golf industry show

SAN DIEGO 2019

CONNECT. **DISCOVER.** ELEVATE.

GCSAA EDUCATION CONFERENCE | TRADE SHOW | GCSAA GOLF CHAMPIONSHIPS

February 2-7 | San Diego Convention Center

PRESENTING PARTNERS

GCSAA NGCOA

PARTICIPATING PARTNERS

USGA NGF

SAN DIEGO 2019
CONNECT. DISCOVER. ELEVATE.

golf industry show

GCSAA EDUCATION CONFERENCE

Golf Course Irrigation Water Quality Panel

Presented by:

Irrigation Association (IA)

American Society of
Irrigation Consultants (ASIC)

Panelists:

Charlie Barebo; CEO- Otterbine- Barebo

Pat Simmsgeiger; President- Diversified Waterscapes

Rick Reinders; CEO- Watertronics

Moderator:

Bob Scott; President- Irrigation Consultant Services

SAN DIEGO 2019
CONNECT. DISCOVER. ELEVATE.

golf industry show

GCSAA EDUCATION CONFERENCE

Lake & Pond Aeration

Charlie Barebo

CEO Otterbine- Barebo

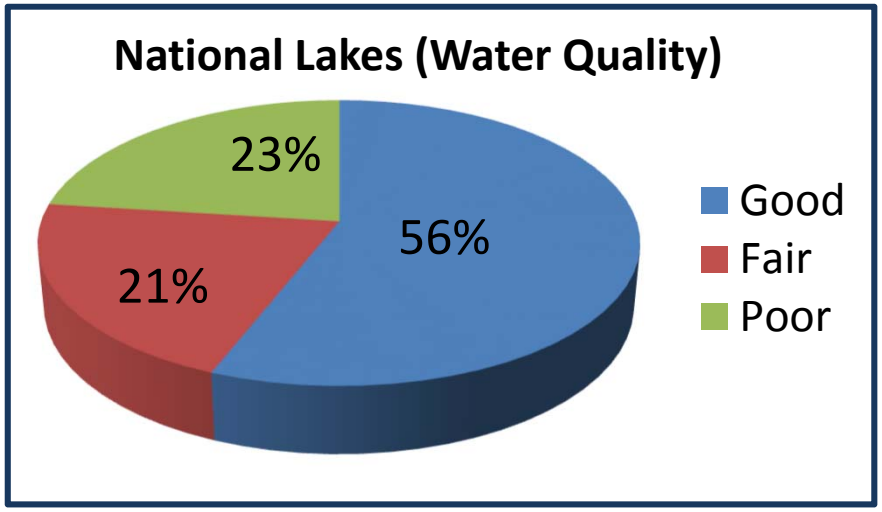
Water Quality Management

- Water quality is a critical factor in the successful management of any golf course.

Water Quality Varies

- Water quality varies at each location
- Recent studies from the US EPA indicates consistent measures in first world countries.

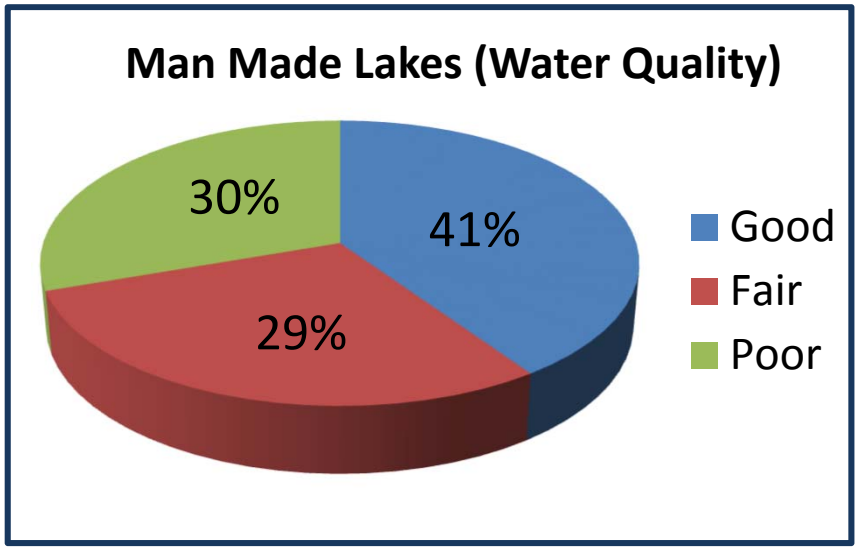
44% of all lakes rank fair or poor in water quality



Man Made Lakes Fared Worse

Almost 60% of man made lakes are rated poor or fair

- Target man made lakes when developing water quality management plans



Oligotrophic Lakes

- Oligotrophic lakes are biologically “young” lakes
- These lakes have very low levels of nutrients, usually less than .001mg\l of phosphorus
- These lakes have little or no algae and macrophyte growth.

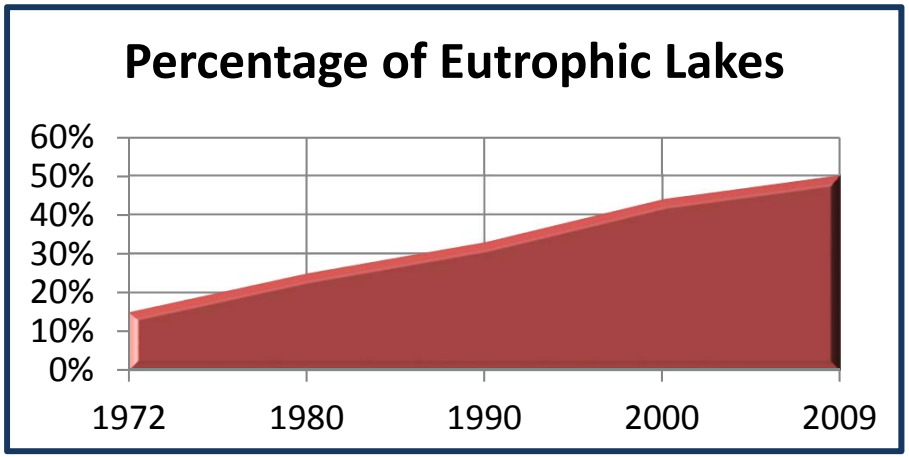
Eutrophic Lakes

- Eutrophic lakes are older lakes characterized by high turbidity, nutrient levels, algae and macrophyte populations.
- Phosphorus levels can be in the range of 1mg/l. One gram of phosphorus supports 100 grams of algae. **Nutrient levels determine the biological age of the lake**.

EPA National lakes assessment

The percentage of Eutrophic lakes has tripled since 1972

- Eutrophic lakes need aeration as a matter of fact



Factors leading to Poor Water Quality

1. Light and Temperature
2. Nutrients
3. Oxygen

Light, Temperature & Depth

Shallow lakes (less than 9 ft./ or 3m) receive light at the lake bottom

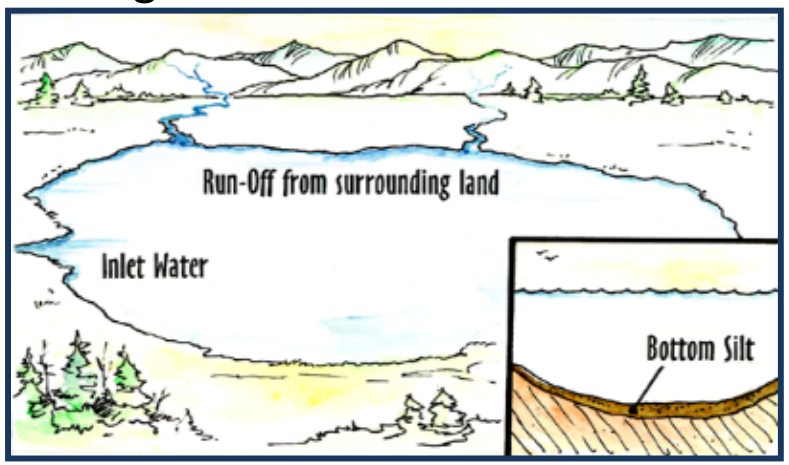
- The entire water column will be productive from a rooted weed and algae standpoint.
- These lakes tend to be very warm.
- This is a favorable condition for algae and aquatic weed growth.

Shallow Lakes Are a Water Quality Management Challenge!

Aquatic Nutrient Sources

- Three most common sources are:

1. Sediment and Vegetation in the Lake
2. Run-off Water from Surrounding Turf Areas
3. Incoming Water



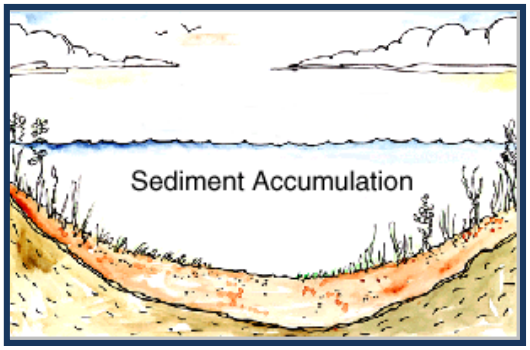
Nutrient Cycling

- Simple algae can reproduce as often as every 20 minutes and has about a two week life cycle
- Dead algae sinks to the bottom of the lake adding to Biomass *(biological matter in the lake)*

U** of Fl tests indicate **sediment can accumulate on the lake bottom at the rate of 1-5 in. or 2.5 - 12 cm Per Year!

Water Storage Capacity

- At a mid-range sediment accumulation rate of 3in or 8cm per year
  - A one surface acre or 4000 m^2 lake would lose 80,000 U.S. gallons or 300m^3 of capacity per year



Run-off from Surrounding Turf Areas

- USGA reports that studies by Dr. Beard estimate that up to 4% of fertilizers run-off or leach into lakes

If 16 metric tons are applied per season up to 1/2 ton or 500 kilograms of phosphorus can run-off into a lake.

- ❖ One gram of phosphorus equals 100 grams of algae

Leaves, grass clippings and other nutrients add to the problem.

Nutrient & Inlet Waters

- Effluent from sewage, waste water treatment plants and leeching from septic systems
- Foaming is an indication of excess phosphorus

Oxygen's Role in Pond/Lake

Oxygen Producers

- Aquatic Plants: Photosynthesis (**Light Side)**
- Wave & Wind Action
- Surface Diffusion
- Rain

Oxygen Consumers

- Bacteria
- Fish & Wildlife
- Aquatic Plants: Photosynthesis (**Dark Side**)

Oxygen's Role in Pond/Lake

Oxygen's Role in Pond:

- Support Animal & Plant Life
- Support Aerobic Bacteria in the Consumption of Excess Nutrients

Healthy Ecosystem

- O_2 Producers Keep Pace with O_2 Consumers
- *Natural Clean-Up Process Keeps Nutrients at Low Levels*

Unbalanced Ecosystem

- Nutrients Outpace Digestion
- Oxygen Consumption Outpaces Supply

Organic Digestion: Aerobic vs Anaerobic Bacteria

AEROBIC (good)

- Requires Oxygen
- Fast
- Efficient
- Complete digestion
- Breaks down wastes into water, carbon dioxide and polysaccharides

ANAEROBIC (bad)

- Anoxic
- 5 to 100 times slower
- Inefficient
- Incomplete digestion
- Terrible odors
- Poisonous by-products
  - methane
  - hydrogen sulfide
  - ammonia

Bacteria's metabolic rate increases in warm temperature

Water Quality Tests: Appropriate US EPA Levels

Dissolved Oxygen	⇨	>4 mg\l Check before sunrise
BOD	⇨	<5 mg\l
pH	⇨	6 to 9 (7 - 8 are neutral)
Alkalinity	⇨	>50 mg\l is well buffered
Chlorophyll	⇨	<2 mg\l
Suspended Solids	⇨	<5 mg\l
Fecal Coliform	⇨	<200 colony forming units per 100ml *No human contact if >400
Total Nitrogen	⇨	<5 mg\l
Total Phosphorus	⇨	>.05 mg\l is considered high > 1 mg\l will experience algae blooms

Poor Quality Tests: Effects of Symptoms

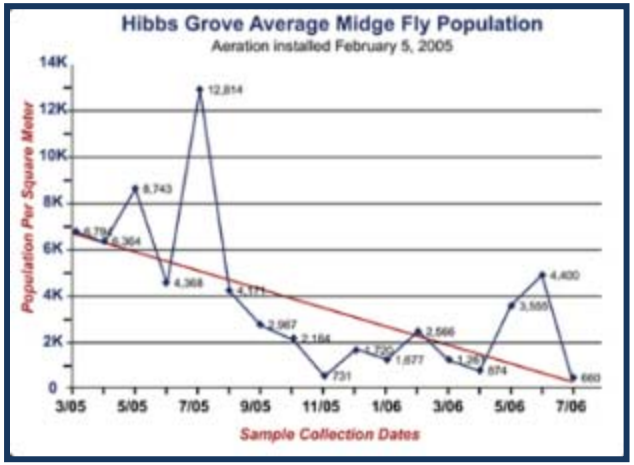
- Algae & Weeds
- Odors & Poisonous Gases
- Soluble Phosphorus
- Iron & Heavy Metals
- Fish Kills
- Insect infestation
- Public Safety

Costs of Not Acting: Oxygen Depletion

- **Fish Kills:** Fish require 4-5 mg\l of Dissolved Oxygen
- **Foul Odors:** Most odors occur in anoxic conditions
- **Insect Infestation**

Insect Control

- Insects breed in waters that are:
  - Rich in organics
  - Low in oxygen
  - Calm or still
- Recent case study
  - Insect larvae population at 6,794 per square meter (6X's the nuisance level)
  - Aeration system installed and run for 14+ months
  - Larvae population drops to 660 per square meter



Aerator vs. Fountain

- Aerators move large volumes of water and adds oxygen to the water.
- Fountains use a nozzle under pressure to create a decorative spray pattern.

Aerator

Fountain

Aeration Defined

- Aeration is the addition of dissolved oxygen to the water
- The second component of aeration is mixing and de-stratification

What Does Aeration Do?

- Aeration improves water quality by impacting the 3 factors:

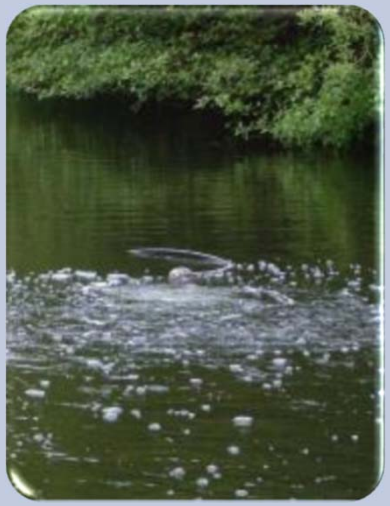
1. **Oxygen:** Aeration encourages aerobic digestion of nutrients by adding oxygen
2. **Nutrients:** These are kept in balance through digestion and oxidation
3. **Temperature:** Mixing breaks down stratification adding O2 to lower levels

Positive Effects of Aeration

- Introduction of oxygen prevents anaerobic digestion and foul odors
- Oxygen in water converts Phosphorus to an insoluble form
- Oxygen introduced at lake bottom inhibits phosphorus release and build up of sediment

Types of Aeration

Surface Spray Aeration



Horizontal Mixers & Aspirators

Air Diffusion

Surface Spray Aeration

- Provides the best aeration and circulation in lakes less than 15ft or 5m deep
- Mixes surface and bottom waters, aerating and creating convection patterns
- Independent research shows that surface aeration adds
  2 mg\L of dissolved oxygen at 10ft or 3m
- Wave pattern is excellent for breaking up algae mats

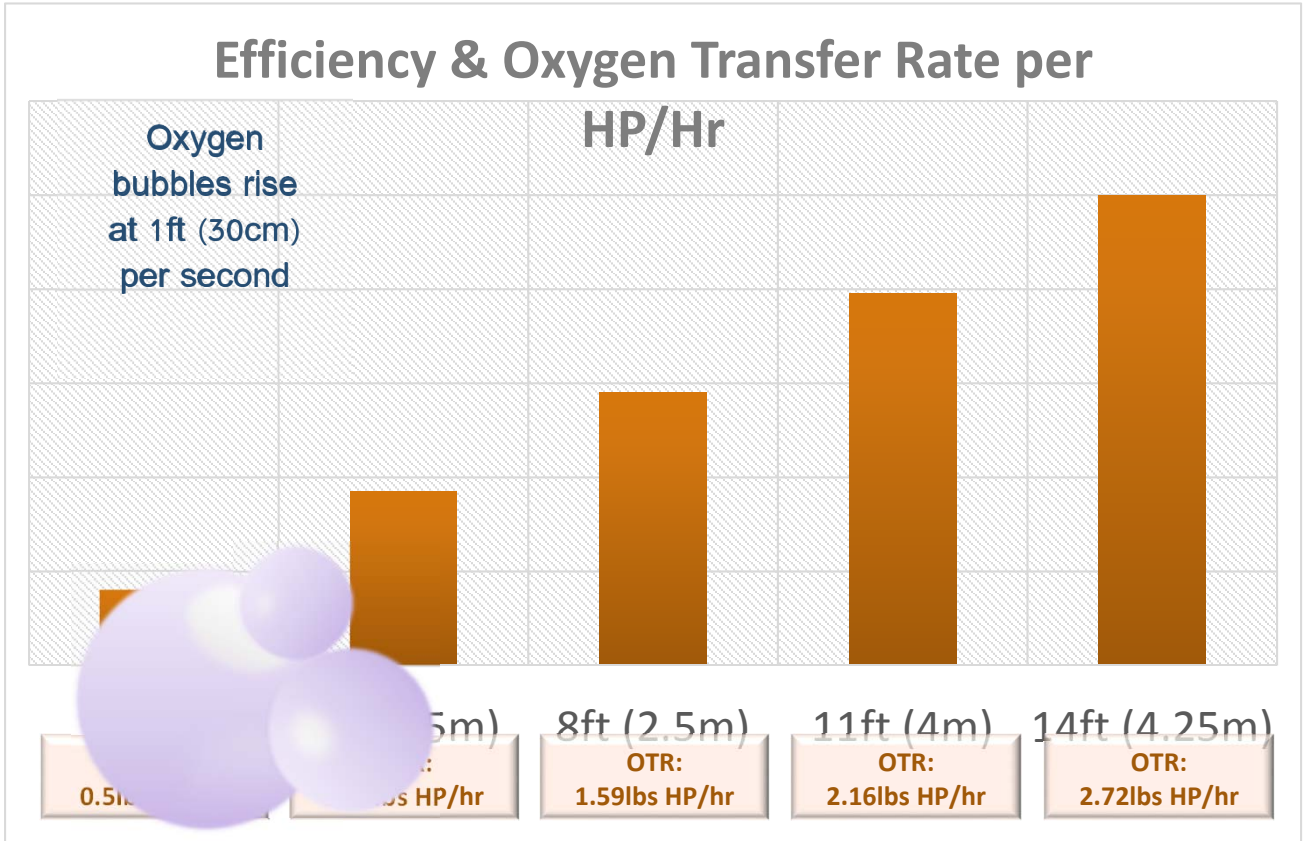
Horizontal Mixers & Aspirators

- These aeration systems are best suited for 3-12ft. or 1-4m
- Units are used to create circulation in long narrow channels or lakes
- Good choice when a spray pattern is not desired

Air Diffusion Systems

- Effective in 15ft or 5m or deeper
- Depth must be sufficient to allow for rising air bubbles to expand towards the water surface
- Most unobtrusive off all systems
- No electricity running water
- Shore mounted compressor forces air to diffusers installed at the bottom of the pond

Efficiencies at depth Diffused air



Choosing the Right System

- **Its all about AIR!**
  - Look for Oxygen Transfer Rates
  - Pounds of Oxygen per HP per Hour
  - Third Party Independent Testing
  - Levels the playing field

It's In the Data

Air is Air, Doesn't Matter How It's Transferred

Request third party, independent Oxygen transfer tests

The ASCE clean water non-steady state test procedures were used for all the testing. The results of the testing indicate the following:

1. Over the airflow range tested, SOTR increases with increasing airflow rate and increasing air release depth.
2. SOTE and SAE decrease with increasing airflow rate.
3. SOTE increases with increasing air release depth.
4. The standard SOTR (Lb O2/Hr) (TDS Corrected 1000) at 8 ft or 2.43 m was 1.59 lb O2/ hp hr
5. The standard SOTR (Lb O2/Hr) (TDS Corrected 1000) at 14 ft or 4.27 m was 2.72 lb O2/hp hr

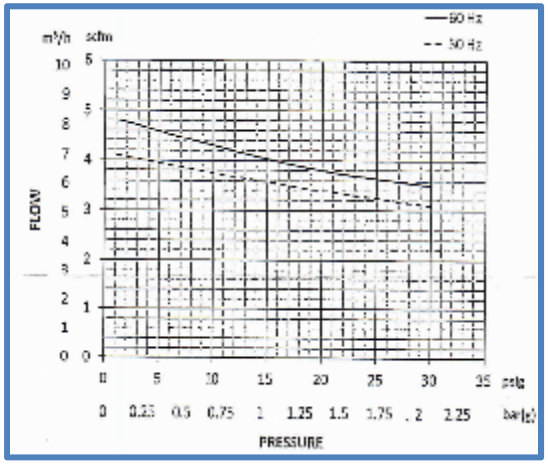
The equipment performed very well. The observed results are as good as or better than similar systems we have tested in the past.

Concept$_3$ 1 Hp High Volume			
SOTR (lb/hr)	Power (kW)	SAE (lb/kW-hr)	Flowrate (GPM)
3.28	1.51	2.17	921

Concept$_3$ 1 Hp Sunburst			
SOTR (lb/hr)	Power (kW)	SAE (lb/kW-hr)	Flowrate (GPM)
2.74	1.96	1.40	530

DISCLAIMER:
These tests were carried out under controlled laboratory conditions. The selection and installation of any of these products at any project site will of necessity incorporate site specific concerns, and therefore must be reviewed by and be the responsibility of a qualified, registered engineer on an individual project basis. Because it cannot control field installation, the St. Anthony Falls Laboratory, University of Minnesota, does not endorse the use of any specific product on which it has performed testing.

Oxygen transfer dependent on compressor SCFM not number of diffusers



- A single 12” diffuser can pass 12 CFM per minute, almost double compressor output.
- -Remember OTR, not theoretical lift rates, are the ASCE standard for measuring an aeration system

Scientific Straight Talk- add 3lbs O2 per Hr

Surface Spray

- 5 ft deep
  - 1Hp High Volume
  - 3.28 lbs O2 HR
  - 300% more efficient
- 8 ft deep
  - 1 HP High Volume
  - 3.28 lbs O2 HR
  - 200% more efficient
- 11 ft deep
  - 1 HP High Volume
  - 3.28 lbs O2 HR
  - 1HP is 50% more efficient

Diffused Aeration

- 5 ft deep
  - 3Hp compressors
  - 3.09 lbs O2 HR
  - 1.09 lbs O2 per HP
- 8 ft deep
  - 2Hp compressors
  - 3.18 lbs O2 per HR
  - 1.59 lbs O2 per HR
- 11 ft deep
  - 1.5 HP compressors
  - 3.14 lbs of O2 HR

Aerator & Diffuser Placement

- Placement is dependent on Size & Shape
  - Place aerators or diffusers to insure maximum circulation
  - Use multiple units for best results
- Streams and canals are best suited for horizontal aspirating aeration systems

Selecting a system

- Establish goals for your lakes
- Know the surface area, depth and power availability
- Select a system that will achieve your goals
- Operational costs and unit life outweigh capital costs by a factor of 5
- Choose a product that has local, factory trained service
- Air trumps all, ask for the OTR tests
- Run the system at night to keep lakes clean

Summary

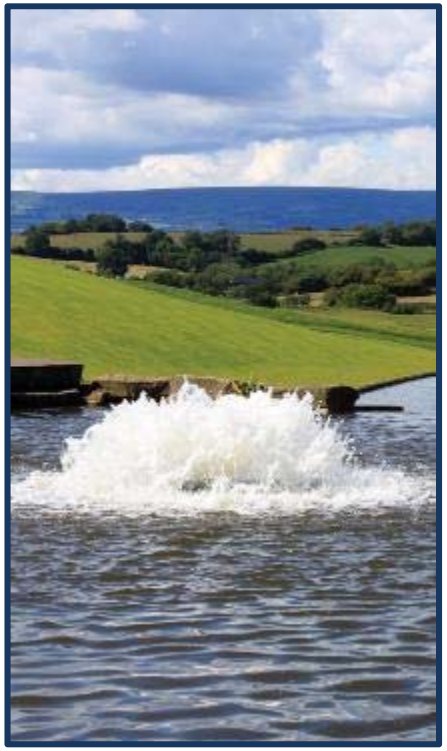
Water Quality Management is a Science

- Identify the causes of your problems:
  - Light
  - Temperature
  - Nutrients
  - Oxygen

Integrate Best Management Practices:

Align to the Causes

- Minimize Light & Heat
- Minimize Nutrient
- Accelerate Digestion
- Use Proactive Tools as the Basis for Your Program
- Use Reactive Tools in Crisis



Thanks
Questions?

Charlie Barebo

Otterbine- Barebo
charliebarebo@otterbine.com

SAN DIEGO 2019
CONNECT. DISCOVER. ELEVATE.

golf industry show

GCSAA EDUCATION CONFERENCE

Crash Course in Lake Management

Patrick Simmsgeiger

President Diversified Waterscapes

Who is DWI?

- Patrick Simmsgeiger
- Founder of DWI
- Over 40 years of experience
- Certified Lake Manager (CLM)
- Limnologist

How can I manage my lakes / ponds?

- Becoming proficient in these 3 areas:
  1.) Understand the factors that contribute to a lake's ecological health.
  2.) Knowing the issues that will arise based on those elements.
  3.) Implementing a solution specifically aimed at that problem.

1.) Factors

- In addition to the important factors mentioned by Charlie (water source, nutrient load, turf run-off, dissolved oxygen) here are a couple other things to consider:
  - Time of year / lake history
  - Surrounding wild-life and bird population

Effects of Bird Poop on Bodies of Water

1 pound of Phosphorus = 500 pounds of algae

1 goose eats 4 pounds of grass a day which is over 4% Nitrogen and about 1.5% Phosphorus

- **Increases** coliform bacteria

In a year, 25 resident geese will

- Consume 18.25 tons of grass
- Produce 13.88 tons of manure
- Contribute 1,205 pounds of Nitrogen
- 365 pounds of Phosphorus

2.) Issues

- Issues are dependent on expectations on the water and property manager. If they don't mind algae and odor then there's no issue.
- But for esteemed golf course managers, the clean and healthy look of a lake or pond is a point of importance. The most common issues in many golf courses are:
  -Abundance of algae
  -Awful odor
  -Dirty looking water
  -Attracting insects / mosquitoes

So what can you do for beautiful water?

3.) Solutions

- We developed a series of highly effective steps aimed directly at the sources of many of these issues.
- Step 1: Kill
  Algae is a common problem among lakes and is the first factor we consider when looking at a lake's health.

Step 1: Kill

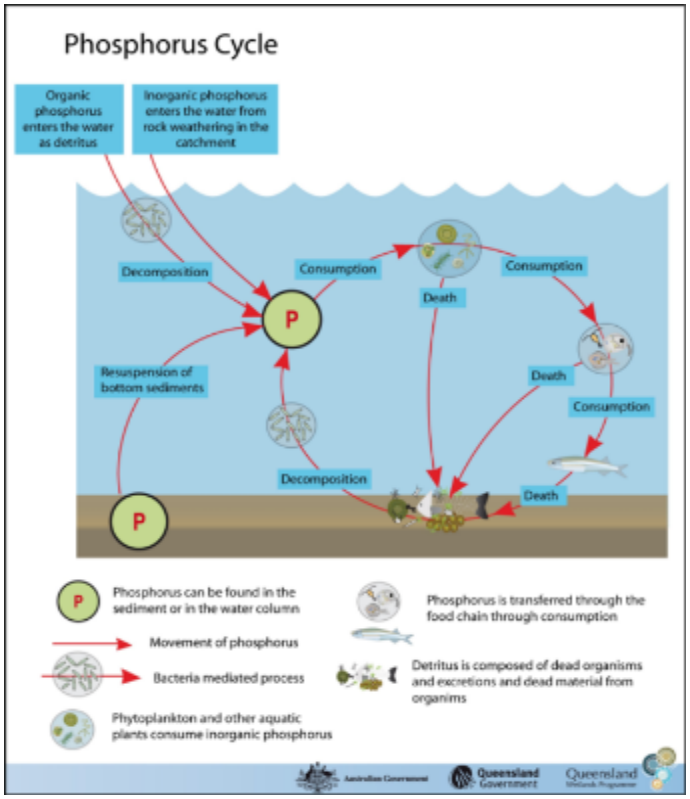
- To kill the algae, we use our copper algaecide sprayed throughout the lake or topically (mild case).

- But, that dead organic material will just deposit nutrients back into the water. It needs to be broken down and digested.

Step 2: Chop

- In order to help the natural lake bacteria digest the dead algae / already existing debris and vegetation, we add a combination of enzymes.

- These enzymes work just like the ones in your saliva or stomach, breaking down organic material into a more digestible form.



Step 3: Drop

- Then, we apply a flocculent that pulls together the suspended particles in the water before dropping the mass to the bottom of the lake.
- The result is stunningly clear water.

Step 4: Eat

- If left at this state, the water will eventually become again overrun by algae and murky water. The presence of bacteria helps eat up the leftover organic material.

- To help this process along, we add additional bacteria, all working to reduce the nutrient load and prevent further algal growth.

Who can I contact for help/advice?

- If you want professional help with managing your water, look for a Certified Lake Manager (CLM).
- We are qualified and possess specialized training and knowledge of the industry.
- Your lakes will be safe in their hands.

Thanks
Questions?

Pat Simmsgeiger

Diversified Waterscapes
343c@dwiwater.com

SAN DIEGO 2019
CONNECT. DISCOVER. ELEVATE.

golf industry show

GCSAA EDUCATION CONFERENCE

Water Filtration Solutions for Lakes and Ponds

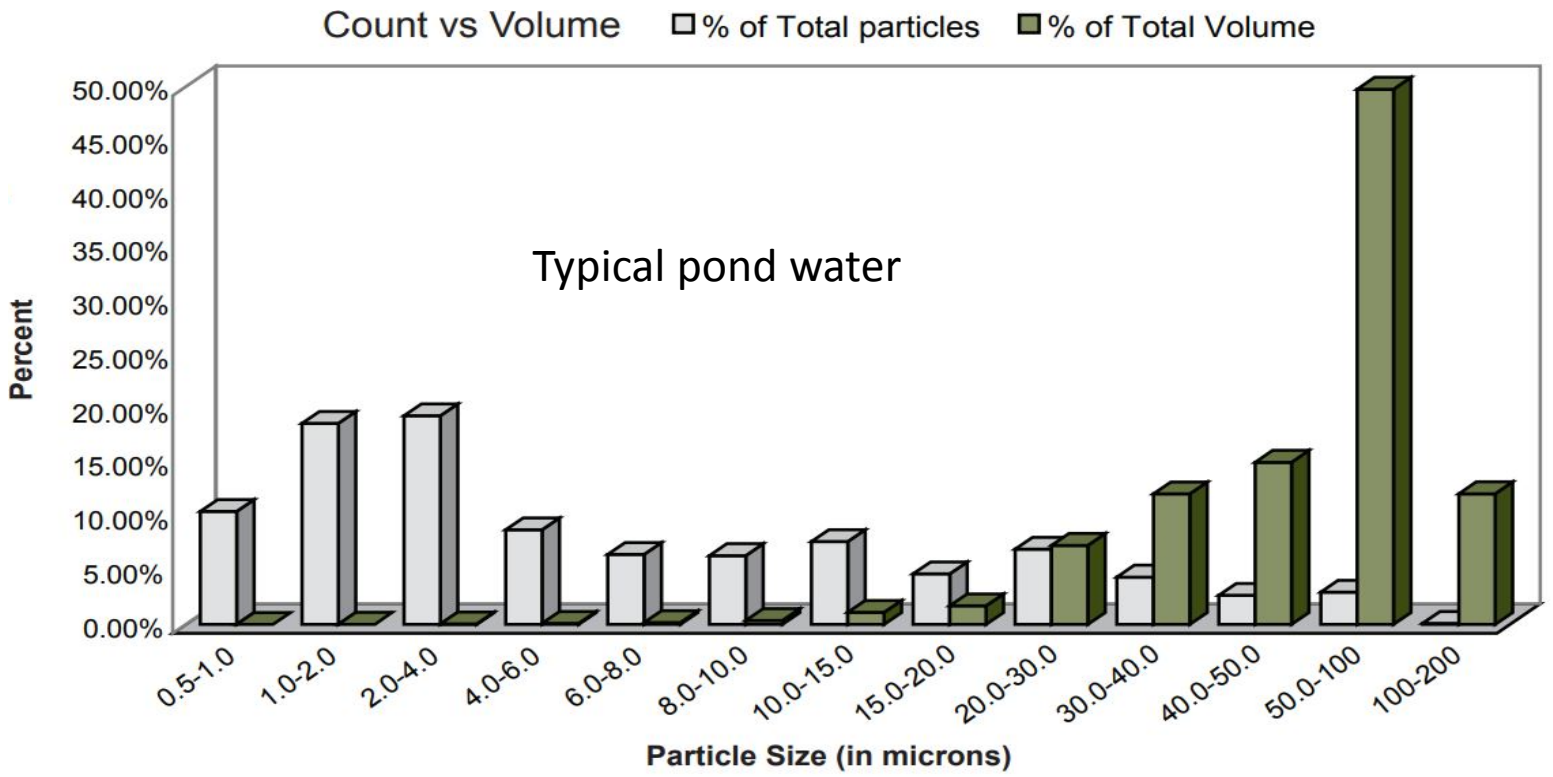
Rick Reinders

CEO Watertronics LLC

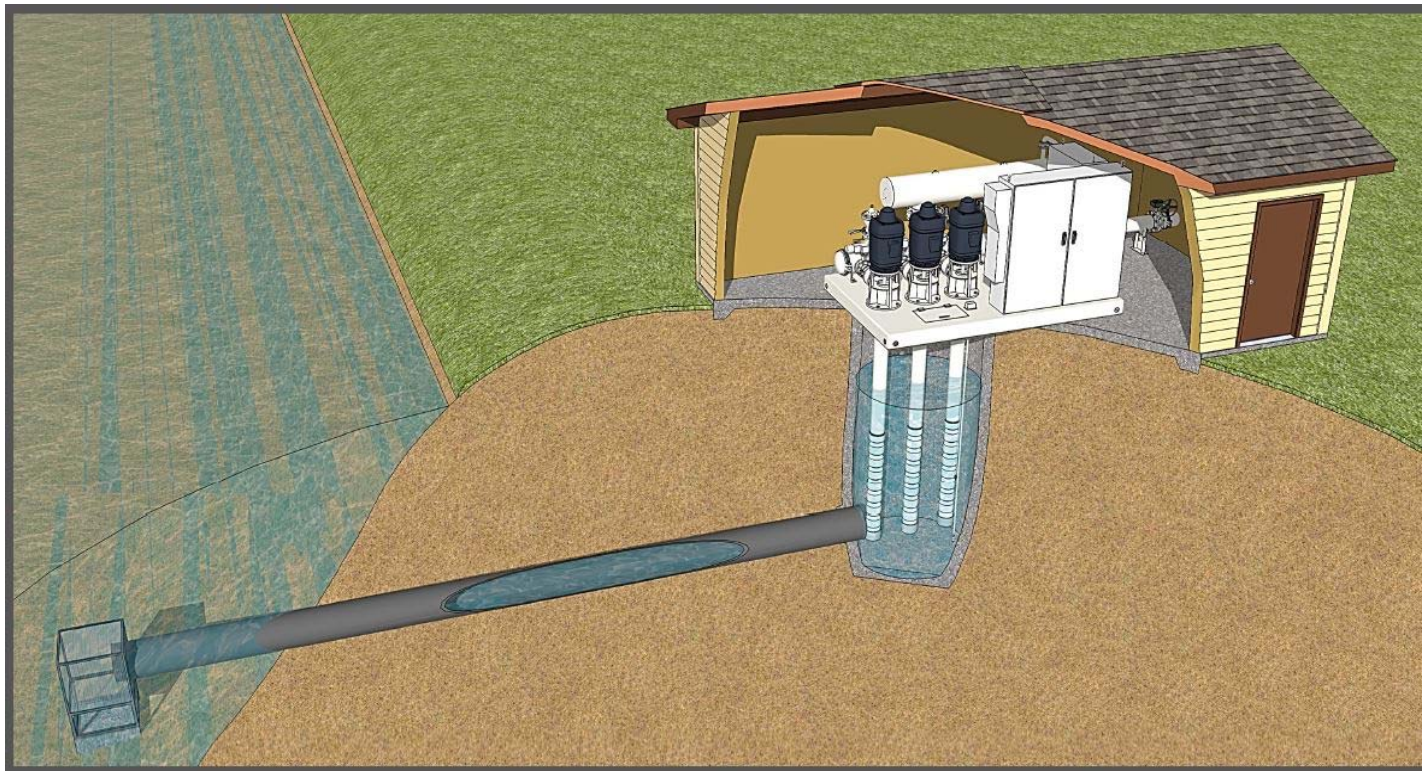
Suspended Solids Removal

Inorganic Materials	**Typical particle Size (microns)**
Sand	100-1000
Silt	2-50
Clay	>2
Plastics	> 300
Organic Materials	
Plant leaves	>300
Sticks	>500
Filamentous debris	50-1000
Algae	80-1000
Bryozoa	50-1000
Shell Fish	40-5000

Particle Size Distribution

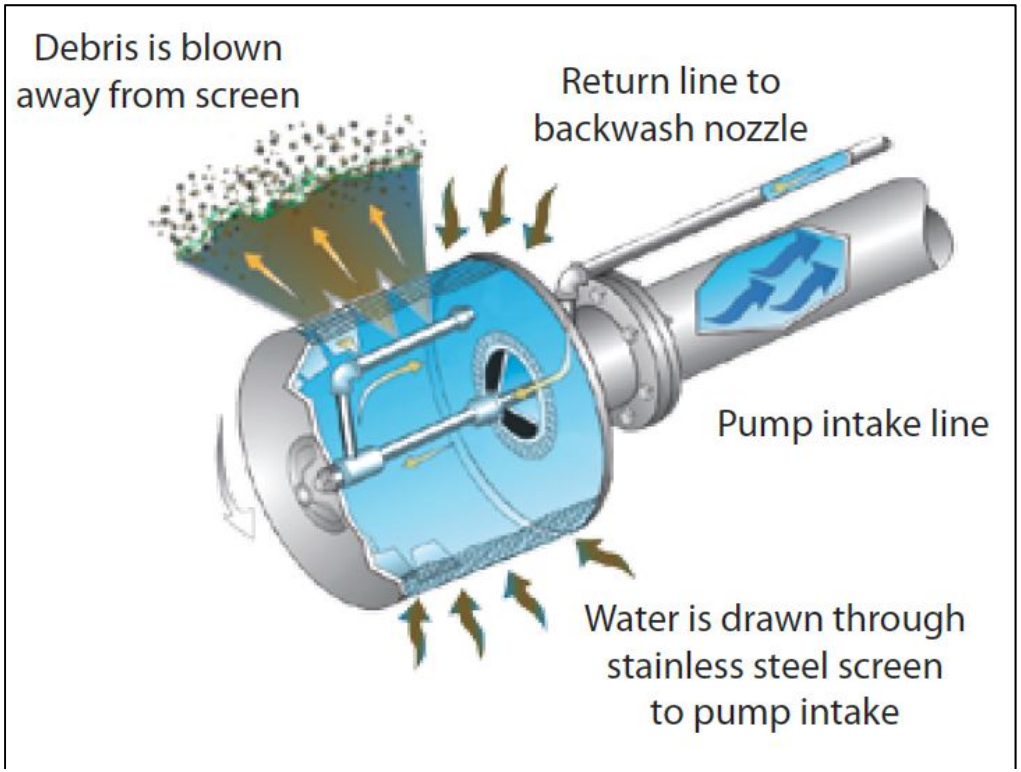


Inlet Filtration



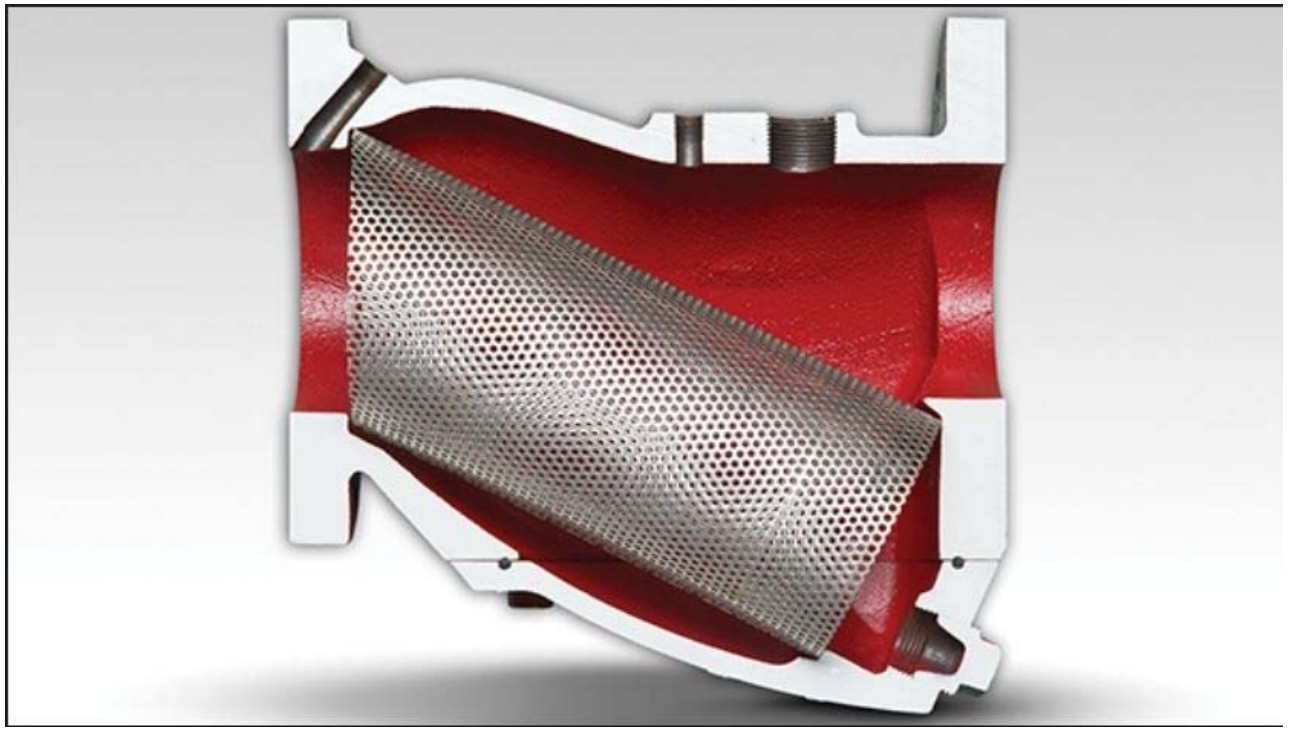
Inlet Filtration

Self Cleaning Strainer



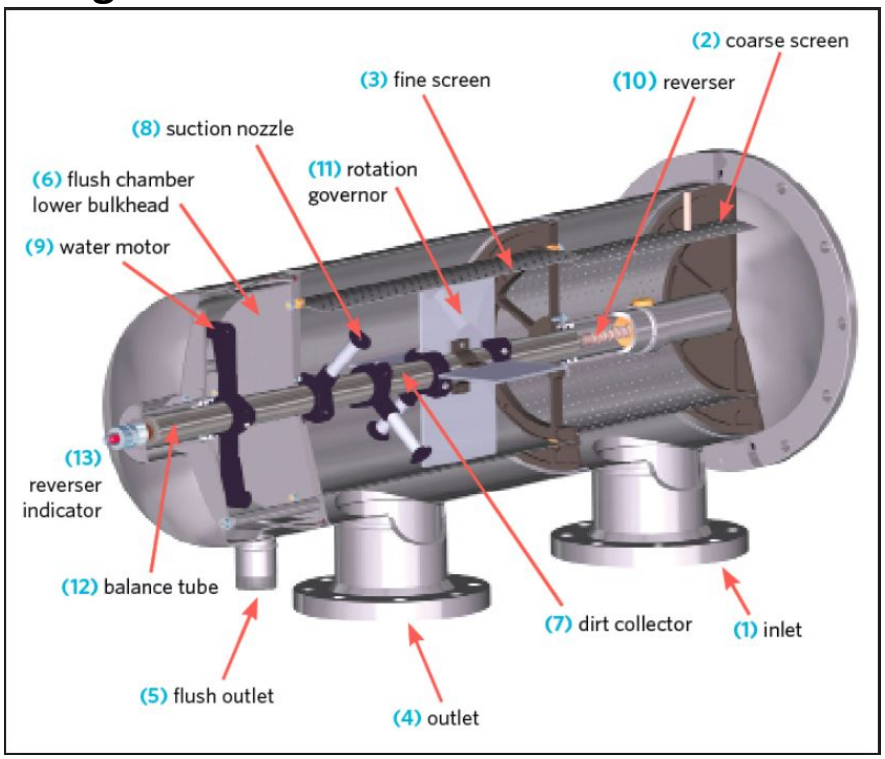
Discharge Filtration

Wye Strainers



Discharge Filtration

Suction Scanning Filters



Discharge Filtration

Disc Filters

Discharge Filtration

Sand Media Filters

Choosing the Right Filtration

- Appropriate filtration by application:
  - Drip Irrigation
  - Spray Sprinklers
  - Rotor Sprinklers
  - Soil Siltation issues
  - Clams and snail issues

Thanks
Questions?

Rick Reinders

Watertronics
Rick.Reinders@watertronics.com

SAN DIEGO 2019
CONNECT. DISCOVER. ELEVATE.

golf industry show

GCSAA EDUCATION CONFERENCE

Golf Irrigation Water Quality Panel Discussion

Charlie Barebo; CEO- Otterbine- Barebo

Pat Simmsgeiger; President- Diversified Waterscapes

Rick Reinders; CEO- Watertronics

Moderator:
Bob Scott; President- Irrigation Consultant Services

Thanks

Irrigation Association (IA)

American Society of
Irrigation Consultants (ASIC)