range 4' to 8', with some areas as deep as 26'. During periods of low water levels, the high sediment level at the western end of the lake became more prominent. The sediment occupied as much as 6' of the 8' of depth in many locations.



The problem area was located at the western end of the lake. This area consists of 160 acres of surface area.



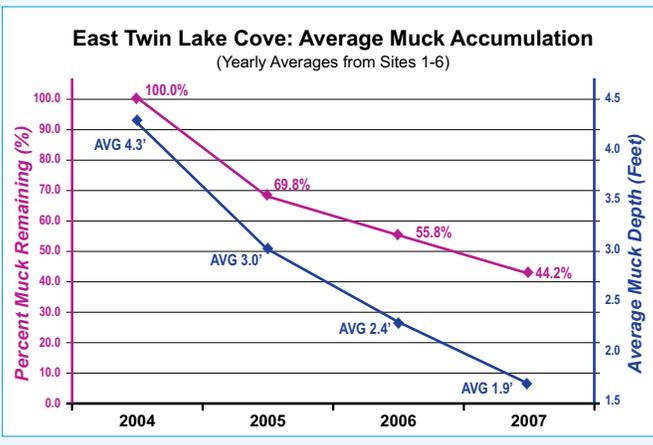
In July 2004, (8) Vertex Air 3 XL systems were installed by Tri-County Aquatics in a 160 acre cove of the 900 acre lake. At the time of installation, muck measurements with a "sludge judge"

were taken at 6 locations. Three of the sites showed levels of 6'- 7' of muck and the average for all 6 sites was 4.3' of muck. The dissolved oxygen at the surface was 4.3 mg/L while the oxygen level at the bottom was 2.0 mg/L, which is a nearly anoxic environment. A water sample sent to a lab to determine the BOD (Biological Oxygen Demand) returned results of a BOD of 58 mg/L, which was much higher than the available oxygen in the water could oxidize and reduce.

The Results Highlights

After two and a half years of operation, tests showed:

- ◆ Approximately 2' less of sediment.
- ◆ Increased wildlife and improved water clarity
- ◆ Dissolved oxygen at the surface increased
- ◆ Biological Oxygen Demand (BOD) decreased to healthy levels



The Vertex Diffuser Advantage

Some aerators add oxygen only at the surface or use large bubbles that escape at the surface, *Vertex diffusers push millions of tiny bubbles from the bottom of the lake to the surface to add oxygen everywhere its needed!*

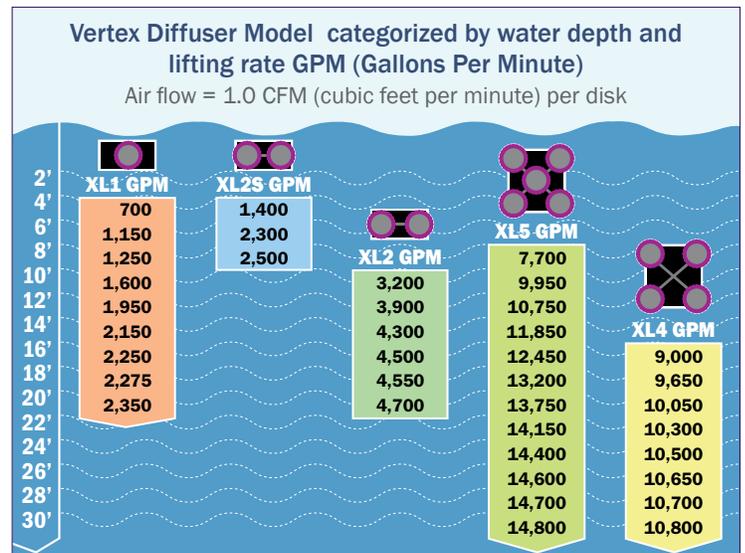
- ◆ 5-year "No Questions Asked" 100% replacement warranty (shipping included)
- ◆ Independently tested pumping rates
- ◆ StableTrak™ technology increases lift velocity
- ◆ FlowControl™ technology equalizes airflow to each disk
- ◆ "Delta" shaped surface pattern increases active surface area and aeration efficiency
- ◆ Self cleaning disks - no yearly removal or acid cleaning required



AirStation Components

- A** Membrane³ Diffuser disk
- B** Clog, wear resistant, flexible polymer membrane
- C** Durable diffuser ring
- D** Barbed hose fitting for tight connections
- E** Lipped chamber to hold ballast

Over 50,000 Membrane³ diffuser disks sold. No reported clogged or blown-out membranes.



Lifting rates represent total water flow as recorded in both independent testing and real world data collected by Vertex from installed aeration systems. Lifting rate varies significantly by air flow, water depth and other factors.

Vertex QuietAir™ Cabinets Are Built to Last

Our durable QuietAir™ cabinets with Brookwood™ compressors are designed to fit into the landscape without being obtrusive while providing maximum effectiveness. Choose plug-in connection for waterside electrical service or **VBS for distant power sources** (remote valve box, sold separately)

- ◆ Highest flow rate of any compressor in its class
- ◆ Available in 115V 60 Hz or 220V – 240V, 50/60 Hz
- ◆ Oil-free, requires no lubrication
- ◆ Superior piston design provides higher pressure
- ◆ Quieter operation and longer life than vane compressors - 2 to 4 times the duty cycle
- ◆ Thermal overload protection

Cabinet Components

- A** Rust free powder-coated aluminum cabinet
- B** Weather, child and vandal resistant keyed cabinet lock
- C** Stainless steel fasteners
- D** Exhaust plenum for longer fan life, noise reduction and weatherproofing
- E** Exterior safety on/off switch (on back of cabinet where shown)
- F** Mounting pad included

Compressor Components

- G** Oversized cooling system
- H** Heavy duty Brookwood piston compressors
- I** SafeStart™ motor protection technology
- J** Pressure relief safety valve
- K** Pressure gauge for airflow adjustment
- L** High pressure blue anodized manifold
- M** High temperature airline hoses



Optional Sound Reduction Kit

- N** High density sound adsorbing foam
- O** Noise reducing twin muffler
- P** Noise reducing side mounted muffler



Bottomline™ Tubing

Tubing is sold separately so that you get the amount you need without waste. Our tubing is durable, self-weighted, remains flexible in cold temperatures.



Remote Valve Box

A Remote Valve Box allows installation of the cabinet wherever it is convenient. Place the cabinet where you have power and deliver the air as far as needed.

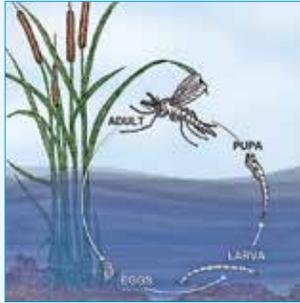


Midge Flies Controlled

90% reduction in 16 months without pesticides

Hibbs Grove located in Cooper City, Florida was experiencing an ongoing outbreak of swarming midge flies from their 6.5 acre lake preventing residents from enjoying their lake front property. Sampling indicated an extreme infestation of midge larvae averaging more than six times the recognized nuisance level.

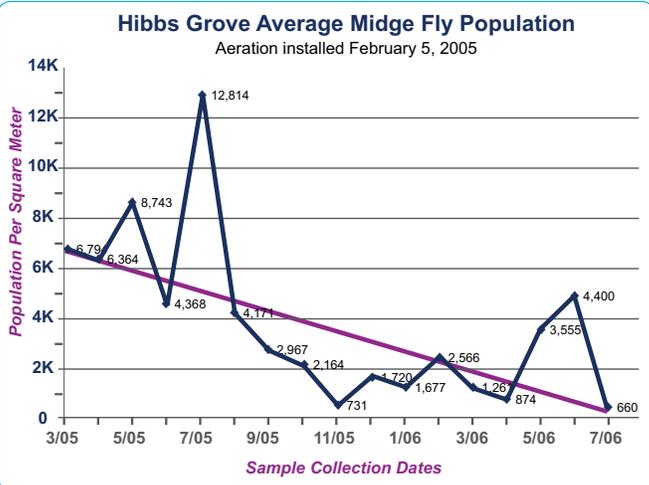
Hibbs Grove turned to the biologists at Vertex Water Features for an environmentally safe solution. Vertex installed a CoActive Air 5 aeration system that provided compressed air to five XL2™ CoActive AirStations placed at the deepest points throughout the lake, effectively circulating the entire water column 0.76 times per day.



The Results Highlights

Oxygen levels increased immediately and accumulated organic muck on the bottom began to decompose, eliminating the habitat and food source that the midge larvae depended on. The improving water quality allowed predators of the midge fly, such as bluegill and aquatic insects to prey on the midges. The resulting increased predation, decreased nutrients and habitat competition contributed to a significant decrease in midge flies.

Within 16 months of the Vertex system installation, the midge fly larvae population had been reduced by 90 percent, from 6,794 larvae/m² to just 660 larvae/m². Throughout the 16 months, there had been a visible increase in fish, dragonflies and water beetles all of which are natural predators of the midge fly larvae. With continued aeration, the oxygen levels have remained elevated and continue to oxidize bottom muck and suppress the midge fly population.



Comparing Types of Aeration: Points to consider

Professional Design Services

- ◆ Free custom aerial mapping, aeration specifications and design
- ◆ Free comprehensive performance calculations including CFM, PSI and turnover rate
- ◆ Largest selection of compressor systems and diffuser models
- ◆ Degreed staff, knowledgeable in aquatic biology, limnology, fisheries sciences and lake management
- ◆ National network of qualified, experienced distributors providing local support, service and expertise

Product Quality:

- ◆ **Published independent aeration performance testing has proven that adding millions of bubbles from the bottom up is the most effective form of aeration**
- ◆ ETL Equipment listing - products meet UL electrical safety codes
- ◆ High efficiency compressors and diffusers provide higher lifting rates with lower power consumption
- ◆ 5-year "No Questions Asked" diffuser warranty and 2-year compressor systems warranty
- ◆ Self-cleaning diffusers, easy to replace filters, extended compressor service intervals
- ◆ Dedicated research and development team working towards continuous product improvement



I installed my Vertex System 5 years ago. It's quiet, and it has been 100% reliable. My pond looks great and my fish are happy and healthy.

Ryan Freeze
Vertex Aeration Owner in Plain City, Ohio



POND LYFE

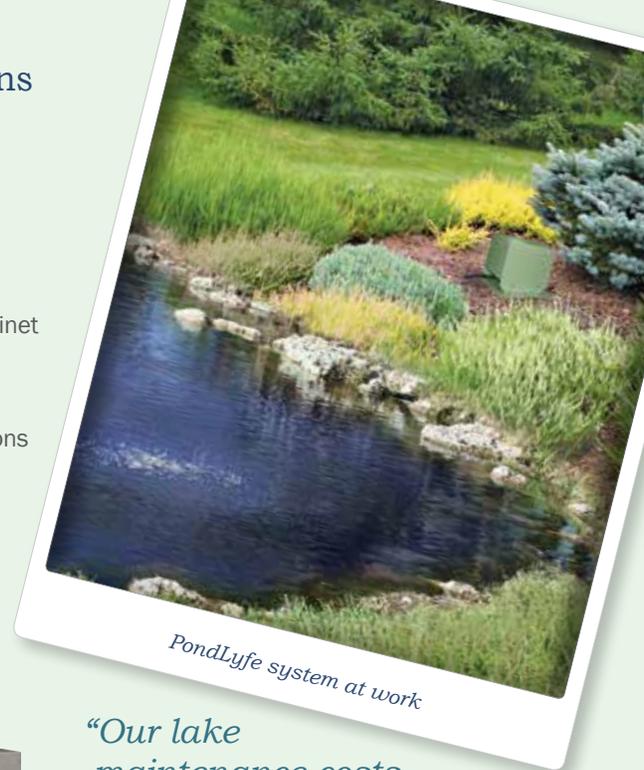
NATURAL ~ SAFE ~ EFFECTIVE

PondLyfe aerators from Vertex address the need for a professional quality aeration system at an affordable price for water gardens and smaller ponds up to 1.5 acres in size and up to 30' deep.

PondLyfe aerators benefit small pond owners who want the best available technology to restore their ponds to a cleaner, clearer and healthier condition naturally by raising oxygen levels, reducing muck, excess nutrients and suspended solids causing murky water.

PondLyfe Specifications

- ◆ Horsepower: 1/4
- ◆ Max. running amps: 2.0/1.6
- ◆ Max. air output (CFM): 2
- ◆ Max. aerated acres: 1.5 Acres
- ◆ GFCI safety circuit
- ◆ Powder coated aluminum cabinet in choice of three colors
- ◆ ETL safety certification
- ◆ Independently tested AirStations
- ◆ Self cleaning membrane diffusers
- ◆ Single 5-micron filtration
- ◆ Restarts under pressure
- ◆ Super quiet operation



PondLyfe system at work

“Our lake maintenance costs have dropped by 60%. The health and appearance of these lakes has improved significantly...”

John Williams
Maintenance & Resident, Lakewood Hills



MICRO LYFE

NATURAL ~ SAFE ~ EFFECTIVE

Pond Restoration Products for Lake Management Professionals

A healthy lake is clear, odor free and has a balance of wildlife and plants. A lake in distress is often lacking in the necessary bacteria and enzymes to breakdown the organic materials that enter the water and has nutrient levels that are too high. The Micro-Lyfe family of products were developed to restore your lake's biology and bring it back to a healthy balance.

Benefits of using Aeration with Other Products

Bioaugmentation and aeration were made for each other. Aeration and water circulation enhance the natural bacterial digestion of muck and other organic materials in a lake. By supplementing with additional types of bacteria and accelerating enzymes, you speed the nutrient, muck and odor reduction benefits of aeration. Since many of these beneficial bacteria require oxygen to perform at an optimal level, aeration will allow you to use less product to achieve the same effectiveness thereby reducing your treatment cost.

Choosing the right products

Concentrate	Improves and maintains the overall health of your lake ecosystem.
Complete	Diminishes high hydrogen sulfide concentrations that cause a rotten egg smell. Use when installing or restarting a lake aeration system.
Sludge Clear	Reduces muck in the bottom of lakes that are black, flocculent, or full of organic sediments.
Digester	Speeds the breakdown leaves, needles, wood, or other organic plant matter on the bottom.
Blue Power	A blue dye product plus enzymes to improve water quality.
Barley Boss	Helps prevent algae scum on shoreline, especially in newly built ponds.



AERATION RESEARCH

Improved Oxygen, Water Clarity and Nutrient Levels

Heron Cay, a high-end gated residential development, was experiencing a number of problems in their 21 acre lake which is central to the community.



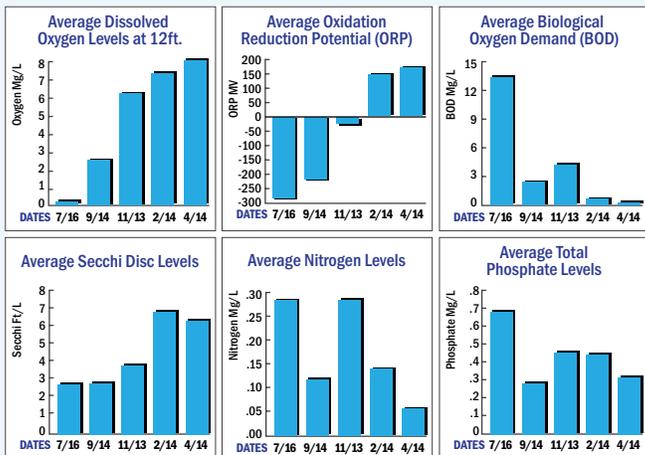
With maximum water depths over 20', stratification caused the lake to experience severely low dissolved oxygen levels at the bottom. Having no beneficial bacteria to break down organics, heavy muck accumulation and foul odors from hydrogen sulfide

gases were present. The lake was consuming what little available oxygen there was faster than it could be replenished, and excessive nutrient levels from fertilizer runoff only made conditions worse. Additionally, the lake's Biochemical Oxygen Demand (BOD) was extremely high.

The Results Highlights

After the design and installation of a Vertex aeration system consisting of **11 diffuser stations** being fed by compressors totaling only 2-1/4 horsepower, Heron Cay was set up on a monitoring schedule to determine how lake dynamics were being affected. The results over the 4 month monitoring period were dramatic. Within days of initial start-up, the systems six main objectives were beginning to be realized:

- ◆ The breakdown of temperature and oxygen stratification
- ◆ Increased oxygen levels occurred throughout the entire water column
- ◆ Decreased Biochemical Oxygen Demand (BOD) - dropped to below detection levels
- ◆ Water clarity increased by 100%, from 3' to 6'
- ◆ Excessive nutrient levels decreased; nitrogen down 80%, phosphorus down 59%



Heron Cay's lake has returned to natural, healthy conditions.

Big, small, deep or shallow. Water bodies are not all alike!

While there are a number of issues that affect all different types of waterways, they also have unique ecosystems, uses and physical characteristics that require more than typical cookie-cutter solutions.

- ◆ **'Homeowner' ponds:** usually smaller, used for fishing, swimming and watching nature
- ◆ **Golf/farm/agricultural use:** irrigation ponds for turf, crops or watering livestock tend to get higher nutrient loads from runoff but need to be low in nutrients for irrigation
- ◆ **Community and public lakes:** large, small, natural or man-made. They are not often used for swimming but need to look beautiful
- ◆ **Marinas:** can be fresh, marine, brackish or have bacteria and odor problems
- ◆ **Canal systems:** man-made for navigation or flood control
- ◆ **Reservoirs:** deeper than other types listed. The movement of the water is tightly controlled and stratification is a serious issue

Get the VERTEX Advantage

"The Vertex Aeration System was an extremely good investment. I haven't had any more stressed or dying fish!"

Bruce Condello

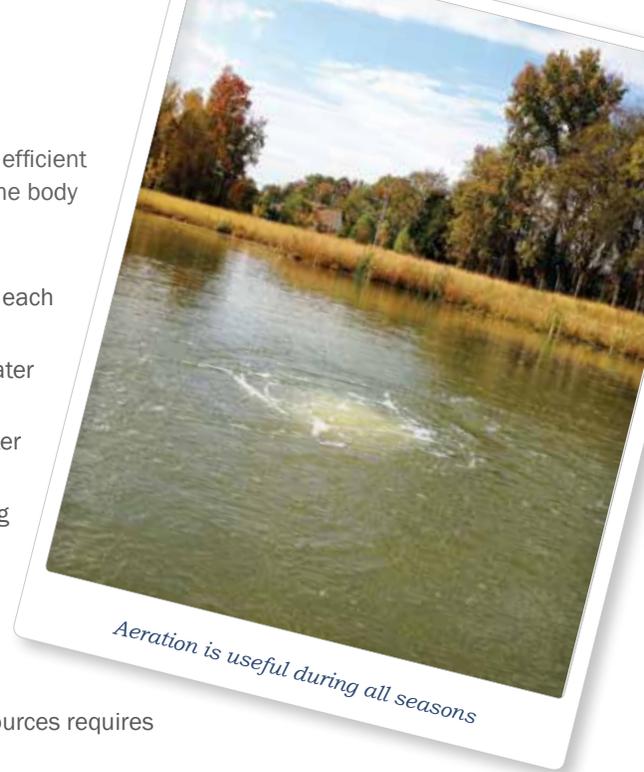
President/Cocreator of Big Bluegill .
Field advisory staff & web moderator of Pond Boss magazine



How do we design your perfect system?

Vertex has the widest selection of components in the industry to design the most efficient and cost effective aeration system. To ensure the best turnover rate throughout the body of water with one of our systems we take into account the following:

- ◆ **Water Depth:** the range of depths throughout the pond or lake can make a difference. If they vary quite a bit you may need more than one AirStation and each may have a different number of disks
- ◆ **Shape:** A fairly round pond is likely to need fewer AirStations than a body of water with multiple 'fingers'
- ◆ **Acreage:** correctly sizing a system takes into account the total size of your water body
- ◆ **Compressor cabinet location:** Our systems are quiet, but if the cabinet is going to be located by a patio or under a window, we have options to make your system even quieter
- ◆ **Power source:** If you have power next to the shoreline a standard system will work. If the power is not by the shore we will design a system with a remote valve box to meet your needs
- ◆ **Watershed and inflow:** Excessive nutrient and organic loading from outside sources requires additional aeration capacity



4 easy steps

1. Measure length, width, several depths and bottom slope
2. Email data to info@vertexwaterfeatures.com
3. Let our specialists design your custom aeration system
4. Have your new system installed by your nearest Vertex Dealer or do it yourself

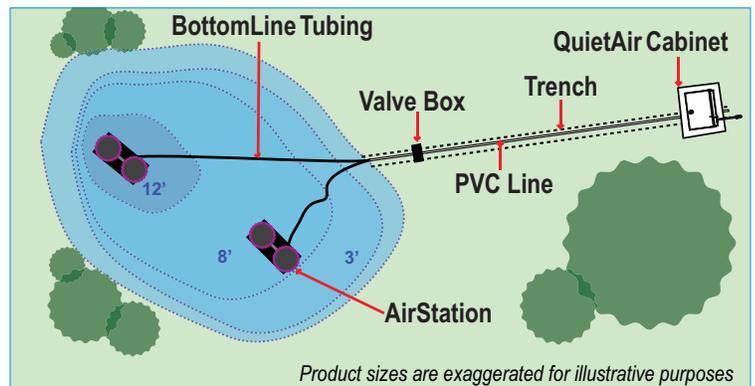


Diagram showing the set-up for a remote valve box aeration system

Same acreage, unique systems!

How different can 2 ponds be?

Many companies tell you that all you need to know is the surface acres and maximum depth. Anyone can see from this example that getting the right system requires a better understanding of your waterway than those two numbers alone can give.

Our aeration specialists work with you to design your custom system

Surface Acres: 2
Volume: 4,818,829 gallons

Air1Plus™ System

- ◆ Two XL2 AirStations
- ◆ Small QA1 Cabinet
- ◆ 1/3 HP
- ◆ 2.5 CFM
- ◆ Deeper lake

Surface Acres: 2
Volume: 3,493,580 gallons

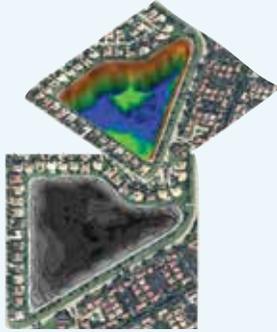
Air5™ System

- ◆ Five XL2 Shallow Water AirStations
- ◆ Large QA3 Cabinet
- ◆ 1 HP
- ◆ 8.6 CFM
- ◆ Shallower lake

AERATION RESEARCH

Phosphate and Ammonia Reduction

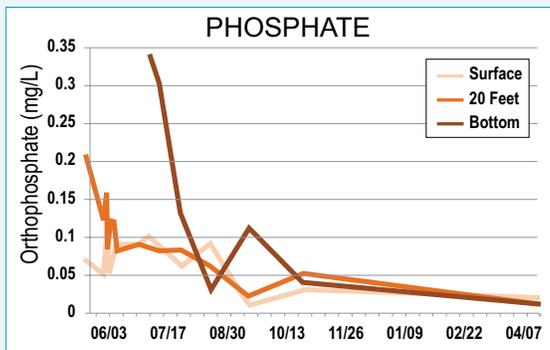
Winston Park is a residential community in Coconut Creek, Florida. Winston Park Lake is 12.7 acres and has a maximum depth of 32' with an average depth of 19.5'. The lake experienced massive fish kills every fall due to a reduction in oxygen during fall turnover, so Vertex installed an



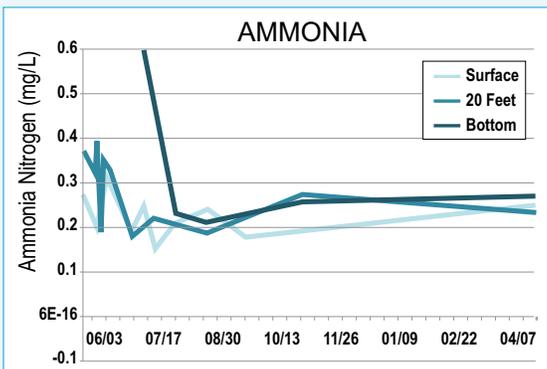
aeration system consisting of **six XL5™ AirStations** powered by 3 Brookwood™ compressors totaling 2.25 HP; which produced 14 CFM of air at 19 PSI. This system is sized to turn the water over in the lake at a rate of 0.8 turnovers per day.

The Results Highlights

Nutrients: The highest orthophosphate levels were observed at the sediment-water interface. These levels were reduced from 0.34 mg/L on July 15, 2009 to 0.01 mg/L on April 7, 2010, a 97% decline. Ammonia levels were also highest in the bottom waters and were reduced 55%. Biological oxygen demand (BOD) improved steadily, decreasing to the background detection limit (2 mg/L) by October 23, 2009. This represents a 60% decline in BOD.



Oxygen transfer: On the morning of June 24, the day after the aerators were turned on full-time, oxygen concentrations averaged only 0.7 mg/L (225 kg of oxygen in the entire lake), with surface values topping out at only 1.75 mg/L. Near complete destratification of temperature was achieved by July 8, after 2 weeks of running the aerators full time.



How do we know so much about water? We test it!

Our understanding of how much oxygen is needed to restore and maintain ponds is based on continued scientific testing and research of the biodiversity, chemistry and structure of lakes. Issues that are obvious and similar may have very different causes from lake to lake so the solutions will vary as well. Vertex aeration achieves the best results because we know the data.



Vertex Research Biologist

Water Quality Testing

The knowledge Vertex has gained from testing water chemistry has improved lake restoration plans by:

- ◆ Tailoring them to specific pond or lake issues
- ◆ Targeting the underlying causes of problems
- ◆ Including the most effective techniques (e.g. best time of day or year to treat)
- ◆ Documenting what does and does not work for future reference
- ◆ **Vertex biologists are available to review test results done by others as part of a troubleshooting strategy for difficult lakes and ponds.**



Contour map of the lake at Tivoli Reserve in Boynton Beach, FL.

Lake Mapping for Aeration Placement

Vertex performs bathymetric lake mapping in Florida for ongoing research into best practices for aeration system placement:

- ◆ Knowing the depths throughout the expanse helps determine the correct type, size and placement of AirStations
- ◆ Sedimentation depths show where aeration is most needed
- ◆ Vegetation under the surface gives insight on oxygen needs

Effective aeration solutions take into account the topography of the waterway since variations in depths can be enormous.

We don't make products, we make solutions.

Many companies start by building a product. Vertex was started with John Gardner and his aquatic biologists at Aquatic Systems Lake Management company looking for environmentally friendly and sustainable solutions to their customers lake and pond needs. Vertex continues to operate from the idea that aquatic science should be the driving force behind all of our sales and product development, with engineering specialists to ensure the quality and safety of the products themselves.

Our Team



Research: Our team of biologists and limnologists lead by Dr. Josette La Hée Kitchens and Independent consultant Dr. Amanda Quillen, conduct ongoing studies that include on site and lab testing of water, algae, plant and sediment samples taken before, during and after aeration has been installed.

Sales and Customer Service: Sue Cruz and Conrad Vanderlely are degreed aquatic biologists with years of experience designing aeration systems that produce the best rate of turnover.

Product Design and Manufacturing: Director of Manufacturing Scott Gardner has a natural talent for designing aeration cabinet/compressor systems. His PondLyfe system for smaller ponds is both cost effective and meets our high standards for quality and longevity. All of our systems are assembled at our facility in Pompano Beach and meet the rigorous electrical safety codes for ETL Equipment listing.

The Vertex Dealer Network

Vertex maintains a network of dealers world wide. Our dealers are specialists in lake and pond management with the knowledge, experience and passion to make sure you get the right system for your water's unique needs. Most of them are respected lake management companies in their locations serving customers of all sizes. They don't just want to sell you a product and walk away, they want your pond or lake to be as healthy as it can be.

We only allow lake specialists to specify and sell Vertex systems!

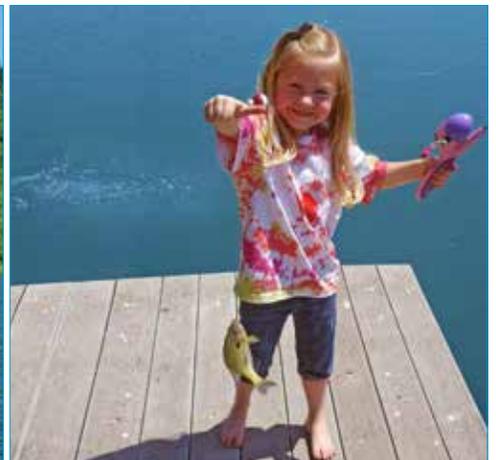


Dr. Josette La Hée Giving a presentation on fish kills at an industry Conference



Vertex aeration sales manager Sue Cruz holds a shirt for one of the winners of the Vertex sponsored Pond Boss Expo Fishing Tournament

Why does Vertex build the best aeration systems? We love lakes!





All of our products are manufactured in Pompano Beach, FL USA