

11. CPA PROJECT APPLICATION FORM

[CPC Use Only: Date Received _____ By: _____
Assigned CPC #2019 - 08 _____]

If possible, use word processor to fill out form. Please answer all questions, use "N/A" if not applicable.

1. a.) Applicant Name and Organization: Last Anderson _____ First Robert _____
Organization(s) (if appropriate) Co-Applicant: Great Pond Advisory Committee _____
- b.) Regional Project: Yes ___? or No? X If Yes, Town/Organization: _____
2. Submission Date: March 15, 2018 _____
3. Applicant Address: St. 270 Whiley Road _____
City/ State: Groton, MA _____ ZIP: 01450-2237 _____
4. Ph. # 978-273-4051 _____ Email: bobandersongroton@me.com _____
5. CPA Purpose. Check all that apply:
Community Housing _____ (Affordable Housing: _____) Historic Preservation: _____ Open Space: :X _____
Recreation X _____
6. Town Committee or boards participating: Great Pond Advisory Committee _____
7. Project Location/Address: Duck Pond & Duck Pond upland buffer area at 228 Whiley Road. _____
8. Project Name: Duck Pond Restoration _____
9. Additional Responsible Parties (If applicable):

Role (specify)	Na me	A d d	Ph. (w/cell)	Email
Property/Site Owner: Upland buffer area	Remigiusz Kaleta	228 Whiley Road	860-389-1435	Remigiusz.kaleta@gmail.com
Duck Pond	Town of Groton	173 Main Street	978-448-1111	mhaddad@townofgroton.org
Project Manager	Robert Anderson	270 Whiley Road	978-273-4051	bobandersongroton@me.com
Project Contractor (or equivalent)	Joe Onorato Solitude Lake Mgmt	590 Lake Street Shrewsbury, MA 01545	508-250-6238	JOnorato@solitudelake.com
Project Consultants				
Other:				
Other				

10. As appropriate, indicate if proposal requires P&S agreement ___ Deed ___
Option agreement ___ Other-describe: Land owner approval received. Will license if required.
11. a.) Assessor info. (map/ block/ lot id.(s)): 131/72/0 _____ b.) Tax classification type: R/A _____
12. Permits required: Zoning: Historic Preservation: Other : Conservation Commission NOI in process
13. Historic Commission Approval signoff (when required): N/A _____ Date: _____
14. Funding: a.) Requested from CPC: \$43.5K (or \$49K*) b.) Committed from other sources: \$ 13K
*see budget option attached
- c.) Annual anticipated total income :\$ N/A _____ d.) Annual anticipated total expense: \$ N/A _____
- d.) Anticipated net income (loss): \$ N/A _____ e.) Estimator name/company: Budget attached
15. CCP Objectives - use codes from **Section 5** to indicate all that apply: **5.3, OSRP 1.2** (see attached)
16. Project Timelines: Proposed Start Date: May 2018 _____ Projected Complete Date: May 2021 _____
17. Estimated Delivery Date of Completion Report to CPC: Annual reports each May _____

18. Project description and explanation (attach additional sheets as needed):
Restoration of Duck Pond, a 26-acre Great Pond that is rapidly eutrophying, by installing a submersed aeration system consisting of a compressor on the shoreline and ten submersed hoses to diffusers at the bottom of the pond at the locations shown on the map. This will restore Dissolved Oxygen at the bottom, resulting in more aerobic bacteria to consume the muck, more oxygen for fish and wildlife, and less Phosphorus released to feed algae and weeds. See attached narrative and flow chart. Project includes six months of aerobic bacteria augmentation for ten acres. It also includes measurements of Dissolved Oxygen, pH, Conductivity, and "muck" depth, and analysis of nutrients Total-Phosphorus, Ortho-Phosphorus, & Nitrates, three times/year at 4 sites. It also includes annual reports to the CPC. See Appendix for Eutrophication Narrative & Flow Chart; Vertex Map, Design Specs, & Data Sheet; Duck Pond photos; and Vertex Case Studies & Catalog.

19. Feasibility: Aeration is widely used to improve pond health (attached case studies)

20. List of attachments: Pg 3: Management Plan; Pg 4: Budget & Donations; Pg 5 Duck Pond Owner Approval; Pgs 6-8: CPC Scoring Criteria; Pg 9: Compressor Site Landowner Approval Pgs 10-13: Groton Organizations' Support Letters; Pgs 14-21: Neighbor Support emails; Appendix: Eutrophication Narrative & Flow Chart; Vertex Map; Vertex Design Specs; Vertex Data Sheet; Photos showing deterioration; Vertex Case Study, Vertex Aeration Catalog (includes more case studies)

21. Additional Information:

The Duck Pond Restoration Project meets Master Plan and OSRP goals and objectives (Pgs. 6-8), is supported by generous neighbor donations (Pg. 4), and expressions of support (Pgs 14-21), and is both urgent and economical.

22. Management Plan: See Page 3

23. Applicant Signature: Robert E. Anderson  Date: 3/15/2018

Co Applicant Signature: J W Zuering, GPAC

Date: 3/15/2018

Co Applicant Signature:

Date:

Duck Pond Restoration Project Management Plan, Risk Analysis

Management Plan:

The tasks required and timing of those tasks are listed on the Budget.

Bob Anderson will manage the project. He has already researched and designed the details of this Duck Pond Restoration Project, raised over \$13K of non-CPA funding, drafted the narrative for the Conservation Commission Notice of Intent and presented at Conservation Commission meetings, resolved the Duck Pond ownership issue with an opinion from Town Counsel, and obtained quotes from multiple potential vendors.

Upon approval of the CPA application, he will schedule and supervise the site preparation by a Contractor, Electrician, and GELD, evaluate and recommend selection of the Lake Management Company vendor, supervise installation, approve invoices, and schedule and supervise water quality treatments and periodic tests/analyses. He will provide periodic reports to the CPC and the Conservation Commission. Mr. Anderson has extensive management experience as a former entrepreneur, a former CEO of a public technology company, and an Advisor to Technology Company CEOs for over 20 years.

Vendor Risk Analysis:

The single expensive item in this CPA is the aeration system, and both the manufacturer and the installer are industry leaders. The Town of Groton has extensive experience with the proposed installer at other Great Ponds.

Budget and Donations

(This application requests use of CPC funds from the 2018 balance)

Item	Timing	Total Costs by Pro	Volunteers Save	Total Cost w/ Vol.
1. Baseline measurements of DO & nutrients	Q3 '17	\$880	\$366	\$514
2. Solicitation of Neighborhood Donations	Q1-'18	\$626		\$626
Printing, Envelopes, Stamps				
3. Conservation Commission NOI:	Q1-'18			
NHESP filing fee; site flags, erosion wattles		\$465		\$465
DeRosa Environmental		\$3,500		\$3,500
4. Site Preparation:	Q2-'18			
Dig trench, install conduit, wires, meter socket		\$5,000		\$5,000
GELD new service fee		\$400		\$400
5. Submersed Aeration System and Installation:	Q2-'18	\$26,600		\$26,600
Power, Diffuser cleaning	18,'19,'20	\$11,100		\$11,100
(\$2500 & \$500 in '18; \$3300 & \$750 in each of '19 & '20)				
6. Aerobic Bacteria Augmentation (6 mos)	Q2,Q3-'18	\$6,000		\$6,000
7. Tests, Analyses (4 sites, 3x/year) & Reports*	18,'19,'20	\$6,300	\$4,000	\$2,300
Dissolved Oxygen, pH, Conductivity, Muck Thickness, Phosphorus-Total, Phosphorus-Ortho, Nitrates				
Annual Reports		\$1,000	\$1,000	\$0
Total Project Cost		\$61,871	\$5,366	\$56,505
less "non-CPA" funds raised		\$13,007		\$13,007
Total CPC Funding Request		\$48,864		\$43,498

Despite including all three years of project costs, the large non-CPA fund donations have kept the CPC funding request the same as the Preliminary CPA application of 1/18/18. (If the CPC prefers fully professional testing and sampling for nutrient analysis, & professional annual reports, an additional \$5K is needed).

	<u>Donations</u>		
Donations of expenses already incurred	\$1,482		
Neighbor donations to Town of Groton	\$10,525		
GPAC donation commitment	\$1,000		
Total "non-CPA" funds raised	\$13,007	21%	23%
Additional required for 25% of Pro total	\$2,461		
Additional required for 25% of Volunteer total			\$1,119

From: David Doneski <DDoneski@k-plaw.com>
Date: March 12, 2018 at 6:36:30 PM EDT
To: 'Mark Haddad' <mhaddad@townofgroton.org>
Subject: RE: Owner approval of Duck Pond Restoration

Mark,

Per our telephone conversation of March 8, I am writing in regard to how the matter of ownership of Duck Pond in the Town of Groton may be treated for purposes of an application to the Community Preservation Committee (CPC) for Community Preservation Act funding to perform weed control/restoration activities in the pond. The issue was identified in your e-mail to me of February 6, 2018, copied below. That message included Robert Anderson's February 5 e-mail to you, describing that although Duck Pond appears to exceed the size requirement for a Great Pond, it has not been so classified by the Department of Environmental Protection (DEP) pursuant to a 'Great Pond List' project undertaken in 1996. You previously informed me that you had signed the owner authorization portion of the funding application, on behalf of the Town. In my view, this is the better approach at present.

Although it may be possible to have the DEP list amended to include Duck Pond, I would expect that the exercise could be a time consuming process and would not likely be completed in sufficient time to allow for the restoration work at Duck Pond to take place this year. I would take the view that having the Town act as the owner (or "for" the owner, presuming that Duck Pond does legally constitute a Great Pond under the ownership of the Commonwealth) is consistent with the protections afforded Great Ponds and the authority of the Town as a municipality and political subdivision of the Commonwealth.

The term Great Pond is defined in Chapter 131 of the General Laws (dealing with inland fisheries, game and natural resources) as "a natural pond the area of which is twenty acres or more." G.L. c.131, §1. Chapter 91 of the General Laws, dealing with "waterways," and the implementing regulations of the DEP at 310 CMR 9.00 define Great Ponds as ponds containing more than ten acres of land in their natural state. See G.L. c. 91, §35. Section 35 also states that such great ponds "shall be subject to any rights in such ponds which have been granted by the commonwealth." Id. "With limited exceptions, the waters of a great pond and the land that comprises the bed of the pond to the natural low water mark belong to the Commonwealth, and the ponds are held in trust for certain public uses." Opinion of the Justices to the Senate, 474 Mass. 1201, 1203 (2016).

Since colonial times, the courts have recognized the authority of both the Commonwealth and the municipalities in which Great Ponds lie to regulate the public use of Great Ponds without reference to the fee ownership of the ponds. See *West Roxbury v. Stoddard*, 89 Mass. 158, 7 Allen 158, 170-171 (1863). Ownership rights of any abutters would extend only to the natural low water mark. See e.g., *Potter v. Howe*, 141 Mass. 357, 359 (1886), cited in *Opinion of the Justices*, supra, 474 Mass. at 1207. See also G.L. c. 131, §45, which provides that "any city or town in which the whole or any portion of any great pond not exceeding five hundred acres in extent is situated may, as to so much thereof, as is located within its boundaries, make and enforce rules and regulations relative to hunting, fishing and boating thereon." Where the purpose of the proposed work at Duck Pond is to preserve it from weed activity which can reduce oxygen within the pond and lead to eutrophication, it is my view that the Town acting as and/or for the Commonwealth in authorizing the application to the CPC is consistent with the long acknowledged public purpose of preserving Great Ponds to the use and good of the public.

Please contact me if you have any further questions on this matter.

David J. Doneski, Esq.

KP | LAW
101 Arch Street, 12th Floor
Boston, MA 02110
O: (617) 556 0007

CPC Scoring Criteria

12.2.1 Function:

1. Meets goals and objectives laid out in current Master Plan and Open Space and Recreation Plan:

The most relevant connection of this CPA to the Goals and Objectives are these two excerpts. Other relevant quotations are further below.

Ground and surface water pollution, OSRP Page 48:

“Some of the larger water bodies in Groton have or have had water quality problems that decrease the aesthetic and recreational values of these resources.[they] have all historically been found to be mesotrophic, the middle stage of a water body’s transformation into a swamp or marsh. Many of these ponds are characterized by the presence of noxious aquatic plants. the Town’s Great Ponds Advisory Committee continues to explore options for better management of these important natural resources.”

Goals & Objectives, Page 79; Seven-Year Action Plan Update, OSRP Pages 81-86:

Goal 1: Promote the preservation of Groton’s important water resources.

Objective 1.2: Maintain and improve surface water quality

Action: Encourage development of comprehensive lake management plans for Great Ponds....

Master Plan:

Sustainability Principles, Page 6. Protect Land and Ecosystems:

“Over the course of its land use planning history, the town has shown enormous concern for the protection of environmentally sensitive lands, natural resources,....critical habitats, wetlands, and water resources. These resources need continued protection..... Going forward, Groton could focus more on other aspects of open space such as recreation....”

Statewide Comprehensive Outdoor Recreation Plan (SCORP), Page 52, and OSRP, Page 74/75:

“Recreation activities with....popularity....include swimming, walking, sightseeing, hiking, and fishing;..... These activities point to needs forbetter access tolakes and ponds.....”

Open Space and Recreation Plan:

Plan Summary, Page 1:

“Maintaining scenic vistas...is important to the community...”

“Groton has also improved several recreation facilities...”

“The community’s dual desires to enhance recreational opportunities and maintain Groton’s rural character by protecting.....natural resources form the foundation for this plan”

Resources of regional significance, Other Ponds, Page 6:

In the next iteration of the OSRP, the following sentence should be included prior to the sentence about Flat Pond, because Duck Pond is twice the size of Flat Pond:

“Duck Pond has access via Groton Conservation Trust land on the north end from Lost Lake Drive and a trail along the Conservation Commission shoreline on the east side with additional access from Little Hollow Road and Duck Pond Drive. It is used for light boating, fishing, and skating.”

Water Resources, Lakes and Ponds, Page 32:

“Two more of the Great Ponds are located near the lake: Whitney or Cow Pond (37 acres) and Duck Pond (21 acres)” [sic: actually 26 acres]

Page 33:

For recreational purposes, public access is provided via protected open space to all Great Ponds located entirely in Groton except Martins Pond.”

Wetlands, Page 36:

Table and text show 4017 acres of total wetlands, of which only 1328 acres are open water (lakes or ponds). Possible interpretation: protect the lakes and ponds from turning into marshes and swamps.

Seven-Year Action Plan Update, Pages 81-86:

Goal 1 is on previous page.

Goal 2. Promote the preservation of important land resources in Groton.

Objective 2.2: Protect lands and water resources of scenic value.

(relevant Goal/Objective, but no specific Action relevant to this CPA)

Goal 3: Provide recreational opportunities for all Groton residents.

Objective: Expand recreational and educational program offerings.

(relevant Goal/Objective, but no specific Action relevant to this CPA)

Goal 4: Promote the efficient management and maintenance of the open space and recreation areas and structures of Groton.

Objective: Implement strategies that will facilitate the care of recreation and conservation areas.

(relevant Goal/Objective, but no specific Action relevant to this CPA)

12.2.1 Function

2. Multiple Funding Sources

The Groton Conservation Commission supports the project and expressed interest in donating significant funds but found that it is not permitted to use the large Conservation Fund and does not have adequate funds in the other accounts. The co-applicant Great Pond Advisory Committee has committed \$1000. The five abutting residents have donated \$4500 to the Town of Groton earmarked for Duck Pond Restoration, and spent \$1482 additional on the Project. Residents of nearby neighborhoods have donated \$6025 to the Town of Groton, earmarked for this project, and solicitations continue. Non-CPA funding to date totals \$13,007, 23% of the total cost if volunteers do testing and sampling, or 21% of the total cost if a lake management company does it all.

12.2.2 Value

1. Overall application quality: CPC feedback has been very positive throughout and the open issues have been addressed in this application.

2. Degree of urgency: The recent rapid deterioration of Duck Pond indicates that the slope of the eutrophication curve has increased significantly. The more weeds, muck, and phosphorus accumulating in the pond, the longer the restoration will take. This is a low-cost approach (relative to herbicides, weed-harvesting, hydro-raking and Alum) that will slow and eventually reverse the eutrophication.

3. Community Support: We have letters of support (Appendix) from the Conservation Commission, the Groton Conservation Trust, the Board of Water Commissioners, and the Groton Lakes Association. We also have supporting emails from 20 neighbors so far.

4. Ease of Execution: Easy execution is indicated by the low cost of the project.

5. Level of Risk: No one or organization has identified any risk areas or negative consequences. The ultimate rate of success can't be predicted precisely, but the widespread use of aeration and the case studies from Vertex (Appendix) indicate a high probability of success with minimal on-going power and maintenance costs.

6. Applicant active in process participation: Several of us attend all CPC meetings of this cycle, and Conservation Commission, Great Ponds Advisory Committee, and Groton Lakes Association meetings as well as keeping them informed about our preparation progress.

DATE: March 14, 2018

TO: Groton Conservation Commission
Groton Community Preservation Committee

FROM: Remi Kaleta, 228 Whiley Road, Groton. Map/block/ID: 131/72/0

SUBJECT: Duck Pond Restoration Project and related CPA to the Groton CPC

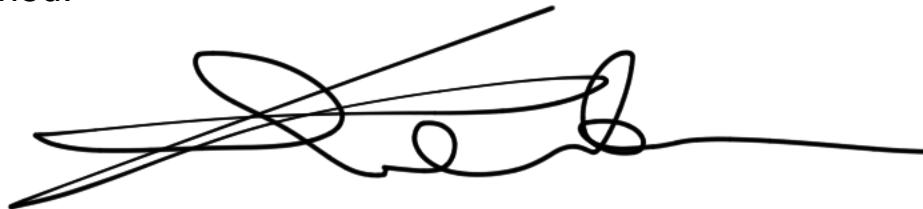
This project proposes to site an Air Compressor equivalent to the Vertex Large Lake HE33 10XL5 on the shoreline between Duck Pond and Whiley Road, near my northern lot line. I give my permission for equipment to access this location and prepare a small site consisting of a 3.5' x 4' level area and a trench for underground wiring from the site up to the nearest power pole. As the system is under 2' high, no wall is required, but the slope just above the system will be contoured to divert any runoff around the system.

To avoid the need to remove the steel guardrail during installation and to avoid the steepest portion of the slope, access from the road will be from south of the guardrail, also on my property.

I assume this installation will be permanent and will allow access for routine maintenance (2/year) and any repairs necessary. If the system needs to be removed, we will allow access for that as well.

I commit to providing whatever documentation the Town of Groton deems necessary to effect this permission and to provide long-term protection for this site, such as a license agreement or contract.

Signed:

A handwritten signature in black ink, appearing to read 'Remi Kaleta', with a long horizontal line extending to the right.

March 14th 2018

Remi Kaleta, 228 Whiley Road, Groton, MA 01450

Date



TOWN OF GROTON
Groton Conservation Commission

173 Main Street
Groton, MA 01450-1237
(978) 448-1106
Fax: 978-448-1113
ngualco@townofgroton.org

Memorandum

TO: Robin Eibye, CPC Administrator

FROM: Nikolis Gualco, Conservation Administrator

DATE: January 17, 2018

RE: Conservation Commission support of Duck Pond Restoration s Proposal.

At its regular meeting on January 9th, 2018 the Conservation Commission discussed with CPC Applicant Bob Anderson (Duck Pond Restoration Proposal) the details of his proposal and the desired effect it would have on Duck Pond. The majority of the Commission expressed support for this project, which if approved would still require the necessary wetland permitting. Mr. Anderson also sought financial support in match funds for his proposal from the Commission. It is unclear whether or not the Commission is permitted to use Conservation Fund monies to support a project such as this and therefore no financial commitment was made to Mr. Anderson. However, several Commissioners expressed an interest in financially supporting the project if possible.

Delivered
Thank you.

GROTON

CONSERVATION P.O. Box 395 Groton, MA 01450

TRUST



gctrust.org

January 4, 2018

Bruce Easom, Chair

Community Preservation Committee
Town of Groton
173 Main St
Groton, MA 01450

Dear Mr. Easom,

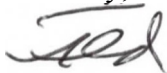
The Groton Conservation Trust (GCT) is a private land trust with a more than 50-year history that owns over 1,400 acres in Groton. The GCT is dedicated to protection, management, and provision of public access to natural lands in town. One of the GCT's parcels, Duck Pond Conservation Area, is located on the eastern side of Duck Pond, and we have trails that run along the pond.

We were made aware of an application from residents of Duck Pond to seek CPA funding for an aeration project to help address the deterioration ("eutrophication") of Duck Pond. We also gained a greater appreciation of the safety hazards from recreational use due to the aquatic weed growth, as well as the issue of declining fish population and the unpleasant smell that are byproducts of the eutrophication. There is evidence that this aeration approach would reduce some of the more damaging effects over a short to mid-term period even as the longer term eutrophication process most likely, would continue. We can also see some benefit in comparing the results from this methodology with other techniques such as harvesting being done at Baddacook Pond.

While the GCT sees the merit of the project, we feel collecting data and analyzing results is a critical element of any funding on our ponds, so we can continue to assess the efficacy of various approaches to minimize the eutrophication that takes place in our local ponds. We are also willing to have two of our Trustees, who teach at the Groton School and Lawrence Academy, respectively to use their students in a project to collect data from the pond.

The GCT appreciates the work that the Community Preservation Committee does and its attention to this matter. If you have questions for us, please do not hesitate to contact me.

Sincerely,



Ted Lapres
President



TOWN OF GROTON
Water Department
173 Main Street. Town Hall
Groton, Massachusetts 01450

Office: 978-448-1122
Fax: 978-448-1123

Superintendent:
Thomas D. Orcutt

Business Manager:
Lauren E. Crory

Commissioners:
John J. McCaffrey Jr.
James L. Gmeiner
Greg R. Fishbone

MEMORANDUM

To: CPC Committee

From: Board of Water Commissioners

Subject: CPC Project #2019-08 - Duck Pond Restoration

Date: January 23, 2018

The Board of Water Commissioners in general supports the application by Mr. Robert Anderson for a non-chemical based approach to treating the weeds at Duck Pond.

If you have questions or concerns regarding our support, please do not hesitate to contact the Water Department.

From: Robert Anderson bobandersongroton@me.com
Subject: Fwd: Groton Lakes Association
Date: March 13, 2018 at 11:08 PM
To: Bob Anderson bobandersongroton@me.com

Page 13

Begin forwarded message:

From: Brad Harper <bradharper4@gmail.com>
Subject: Re: GLA
Date: February 28, 2018 at 3:22:15 PM EST
To: Robert Anderson <bobandersongroton@me.com>

Hi Robert,
Thanks for your patience here.

At this time the GLA can be included as a non monetary supporter of the Duck Pond aeration project.
Please include the GLA as among your listed supporting groups as part of your application package or whatever other material you submit.

Thanks
-Brad

Very Truly Yours, John and Linda Valentine

RM

From: Ryan Meeds meedsr@gmail.com **Subject:** Duck Pond Restoration Project

Date: February 11, 2018 at 4:01 PM **To:** bobandersongroton@me.com

Cc: Brenda Meeds brendameeds@gmail.com, Connor Meeds connor.meeds@gmail.com, colby.meeds07@gmail.com

Good afternoon Bob,

I want to first thank you for your effort in pursuing the restoration of one of Groton's beautiful ponds. We appreciate you bringing this to our neighborhoods attention and are in full support of the project.

Our family moved across the country from Seattle arriving to Groton in 2006 arriving to reside at 57 Duck Pond Road in Groton Woods with the pond directly in our back yard. The first time we visited and viewed the pond and wilderness around it, we knew this was the place for us to raise our young family. Since that time I agree fully that we have witnessed the continuing transformation of a higher volume of weeds, a recessed water line and a shore line increasing in mud "muck" making activities like kayaking and other less pleasurable.

Caring deeply about not just Duck Pond, but all of the lakes and ponds in our town, my son Connor Meeds even spent a good amount of his summer and weekends choosing to volunteer for the Groton Conservation Department while teaching and protecting boaters from the spreading of infectious weeds into Lost Lake.

We are happy to contribute \$200.00 to the project as well my boys Connor and Colby are contributing another \$100.00 for a total \$300. Additionally I will add that if any part of the future restoration project of Duck Pond were to require or have a need for volunteer labor, I would be happy to donate my time and labor.

Thank you again for your and the entire supporting teams efforts and please let me know if we can be of assistance.

Best Regards

Ryan and Brenda Meeds, Connor and Colby Meeds 57 Duck Pond Road Groton, Ma, 01450 978-272-1040

JG

From: Jim Glatiotis jglatiotis@gmail.com **Subject:** Support for Duck Pond Restoration

Date: February 17, 2018 at 8:21 PM **To:** bobandersongroton@me.com

Hi Bob,

Thank you for stopping by to discuss the effort to raise funds and solicit expressions of support for the project to restore Duck Pond. In past years I have enjoyed this picturesque treasure many times, and feel fortunate to have have had such a beautiful natural area right across the street from my home. I certainly support the allocation of funds to restore the pond to its former state.

Sincerely,

Jim Glatiotis 150 Duck Pond Drive

BE

From: Bill Ellerkamp bill.ellerkamp@gmail.com **Subject:** Duck Pond Restoration Project

Date: March 5, 2018 at 10:30 AM **To:** bobandersongroton@me.com

Hi Bob,

Thanks for stopping by Saturday and promptng us to act on the Duck Pond Restora8on Project. Susan and I are happy to contribute to this worthy project. We regularly walk, at least several 8mes a week, in Skinner Forest and around Duck Pond. It is a beau8ful area "right in our back yard", which we want to see maintained for the pleasure of all!

We have mailed a check, in the amount of \$500, to the Town of Groton in support of this project. Thank you for your service to the community!

Best regards,

Bill and Susan Ellerkamp 212 Whiley Road

T

From: Thompson thompsonmonty@comcast.net **Subject:** Duck Pond

Date: February 23, 2018 at 12:40 PM **To:** bobandersongroton@me.com

Hi Bob

We were away for the past week and we are just now reading your letter. Please include us in any action to support the restoration of Duck Pond. We donated \$1000 before we left for vacation on the 15th and I am hoping you received it. We mailed the donation with the envelope included in the information you gave us. If you need any assistance I would be happy to help. I am a stay at home mom and I have time to help with mailings or phone calls.

If you need further monetary donations we may be able to help.

Warmest regards, Johanne Thompson 508-574-1379



From: Katie Novak novak414@gmail.com **Subject:** Re: Duck Pond

Date: February 28, 2018 at 6:32 PM **To:** Robert Anderson bobandersongroton@me.com

Bob-

Thanks so much. I will send in a check this evening.

As for the trails, they were one of the main attractions for buying our house. In the spring, we hike the trails daily. When my youngest son, Boden was only a couple of weeks old, we packed him in the Baby Bjorn and hit the trails with the other three, who were only 5, 4, and 4 at the time, with us. Now that they are a little older, my oldest three kids love hiking along in the spring, jumping over muddy puddles pretending they are lava. Our dog, who is almost 17, is thrilled to sniff around and roll around in the sun. In the summer, we take nightly strolls, when the mosquitos aren't too bad, and skip rocks on the pond. In the winter, we taught our kids to snow shoe on those trails. On Christmas Eve, we hid carrots in the trails for the reindeer. We haven't adventured out in kayaks yet, but it's on the to- do list. We definitely support a project to keep the woods and the pond in their pristine shape so many families in the future can enjoy nature and time together without a screen in front of them. Being surrounded by the wilderness is what makes our town so special, and investing in that lifestyle is a great opportunity to preserve it!

Please let me know who else I can send this email to, if necessary.

Katie and Lon Novak 195 Duck Pond

Katie Novak, Ed.D. Educational Consultant Author of [UDL Now](#), [UDL in the Cloud](#), [Universally Designed Leadership](#), and [Let Them Thrive](#) www.katienovakudl.com @KatieNovakUDL



From: Robert Anderson bobandersongroton@me.com **Subject:** Fwd: Pond

Date: March 13, 2018 at 1:38 PM **To:** Bob Anderson bobandersongroton@me.com

From: Kathryn Ellis Moore <kathryn.ellis.moore@gmail.com> **Subject:** Re: Pond **Date:** March 12, 2018 at 10=00=56 PM EDT **To:** Robert Anderson <bobandersongroton@me.com>

Town of Groton re: Duck Pond Restoration Project

We would like to express our support for the work that's been done to support Duck Pond 's future. Our family of 4 has been fortunate to live adjacent to the Pond since 1994. We can't say enough about how important this pond and beautiful area means to us. We have no plans of ever leaving. Its sustainability is so very important to us. We wholeheartedly support the actions of Duck Pond Restoration Project.

Kathryn & Michael Moore and Family

From: Kanti Mann <kantimann@gmail.com> Subject: Support for Duck Pond Restoration and Preservation
Date: February 8, 2018 at 12:31:39 PM EST To: Judy & Bob Anderson <bobandersongroton@me.com>

TO: Board of Selectmen Groton FROM: Kanti and John Mann

Greetings:

John and I are honored to help the Duck Pond restoration efforts in any way possible. To show our support, a check for \$500 is on its way to you today.

I cannot tally the time I spend watching the seasons and wildlife work their wonders on and around the pond. Hearing the sounds of and watching the skaters in the winter, seeing walkers of all ages on the trails, and beavers playing in moonlight reflections at night is a constant source of peace and fulfillment for us both.

We fell in love with Duck Pond and our little home in the late 90's, and continue to marvel at our fortune. To us, it is simply unthinkable that the tranquility and beauty of the pond could be lost at any time in the future. Especially now, when we actually know (thanks to much hard work by our many smart and dedicated neighbors) that viable solutions to the pond's ailments exist.

Please count on as for as much support as we can offer. Sincerely,

Kanti and John Mann 290A Whiley Road Groton, MA 01450



From: sblieden@rcn.com Subject: Duck Pond Restoration Project support

Date: January 28, 2018 at 9:19 PM To: bobandersongroton@me.com

Hi,

My husband, Ira, and I moved to Groton recently. We were attracted to Groton in a large part due to the beautiful wooded areas and scenic neighborhoods. We would like to see the Duck Pond Restoration Project move forward in order to maintain the town's natural beauty and walking paths.

Thanks, Sue Blieden

SB

From: Suzanna Black suzanna1939@verizon.net **Subject:** Duck Pond

Date: March 1, 2018 at 11:24 AM **To:** bobandersongroton@me.com

I support the Duck Pond Restoration Project. The good health of Duck Pond is important to neighbors for quiet recreation and to the local wildlife (beaver, otter, fox, deer, fisher, and more) for sustenance. It is a valuable asset to the whole community. Sincerely, Suzanna Black 437 Lost Lake Drive.

Sent from my iPad

JJ

From: James Joyce joycejr2@gmail.com **Subject:** Project support

Date: February 21, 2018 at 4:45 PM **To:** bobandersongroton@me.com

The Joyce family of 51 Duck Pond Drive, Groton, MA, supports the efforts to restore Duck Pond for both ecological and recreational reasons. We would like to see more fish and wildlife, less nuisance weeds, and less "muck". Duck Pond should be maintained as a natural open-water resource for public enjoyment.

We support the installation of an submersed aeration system and urge the Community Preservation Commission to submit this proposal for a vote at the 2018 Spring Town Meeting.

Thank you, James Joyce 51 Duck Pond Drive Groton, MA 01450

PR

From: Peter Rowden pete.rowden@yahoo.com **Subject:** Duck Pond Restoration Project

Date: February 18, 2018 at 5:03 PM **To:** bobandersongroton@me.com

Cc: Peter Rowden pete.rowden@yahoo.com

Hi Bob,I tremendously enjoy Duck Pond's walking trails and seeing the wild life. I have sent a check of \$500 to the Board of Selectmen's office.Best,Pete and Cathy Rowden

D

From: dennisjmurphy@charter.net **Subject:** Duck Pond Restoration Project

Date: March 6, 2018 at 1:49 PM **To:** bobandersongroton@me.com

I support the objective of the Duck Pond Restoration Project to reverse the eutrophication of the pond.

GN

From: Gleb glebu@comcast.net **Subject:** Re: Duck Pond Restoration Project

Date: January 27, 2018 at 4:17 PM **To:** bobandersongroton@me.com

Dear Robert -

Thank you for organizing the community fundraising to support the Duck Pond Restoration Project. This was on my mind for a while and I am glad to see the initiative being taken on this urgent issue. I will send a check for \$500 to the Town of Groton as my initial donation. Please keep me informed on the progress and feel free to call me.

Kind regards, Gleb

Gleb Nechayev 358 Whiley Road Groton, MA 01450

JA

From: Jean Armstrong jean_armstrong@verizon.net **Subject:** Duck Pond Restoration Project

Date: February 26, 2018 at 9:26 AM **To:** bobandersongroton@me.com

Hi Bob, Mike and I are making a \$100 donation for the Duck Pond Restoration Project. We support this effort to protect the open spaces in Groton. Thank you for your efforts toward this project.

Jean Armstrong, Mike Milano 1 Little Hollow Lane, Groton

ED

From: Emily Davis butterfield.emily@gmail.com **Subject:** Duck Pond Restoration Project Donation

Date: February 1, 2018 at 5:21 PM **To:** bobandersongroton@me.com

Hi Bob, Andrew and I have donated \$50 to the project and mailed it to the town. Thank you for all you do and good luck!

Emily Davis 176 Whiley Rd.

TS

From: Tracy Stiles stilestjk@gmail.com **Subject:** Duck Pond Restoration Project

Date: March 3, 2018 at 10:16 AM **To:** bobandersongroton@me.com

Hello, I have just mailed a check to the Town of Groton in the amount of \$250 in support of the Duck Pond Restoration Project. Thank you!

Ken & Tracy Stiles 151 Duck Pond Drive Groton

MS

From: Amy St. Pierre amy.stpierre@gmail.com **Subject:** Duck Pond Restoration Project

Date: February 26, 2018 at 8:10 PM **To:** bobandersongroton@me.com

Hi Bob, Mark and I would like to donate \$50 towards the Duck Pond Restoration Project. Thank you for making this all happen. Thank you,

Mark & Amy St. Pierre 200 Duck Pond Drive 978-448-8264

Appendix Index

Pages A1-A2:	Duck Pond Eutrophication Narrative
Page A3:	Eutrophication Flow Chart
Page A4:	Map of Duck Pond with Diffuser Locations
Page A5:	Vertex Design Specifications
Page A6:	Vertex Data Sheet for LLHE33
Page A7:	Photos: Recreation & Views in past years
Page A8:	Photos: Wildlife in past years
Page A9:	Photos: Weeds in recent years
Page A10:	Photos: "Muck" prevents water access & is a hazard
Pages A11-A15:	Vertex Case Study: East Twin Lake
Pages A16-A26:	Vertex Brochure with more case studies

Duck Pond is a 26-acre Great Pond that is deteriorating (“eutrophying”). The symptoms are a recent rapid annual increase in nuisance aquatic weeds and an increasingly thick sediment layer of organic material (“muck”). There also has been a decrease in water clarity and fewer fish (fishermen), otters, beavers, and herons. The weeds and bottom muck also are a recreation barrier and safety hazard. The attached photos show the pond in past years and the recent weed growth. They also show some of the wildlife that used to be plentiful.

The increased weed growth indicates an excess of nutrients (the definition of eutrophication), particularly phosphorus, which was confirmed by Nashoba Analytical in August 2017 (.04-.06 mg/L while the EPA water quality criteria specifies under 0.025 mg/L). An ever-thicker layer of bottom muck indicates insufficient dissolved oxygen (DO), which kills the aerobic bacteria needed to consume the organic material like dead weeds and fallen leaves. The replacement anaerobic bacteria can release hydrogen sulfide that is toxic to fish. The lack of DO also creates a “dead zone” along the bottom, which kills or drives out insects, fish, and other wildlife, and it enables more phosphorus to be released from the nutrient-rich sediment layer to feed plants and algae, thus increasing the biomass.

This deteriorating cycle is illustrated in the red portion of the attached flowchart. Insufficient dissolved oxygen causes the results described above. As the organic material is not consumed completely, the bottom muck gets thicker, making the pond more shallow, enabling more sunlight to reach weeds and becoming a barrier to recreation and a safety hazard as described below. Finally, the excess nutrients in the muck, particularly phosphorus, are released to cause further weed growth, which increases the biomass. The long-term reproduction and decomposition of the large biomass causes rapid sediment accumulation that changes the ecosystem from a pond to a wetland marsh.

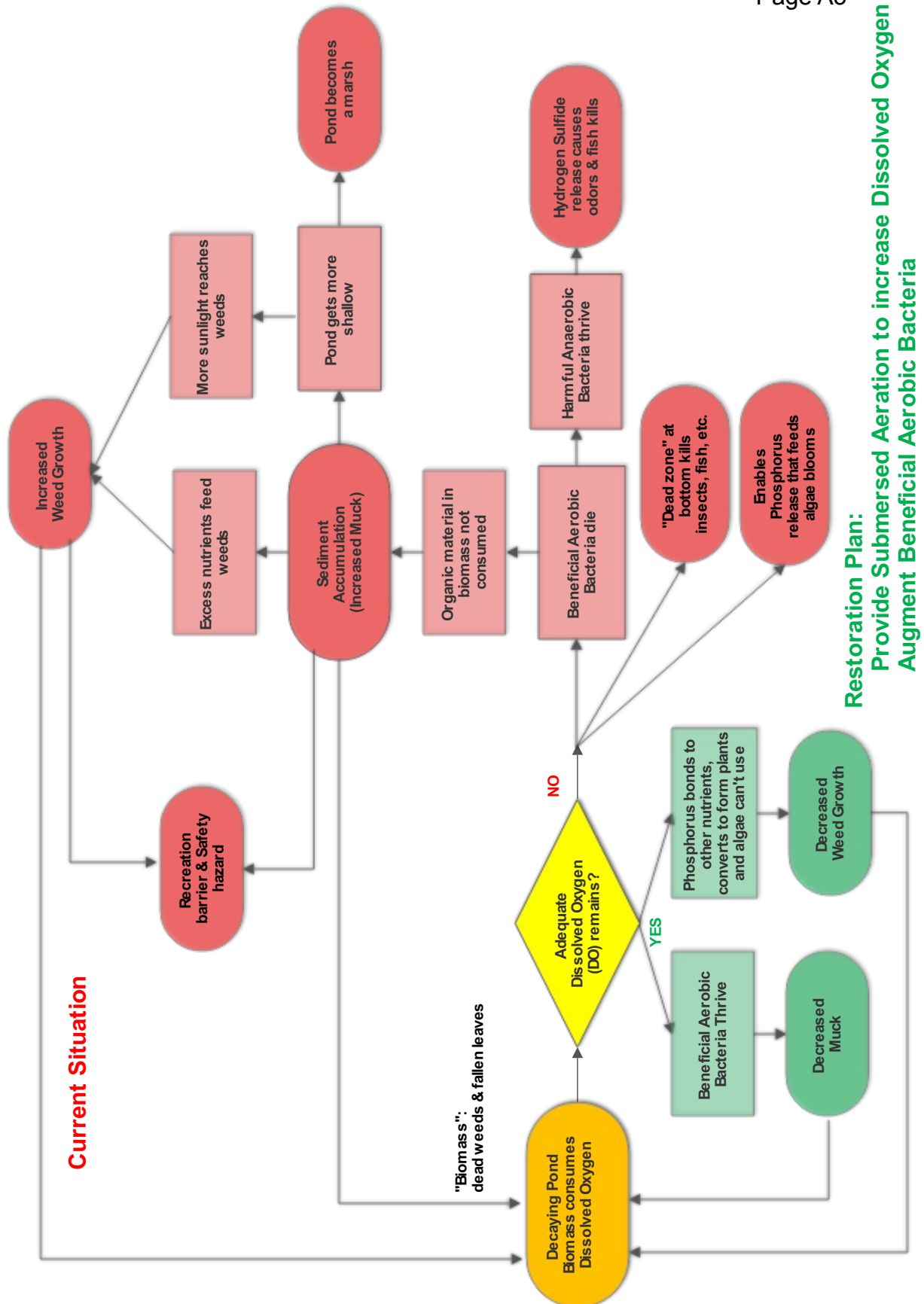
In addition to the environmental impact, the eutrophication of Duck Pond will result in the loss of a beautiful, quiet, natural recreation area and viewscape. There already is a safety hazard caused by the thick weeds and quicksand-like bottom muck for anyone falling out of a kayak or canoe. The thick weed cover and decreasing water clarity cause an even greater safety hazard for someone on a stand-up paddleboard (SUP) because unseen submerged branches can be hit with a fin, causing the rider to fall off. There are recreation barriers for all boaters because a barrier of thick muck prevents access to the pond when the water level drops in the summer, and the thick weeds drag on paddles and fins.

Without pond maintenance to slow the eutrophication process, Duck Pond will become a marsh and will lose the diverse wildlife that have been observed and photographed for years. Without pond maintenance, recreation activities such as canoeing, kayaking, stand-up paddle-boarding, fishing, and ice skating will be lost, as well as the attractive viewsapes enjoyed by those using the Groton Conservation Trust and Groton Conservation Commission trails around the pond.

The proposed Duck Pond Restoration Project includes the installation of an aeration system compressor on the shoreline between Duck Pond and Whiley Road, between 228 and 260 Whiley Road. This location is recommended by GELD as it is near

electrical power that can be trenched from a pole to the system. Ten hoses will pipe air from the system to submersed diffusers at the locations shown on the enclosed Vertex map/diagram. The small air bubbles from the diffusers carry low-oxygen water from the bottom to the surface where it mixes with oxygen-rich surface water and atmospheric oxygen before sinking back to the bottom. After sufficient dissolved oxygen has been restored along the bottom of the pond, aerobic bacteria will return naturally to start consuming the muck and re-establishing a healthy environment for fish and other wildlife. A monthly augmentation of beneficial aerobic bacteria will accelerate this process. The result will be the cycle illustrated on the lower (green) portion of the flowchart. Adequate dissolved oxygen will enable aerobic bacteria to thrive, which will consume more of the muck. It also will help phosphorus to bond to other nutrients and become unavailable to plants and algae, reducing weed growth in the long-term. Less muck and less weed growth will reduce the pond biomass.

The objective is a restored healthy ecosystem and recreational resource in Duck Pond.





Vertex Water Features

Lake Aeration Systems & Floating Fountains
Tel: (800)432-4302 / Fax (954)977-7877

Solitude Lake Management Duck Pond

LL HE33 10XL5



Legend



Compressor Cabinet
XL5 AirStation
BottomLine Tubing

Optional Equipment

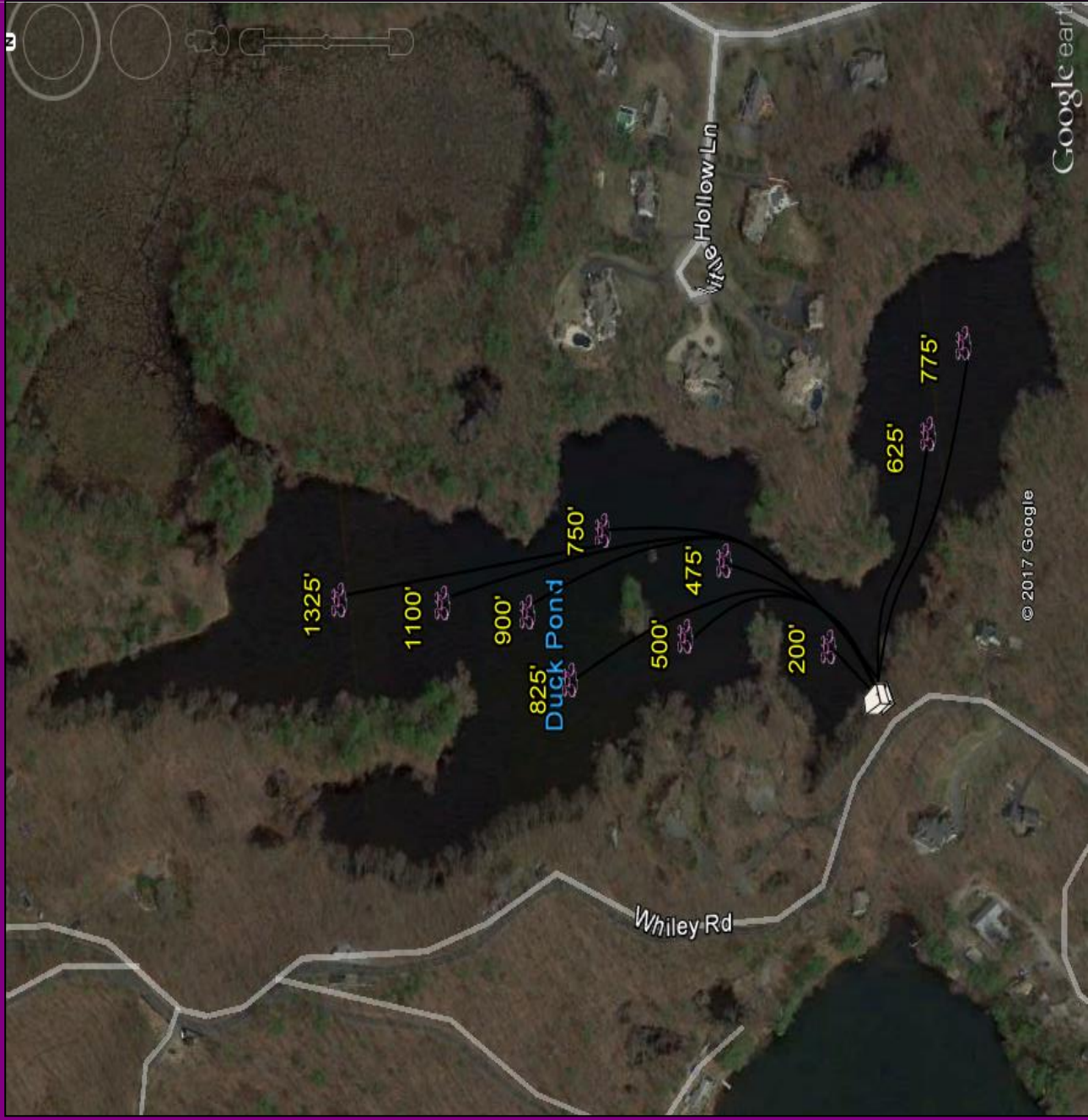


Shoreline Valve Box
1" PVC Pipe

Site and System Specifications

Surface Acres:	24.5
Perimeter Feet:	8,125
Lake Volume, Gal.:	28,286,401
Total Acre Feet:	87
# of XL5 AirStations:	10
CFM / AirStation:	2.96
GPM / AirStation:	3,859
Daily Pumpage:	55,565,844
Turnovers/Day:	1.96
System PSI:	11.8

Date: 12/19/17



Your Custom Vertex Aeration System Design Specifications

Lake Solutions Ver. 17 May 2016

Customer Name:	Solitude Lake Management
Contact Name:	Joe Onorato
Site Name/Number:	Duck Pond
Date:	December 19, 2017
Vertex Biologist:	Tamerra Jones

Surface Acres:	24.50
Perimeter Feet:	8,125
Slope Ratio Relative to 1	7.5
Average Center Depth:	4.0
Average Depth	3.5
Circulation Constraint Percentage	0.0
Total Acre Feet	86.8
Lake Volume (Gallons)	28,286,401
Monthly Influent Volume (Gallons)	0
Total Volume Requiring Aeration (Gallons)	28,286,401
GPM / XL5 AirStation	3,859
Gallons Pumped / Day	55,565,844
System Working Pressure (PSI)	11.8
Air Delivery Per AirStation at Depth(CFM)	3.0
Number of XL5 AirStations Specified:	10
Complete Turnovers / Day	1.96

Terminology

Surface Acres:	Total Surface Acres of Entire Water Body
Perimeter Feet:	Distance in Feet Along The Shoreline Around the Water Body
Bottom Slope Ratio :	Distance in Feet From Shoreline For Each Foot Increase in Depth
Average Center Depth:	Average of Depth Readings in Deepest Areas
Average Depth	Average Depth of Entire Lake in Feet
Circulation Constraint %	Reduced Circulation Due to Narrow Lake Areas, Islands, Etc.
Total Acre Feet:	An Acre Foot Equals One Acre One Foot Deep
Lake Volume :	Volume of The Entire Water Body Expressed in U.S. Gallons
Influent Volume:	Water Flowing into Lake that Requires Additional Aeration Capacity
GPM	Gallons of Water Pumped Per Minute
Gallons Pumped / Day:	Total Gallons of Water Pumped by All AirStations Per Day
PSI	Pounds Per Square Inch
CFM	Cubic Feet Per Minute
# of XL5 AirStations:	Recommended Number of XL5 AirStations For Proper Aeration
Turnovers / Day:	Number of Times Per Day the Entire Volume of The Water Body is Pumped From the Lake Bottom to The Lake's Surface



Vertex Water Features

2100 NW 33rd Street, Pompano Beach, Florida 33069

Tel:800-432-4302 / Fax:954-977-7877

www.vertexwaterfeatures.com

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Vertex LL 33HE™ Compressor System



Do you want to control unsightly and harmful algae blooms, eliminate foul odors, reduce muck, improve fisheries and add life giving oxygen to your waterway?

The new Vertex LL 33HE™ high efficiency air compressor system is ideal for aerating larger lakes, inland canals, harbors and marinas. The LL 33HE provides you our most advanced technology yet in large single phase compressor systems for restoring impaired waterways.

Features & Benefits

- ♦ **Powerful:** Brookwood super-duty 230V single phase HighFlow™ compressors provide 30 PSI of working pressure, for depths up to 50' deep.
- ♦ **Higher Efficiency:** Brookwood HighFlow™ systems reduce monthly electric bills about 40% over rotary vane and 10% over other piston compressor systems.
- ♦ **Total Airflow:** 33 Cubic Feet/Minute – Industries highest flow rate and a 50% increase over our next largest single phase system.
- ♦ **Epoxy Coated Compressor Heads:** New corrosion protective coating protect components against demanding summer temperatures and high humidity.
- ♦ **Extended Service Intervals:** When operated 24/7, the compressor service interval is typically every two to three years.
- ♦ **Compressor Cabinet:** Heavy gauge, powder coated, reinforced and welded aluminum construction with stainless steel fasteners.
- ♦ **Redundant Cooling System:** Three oversized 7" axial fans with excess capacity to protect compressors from over-heating and premature motor failure for world-class reliability.
- ♦ **Vertex SafeStart™:** This exclusive technology boosts airflow while allowing safe, automatic restart following power supply interruption.
- ♦ **Versatility:** System is totally customizable, operates all models of Vertex AirStations™, BottomLine air supply tubing and VBS remote valve boxes as needed.
- ♦ **World's Best Warranty:** 3 years parts coverage on compressor system excluding wearable parts (air filters and compressor maintenance kits), 5 years on all AirStations™ and 15 years on BottomLine™ air supply tubing. See our website for details.



Up Your Game with Vertex quality and performance.

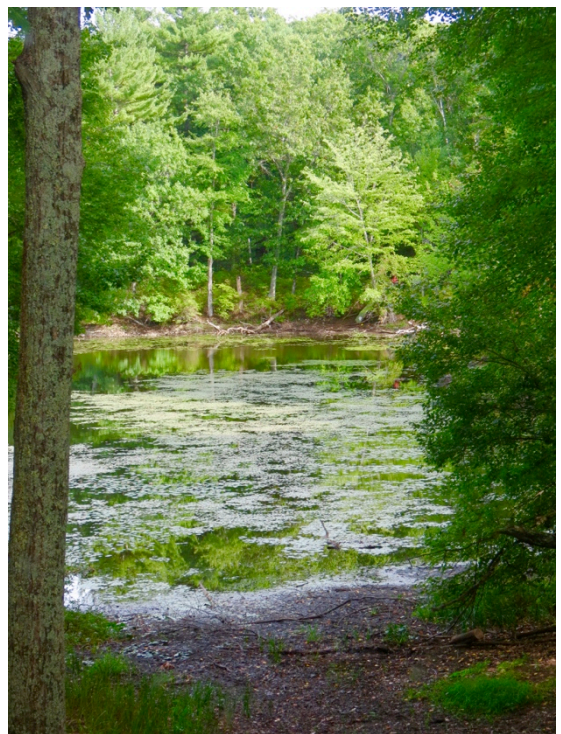
Call Vertex Water Features today for free consulting and design services and the location of a dealer near you.



(844) 432-4303
www.vertexwaterfeatures.com







A risk to anyone in the pond, and it prevents access when water level drops



Aerators Case Study: East Twin Lake, MI

Muck Reduced an Average of 2.8' in 10 Years - An Independent Study on the Effectiveness of Vertex Aeration to Eliminate Accumulated Sediment

A report commissioned by an independent party (in Michigan, USA) demonstrates the reduction of organic lake bottom sediments after the installation of a properly designed aeration system.

"In this study, a Vertex CoActive AirStation XL system (see installation diagram below) was designed and installed. Delivering oxygen to the lake bottom using this system is a very effective way to introduce oxygen into eutrophic water. Oxygen is necessary for the bacteria to thrive, and it is the bacteria that do the important work of digesting the nutrient rich sediment.

Detailed data reports are available at the end of this paper.

So again, with our assistance positive results are obtained by using aeration in a troubled aquatic environment. How many years of water quality problems, particularly those associated with cyanobacteria will we need before governments take a serious look at phosphorous laden sediment, and then take serious action to remediate the problem?" - *Twin Lakes POA*

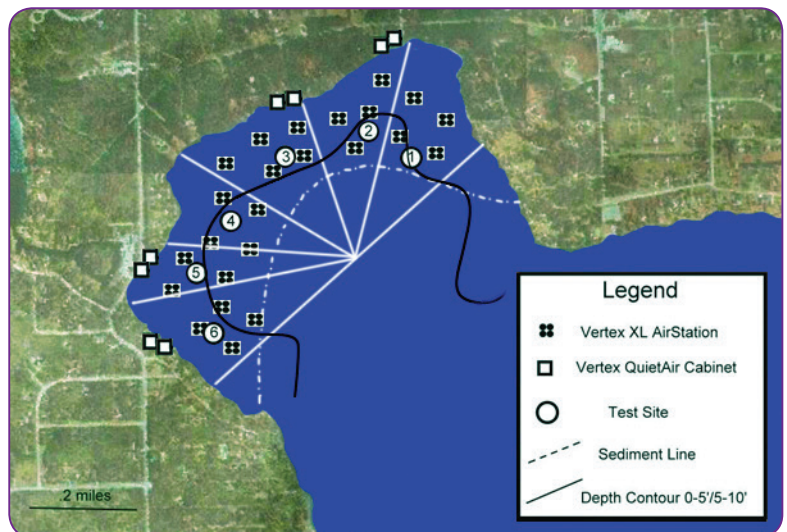
Lewiston's East Twin Lake Develops An Aeration System

By Gregory Bator
East Twin Aeration Association, LLC
Twin Lakes Property Owners' Association, Board Member

East Twin Lake is a shallow lake in Montmorency County. The lake, along with its Association sister West Twin Lake, form the heart of Lewiston's determined return to the glory days of its timbering heritage at the turn of the last century. East Twin covers about 900 acres of surface area with 9,300 perimeter feet of shoreline. The lake contains roughly 192 million gallons of water.

Lewiston's timbering times gave this bucolic area its identity, and perhaps more. Almost 100 years since the fires which destroyed the lumbering mill housed on the banks of the East Twin Lake, lake users confronted the timbering past as water levels receded in 2000. Boaters were frequently surprised by a sudden bump as they glided boats across the water. The bump was from the remaining upright pillars that supported a small gauge railroad track that extended far into the lake.

A community project removed over 90 dangerous timbers from the lake in 2002. In clearing the lake from these obstructions, discussion turned to the noticeable levels of sediment in East Twin Lake, primarily concentrated at its west side. Was this sediment a sawdust gift from our timbering forefathers that was stored on our sandy-bottomed lake? In 2002, we were determined to come to the aid of our upper mesotrophic lake. We were not satisfied seeing our lake filled with unsightly and increasing sediment.



East Twin Lake Aeration Study

Site map of sediment location, depth contours, sampling locations and Vertex aerator placements

The Problem

East Twin is a relatively shallow lake. Depths range four to eight feet, with some areas no deeper than about 26 feet. The lake bottom is primarily a hard sandy surface. During a period of low water levels, the high sediment level at the western end of our lake became more prominent. The sediment occupied as much as six of the eight feet of depth in many locations. These levels were unacceptable to boaters, water enthusiasts, and fishing aficionados. Our problem area is located at the western end of our lake. This area consists of 160 acres of surface area. An existing island on our lake and a sand bar, which traverses from the island to the northern shoreline, roughly contains it.

How could we rid our lake of this unacceptable sediment? Once we confronted this question, our goal developed. We were determined to improve water quality/clarity, improve property values, and increase lake enjoyment, by decreasing the sediment level.

Studying Our Sediment Problem

Our suspicions that the sediment was submerged sawdust from the timbering operations were unfounded. One of our initial tasks was to determine the composition of our sediment. There were two primary reasons for this work. First, we wanted to ensure that the material was not toxic or harmful if we disturbed the substance. We also recognized that removing a dangerous substance could be very costly, and perhaps beyond a volunteer reach. Second, we wanted to learn the sediment composition in order to design an effective decomposition program.

We engaged the services of a water testing company who analyzed samples of our muck. The sampling study revealed that our sediment consisted of natural organic material including, but not concentrated with sawdust. Armed with this information, we turned to the selection of removal options.

Determining our Options

Undesired sediment could be removed by dredging. We learned that dredging involves two costly steps: the removal process and the disposal process. While removing the sediment could be achieved at considerable expense, securing nearby elevated land to store the material posed a financial burden beyond our means.

Adding biologic agents, tiny bug-like microbes, was another possible solution. The prospect of dumping drums of biologic agents into the lake and charging these agents with the task of eating our muck was cast aside. This also is an expensive process that must be continually repeated. A certain risk that we might be introducing an unknown harmful agent to our waters also dissuaded us from this approach.

We chose to use an aeration method. Adding oxygen to our lake would act similar to a bubbler in our childhood fish tank. Bubbles would circulate water, aerobic activity would thrive, water clarity would improve, and water quality would be enhanced.

Organizing Our Resources: People and Money

The initial study and project determination was made by a small core group of lake supporters spearheaded by Alan Kiriluk, an ardent lake supporter. This group formulated a proposal to identify, fund, and solve our lake's sediment issue. The issue was publicized through our lakes' association newsletter and presented in an hour-long forum at our association's annual meeting in 2003.

The approximate 90 lake supporters received a detailed proposal describing the method of attacking the sediment issue and the level of financial support needed to begin the project. The financial projection assumed that monetary support of all lakefront owners would not be received. The financial targets were built based upon participation of only 30% of lakefront owners and a small group of lake access users. We determined that we would gladly confront the issue of having raised too much money, rather than not enough.

The lake association endorsed the project. Mailings were distributed to all lakefront and lake access property owners requesting their financial support of \$5.14 per linear feet of lakefront owned or for back lot owners a flat amount of \$257. Most importantly, we indicated that if our target of \$50,100 was not raised by a date certain four months later, the project would be stopped and all funds would be returned. Coupling this deadline with a specific proposal and solid information were critical to the project's success. Through personal solicitations, newsletter articles, and direct mailing, approximately \$60,000 was raised within a four-month period to meet the project's deadline.

Engaging Professional Services

We determined that an aeration system must be professionally installed and maintained. Several methods of artificial aeration exist. Air can be introduced to a lake by injecting air in the lake, mechanically mixing the water, or agitating the water with paddles or fountains. We chose to inject air into the lake through the use of submerged diffusers that are fed air pumped by shoreline compressors through heavy tubing resting on the lake bottom.

A national company skilled in aeration systems for industrial and large residential projects, Vertex Water Features, was chosen to assist our efforts through their local affiliate Tri-County Aquatics, Inc. Further study and design work was performed.

Our aeration effort is concentrated in the lake's west end where the sediment problem was most prominent. We contracted for the purchase and installation of eight land-based compressors that would each feed three diffuser units. Each diffuser unit consists of four rubberized membranes containing multiple tiny holes. In total, the four compressors would feed 24 diffuser units consisting of 96 membrane bubbleers.

Our total project cost was \$44,000.00 in 2004 with an anticipated six to seven thousand dollar professional maintenance and utility expense annually.

Legitimizing the Organizational Effort

The East Lake Aeration Association, LLC was formed with the State of Michigan. Insurance coverage was obtained in the unlikely event unforeseen problems developed. Three property owners and our local township were solicited to house the compressor units on the shoreline of their property. Arrangements were made to bring electrical supply to each compressor unit.

Application was made with Michigan's Department of Environmental Quality (DEQ). Securing the permit to conduct the aeration program was an extensive process. We were required to establish the authority to place the aeration units within the riparian interests of adjoining property owners. We were also required to present the detailed locations of the proposed units and their impact on the lake and its fish population. The DEQ conducted additional study in coordination with the DNR fishery experts, before approving the permit.

The permit was granted. Installation was completed in July 2004 when the aeration units were turned on.

How Does Aeration Work? What Does it Accomplish?

We knew that the sediment levels in our lake created low oxygen levels in the muck. When low oxygen levels are present the water's condition is anaerobic. This is undesirable. When aerobic conditions exist, tiny aerobic organisms can exist to naturally eat up or decompose the sediment at faster rates. This was desired.

Initially, most people believe that the air introduced into the lake supplies the requisite oxygen to create aerobic activity. This belief is not correct. The aeration units pump air into the membranes that create columns of bubbles that circulate the lake's water from bottom to top. When water is exposed to the atmosphere it is oxygenated from a process called diffusion. The chief operative characteristic of our aeration units is actually water circulation.

Our aeration units operate once the lake ice disappears in April and are turned off when the ice reappears in November. The diffuser units and the air hose tubing remain in the water year round; nothing is removed.

When activated, the units operate continuously day and night. The operating units are housed in protected metal cabinets and contain two 1/3 hp compressors. The units are quiet and trouble-free. In total, the units are connected to 12,000 feet of self-weighted bottom line tubing that remains at the lake's bottom. On only one known occasion, a low drafting boat pulled the tubing, with no apparent damage to the boat or tubing. The tubing is connected to 24 diffuser units that each creates four columns of tiny bubbles at the water's surface. The 24 diffuser units are situated in specifically designed locations. The units are not moved. On rare occasions, a unit placed in shallow water surfaces. When this occurs, the unit is weighted and returned to the bottom. On average we have replaced one diffuser unit each season that becomes damaged by ice or contact with a boat if surfaced. When operating, the diffusers present no risk or interference with normal water activities.

The diffuser system circulates over 200 million gallons of water daily. This water circulation allows the biologic oxygen demand (BOD) to reach levels necessary for aerobic activity to occur in the lake. BOD is widely used in environmental engineering practice to determine the amount of oxygen water requires for the sediment breakdown process. Before the aeration program began, the heavy sediment areas were anaerobic.

In other words, the lake was relatively stagnant, holding increasing amounts of suspended muck, with no aquatic organisms existing to eat up the unwanted sediment.

Is Aeration Working? Yes. Is our Sediment Gone? No.

We still have sediment in our lake, but less than before. In our initial project proposal we forewarned everyone that the aeration approach did not seek quick or dramatic results. We entered this program with eyes wide open and spirits prepared for long-term results only. We hoped to reduce our sediment levels by 6 inches per year.

We appear to be exceeding our conservative projections. Testing results are demonstrating continual drops in the undesired sediment levels. After two and a half years of operation, tests are revealing approximately two feet less of sediment in our lake. These tests are conducted 4 times per year in the same locations. Data retrieved from the tests demonstrates reduced sediment levels. These are encouraging results.

Anecdotal reports of lake users have been positive. Increased wildlife has been identified, perhaps attracted by the sediment particles being pushed to the surface. Improved water clarity has also been noted with some west end lake users now being able to see their sandy bottom.

Observations at the 10 Year Mark from TriCounty Aquatics

The average muck depth has gone from approximately 4.3ft to 1.5ft over the past ten years; giving a yearly average reduction of 3.36". It is important to note, however, that most of this reduction occurred within the first 6 years after the installation of aeration. Average muck levels from 2009 to present, have shown little reduction in muck depth and seem to have stabilized. This stabilization could potentially be explained by the fact that some compounds that form during the decay processes (lignocellulose) can become almost chemically inert, where breakdown rates are extremely slow depending on the microbial community.

It is important to understand that previous assessments on the lake's dissolved oxygen levels at the sediment water interface showed that the lake's microbial community was in a predominantly anaerobic state. This is because when oxygen concentrations fall below 2 mg/L (which was observed), the rate of aerobic oxidation is reduced significantly. Anaerobic bacteria can oxidize organic matter without the use of oxygen, but the end products include compounds such as hydrogen sulfide (H₂S), ammonium (NH₄), and methane (CH₄), which are toxic to many organisms. The process of anaerobic

decomposition is also much slower than that of aerobic decomposition and can potentially explain why the lake was accumulating more muck than it was reducing. Having increased oxygen at the sediment water interface most likely caused a shift in the microbial community, increased and expanded the range for desirable benthic macro-invertebrates (i.e., Shredders & Grazers), and improved overall sediment chemistry (i.e., changes in redox state). All of these factors could account for the high reduction rates seen from 2004-2009 and no net gain in muck from 2009 to present.

It can be expected that the lake will regress back into its previous state of accumulating organic muck if the aeration system is turned off. In order to maintain the benefits associated with increased oxygen at the sediment water interface and prolong the lake's "life", it is recommended that the current aeration systems remain running (24hrs/day). Although future operation will come with annual maintenance and operational costs, it is expected that the benefits would outweigh the cost.

It is also recommended that the lake's current sediment monitoring program be continued. This will allow for best management practices into the future that are based off actual data not anecdotal observations.

Contact Resources

www.vertexwaterfeatures.com

www.tri-countyaquatics.com

lewistonlakeliving@gmail.com

Eight Vertex Air3 XL4™ Systems installed at East Twin Lake Cove



The Vertex Air3 XL4™ pond aerator is a super-efficient, affordable and safe system. In a typical pond, an Air3 XL4™ can aerate approximately 4-7 acres depending on shape, slope, oxygen demand and other factors. Two 1/2hp (0.75kW) Brookwood™ SafeStart™ compressors, housed in our rustproof aluminum outdoor cabinet, feed three bottom mounted XL AirStations™ utilizing Vertex's MicronBubble™ technology.

The rising force of millions of bubbles circulates the entire water column, entraining bottom water up to the surface allowing vital oxygen to be absorbed and poisonous gasses expelled. With no electricity in the water, Vertex's aeration systems are safe for any type of water recreation.

Total System Install

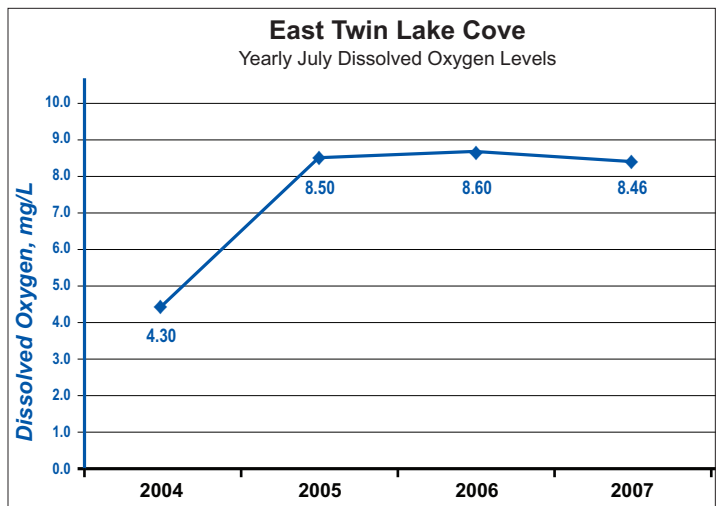
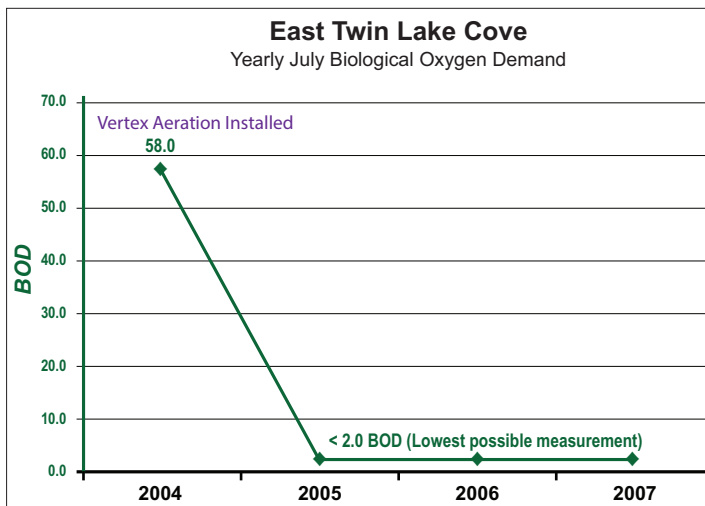
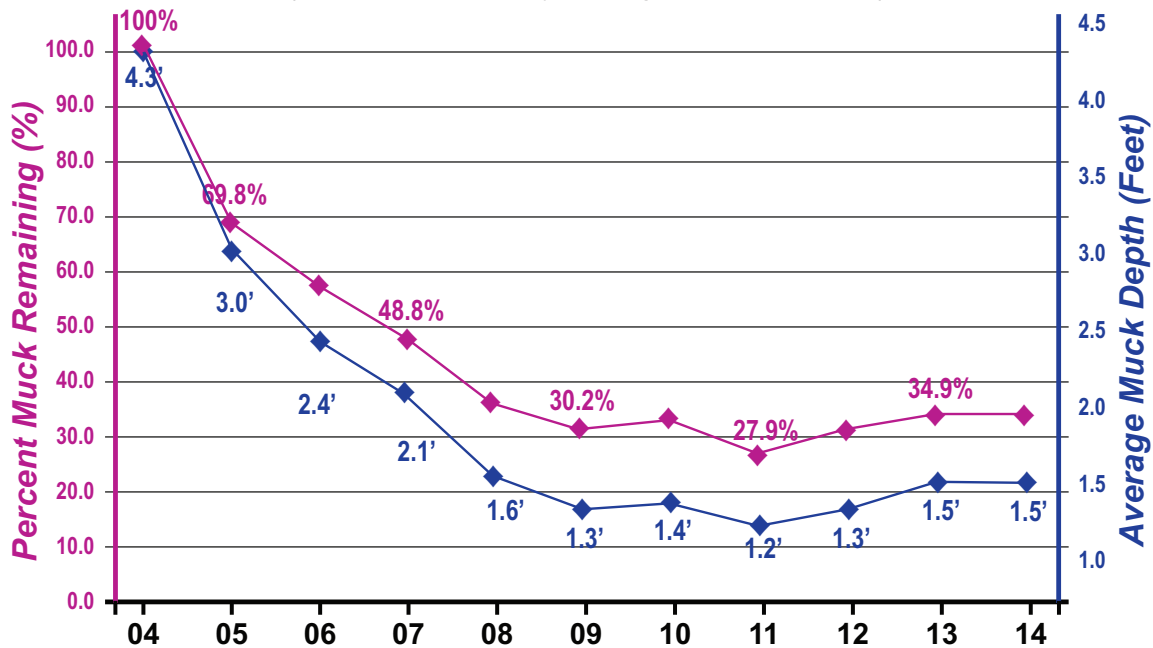
- ◆ 24 XL4 AirStations: (96) 9" flexible membrane discs
- ◆ 8 QuietAir Cabinets: (16) 1/2hp Brookwood Compressors

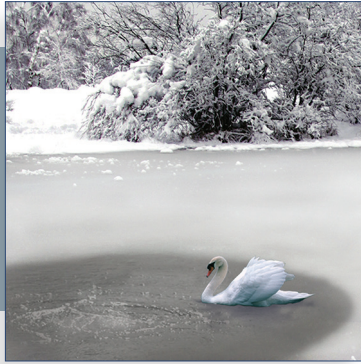
Aeration of East Twin Lake Sediment, BOD and Oxygen Results

In July 2004, eight Vertex Air 3 XL systems were installed by Tri-County Aquatics in a 160 acre cove of an 900 acre lake. At the time of installation, muck measurements with a "sludge judge" were taken at six locations to determine the amount of muck on the bottom. Three of the sites showed levels of 6 and 7 feet of muck and the average for all 6 sites was 4.3 feet of muck. Oxygen readings were taken at the surface and at the bottom to assess the quality of the water. The dissolved oxygen at the surface was 4.0 mg/l while the oxygen level at the bottom was 2.0 mg/L, which is virtually an 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.

Tri-County Aquatics, Inc, the installer of the aeration system located within East Twin Lake in Lewiston, MI, has been performing multiple sediment readings at six locations within the lake, in order to track aeration's effect on reducing muck. A summary of the last ten year's sampling is outlined below.

East Twin Lake Cove: Average Muck Accumulation
(2004 to 2014 Yearly Averages from Sites 1-6)





Water Quality Solutions



Vertex Water Features
Pond and Lake Aeration

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: 3 years, excluding wearable parts (air filters and compressor maintenance kits)
- ◆ Cabinets: Lifetime protection against rust
- ◆ Tubing: 15 years



Vertex Water Features
Pond and Lake Aeration

2100 NW 33rd Street • Pompano Beach, FL 33069
P: 844-432-4303 • info@vertexwaterfeatures.com
www.vertexwaterfeatures.com

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%

AERATION RESEARCH

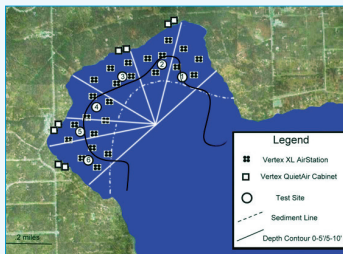
Muck Reduced 2.4' in 3 Yrs

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.



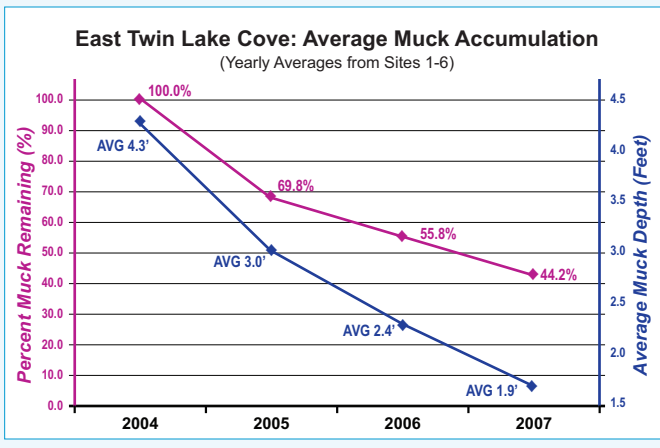
In July 2004, (8) Vertex Air 3 XL systems were installed by Tri-County Aquatics in a 160 acre cove of the 900 acre lake. At the time of installation, muck measurements with a "sludge judge"

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!*

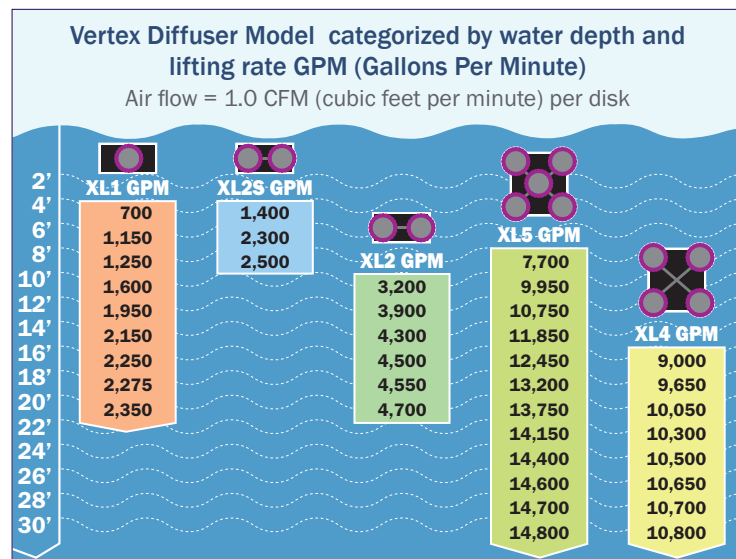
- ◆ 5-year "No Questions Asked" 100% replacement warranty (shipping included)
- ◆ Independently tested pumping rates
- ◆ StableTrak™ technology increases lift velocity
- ◆ FlowControl™ technology equalizes airflow to each disk
- ◆ "Delta" shaped surface pattern increases active surface area and aeration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

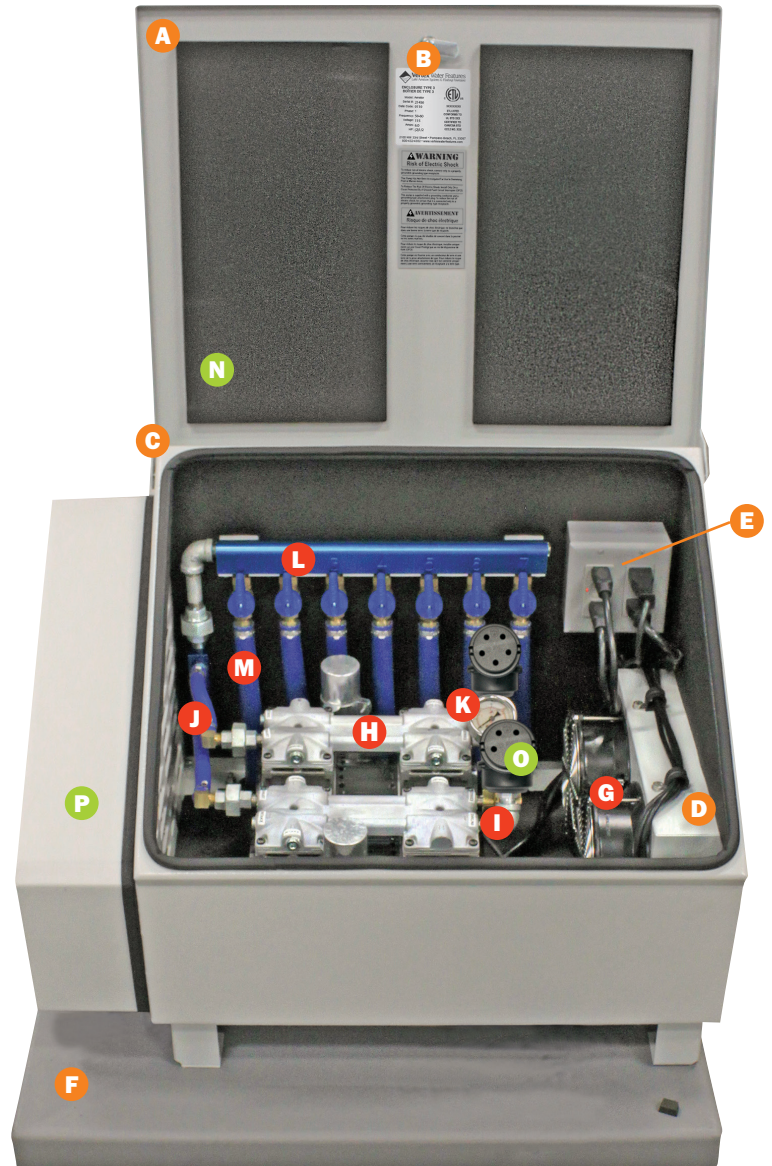
Compressor Components

- 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



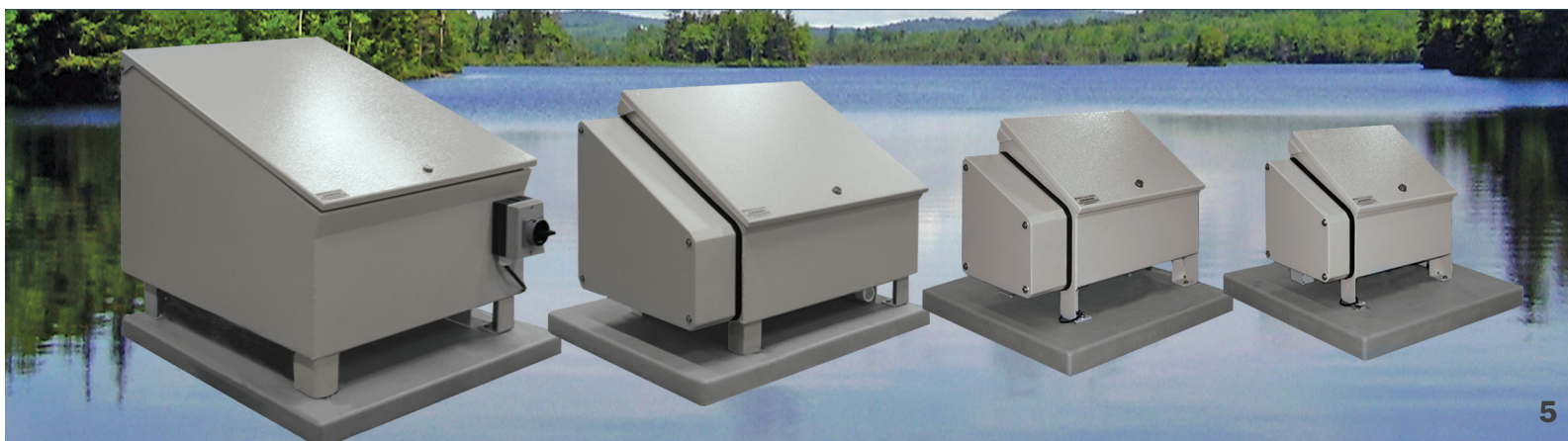
Bottomline™ Tubing

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.



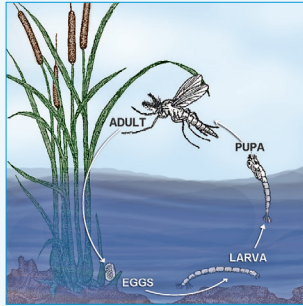
AERATION RESEARCH

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.

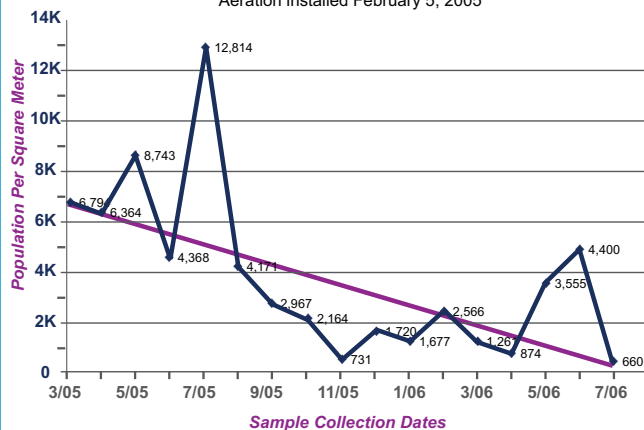


The Results Highlights

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.

Hibbs Grove Average Midge Fly Population
Aeration installed February 5, 2005



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 3-year compressor systems warranty, excluding wearable parts (air filters and compressor maintenance kits)
- ♦ 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.

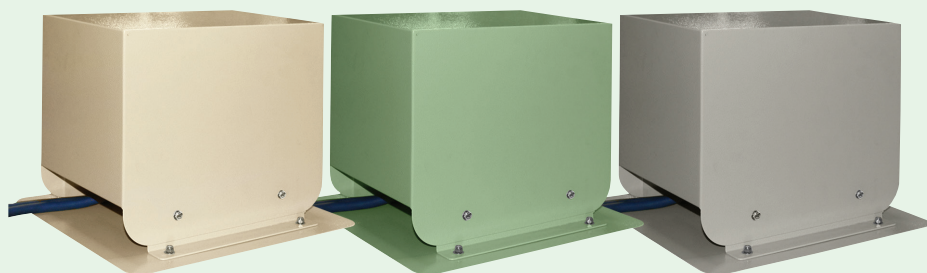
PondLyfe Specifications

- ◆ 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



"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.



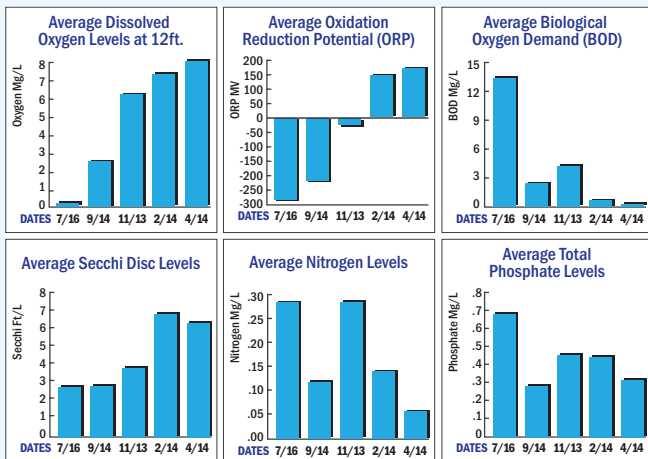
With maximum water depths over 20', stratification caused the lake to experience severely low dissolved oxygen levels at the bottom. Having no beneficial bacteria to break down organics, heavy muck accumulation and foul odors from hydrogen sulfide

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:

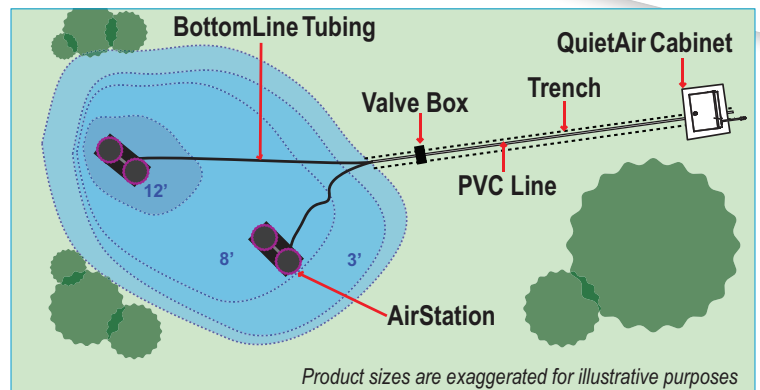
- ♦ **Water Depth:** the range of depths throughout the pond or lake can make a difference. If they vary quite a bit you may need more than one AirStation and each may have a different number of disks
- ♦ **Shape:** A fairly round pond is likely to need fewer AirStations than a body of water with multiple '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



Aeration is useful during all seasons

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



Product sizes are exaggerated for illustrative purposes

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

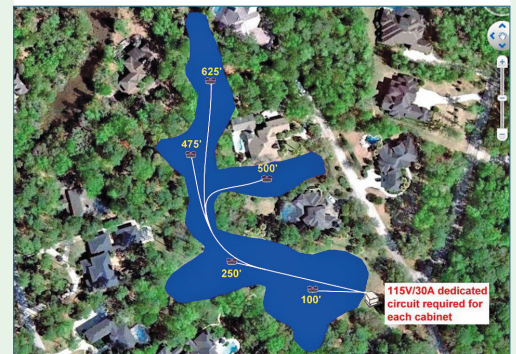
Surface Acres: 2
Volume: 4,818,829 gallons



Air1Plus™ System

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

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



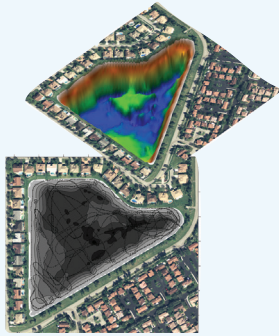
Air5™ System

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

AERATION RESEARCH

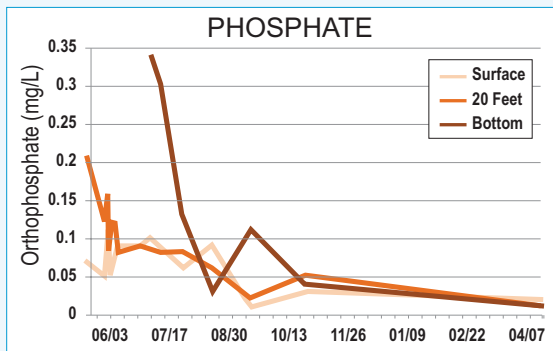
Phosphate and Ammonia Reduction

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.

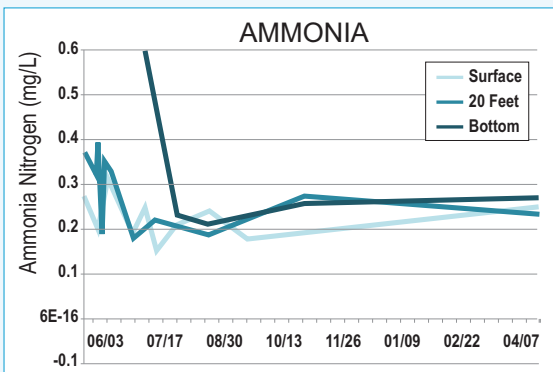


The Results Highlights

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.

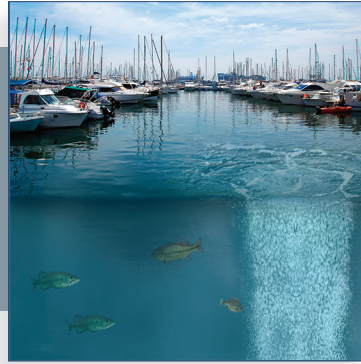
We only allow lake specialists to specify and sell Vertex systems!



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