

A scenic landscape photograph of a calm lake reflecting a clear blue sky with scattered white clouds. The shoreline is lined with a dense forest of trees, some showing autumn foliage in shades of yellow and orange. A large, curved white graphic element separates the left side of the image from the right side.

Why wait decades
to enjoy your
water again?

In-Lake Phosphorus Mitigation for the Restoration of Impaired Lakes and Streams

Pamela Dugan, PhD

March 17th, 2022

ILMA-AFS Conference

Agenda

**EutroPHIX-
SePRO**

**The
Problem**

**Harmful Algal
Blooms**

**EutroSORB
Platform**

**Sediment
Treatment**

**Water Column
External Load**

**Case
Studies**

**Morrison
Lake (MI)**

**Kitsap Lake
(WA)**

**Lady Bird
Lake (TX)**

**Wilmot Creek
(CO)**

A **TECHNICAL RESOURCE** team within SePRO focused on water quality restoration and harmful algal bloom management



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Adaptive Management

We recommend a process of continued monitoring, stakeholder input, and adaptive management to successfully achieve or sustain project goals.



Prescription

Utilizing information gained in the assessment phase to develop a plan and strategy.

2.



Stakeholder Input

Collaboration to create an understanding of the project, determine feasibility, and outline desired goals.

1.



Assessment

Collection of historical information, water quality data, and lake sediment samples.

3.



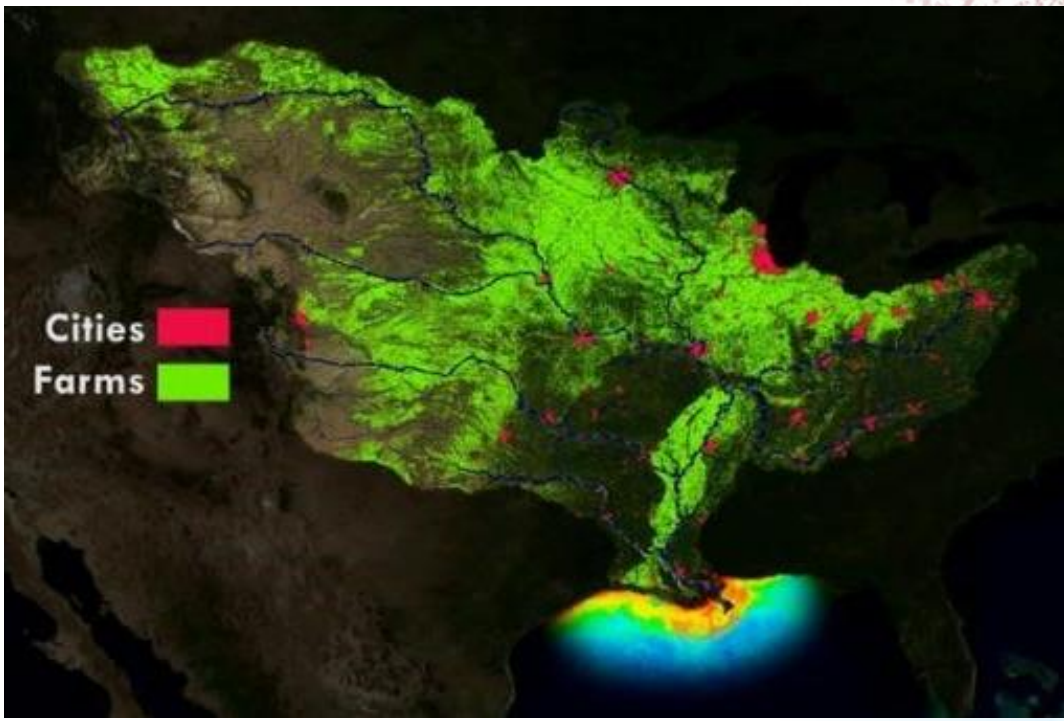
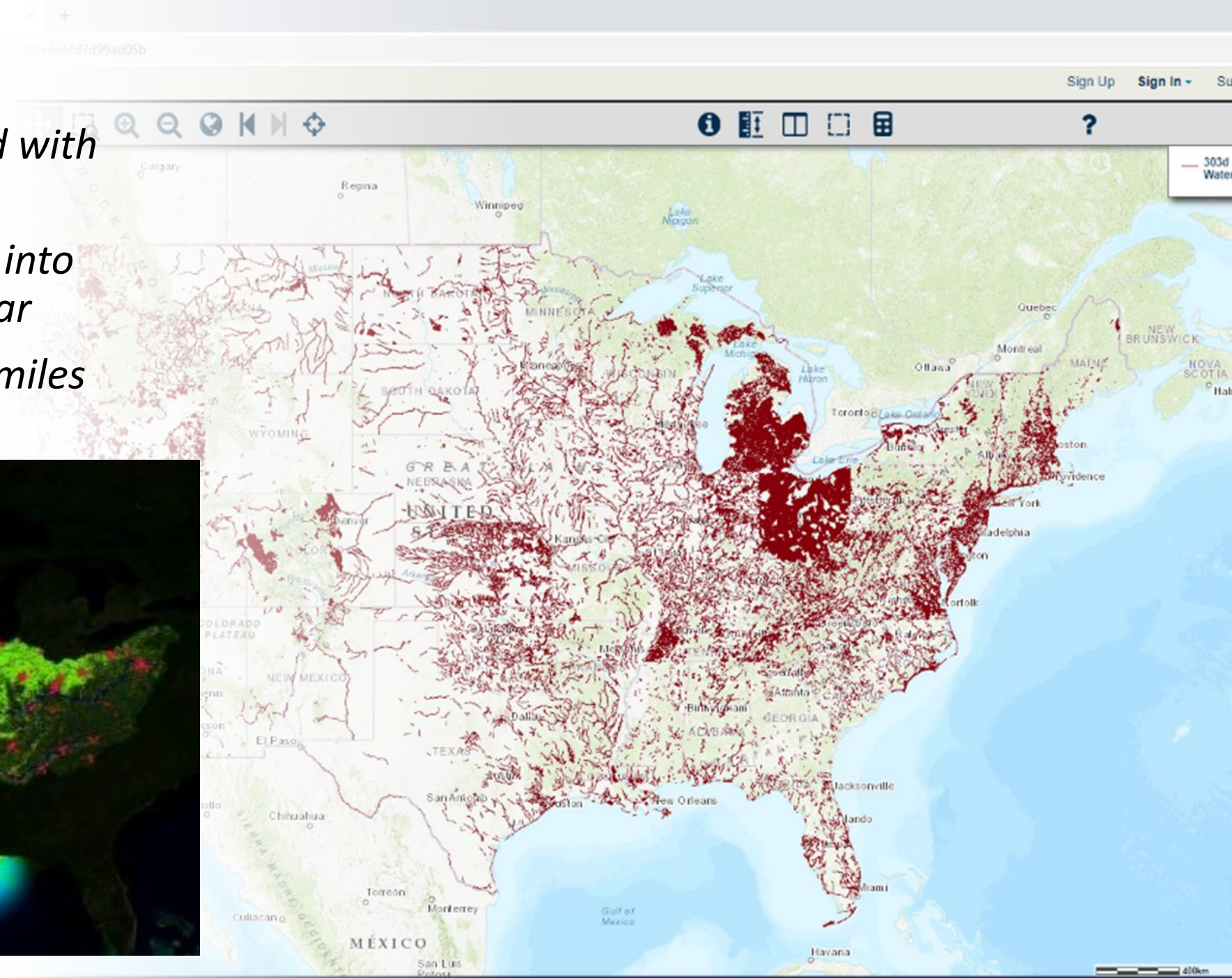
Implementation

Efficiently and effectively executing the prescription outlined.



EutroPHIX™

- *Over 48,000 lakes impaired with phosphorus in the US*
- *>300,000,000 pounds flow into the Gulf of Mexico each year*
- *Dead zone > 6,000 square miles*





WATER POLLUTION CONTROL RESEARCH SERIES •

PROBLEM LAKES IN THE UNITED STATES



U.S. ENVIRONMENTAL PROTECTION AGENCY

- 1971
- 425 Lakes
- Most are still impaired

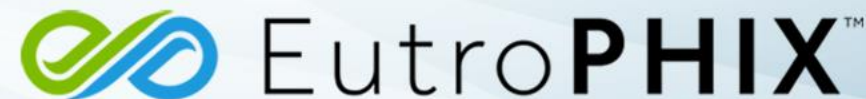


1972-2022
The Next 50 Years

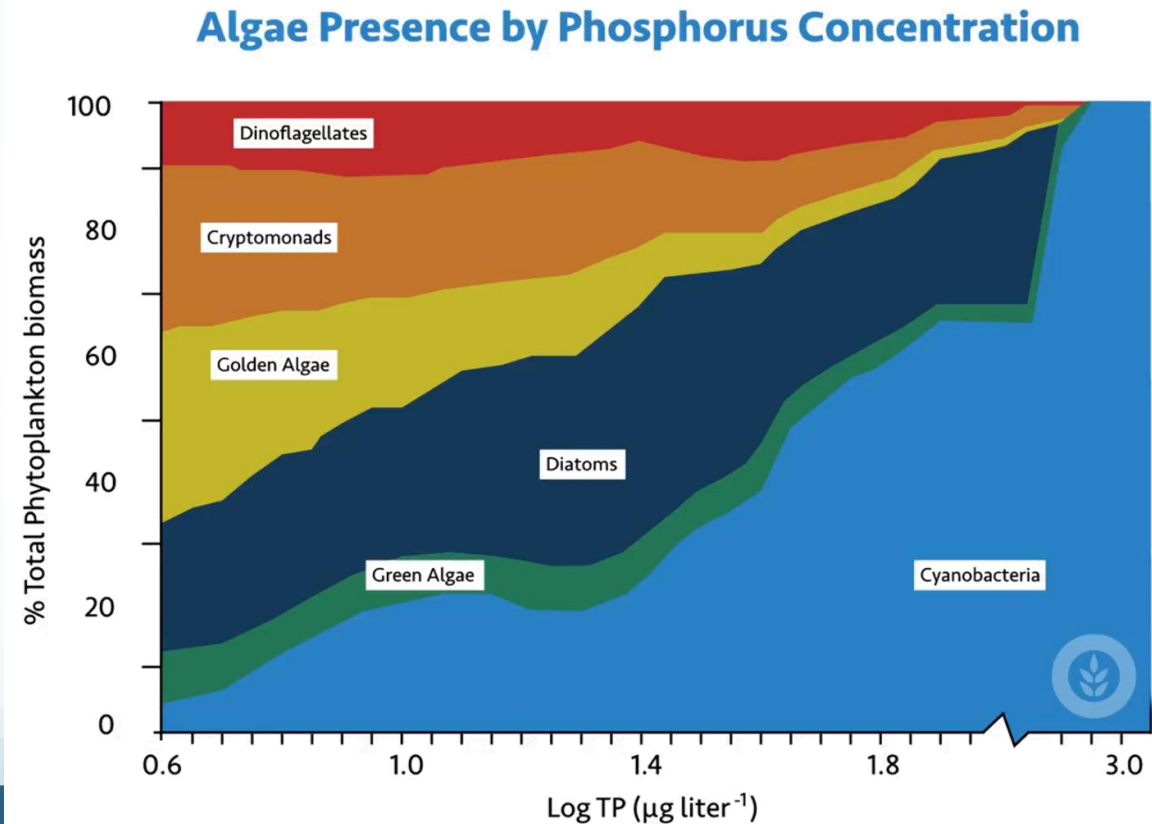
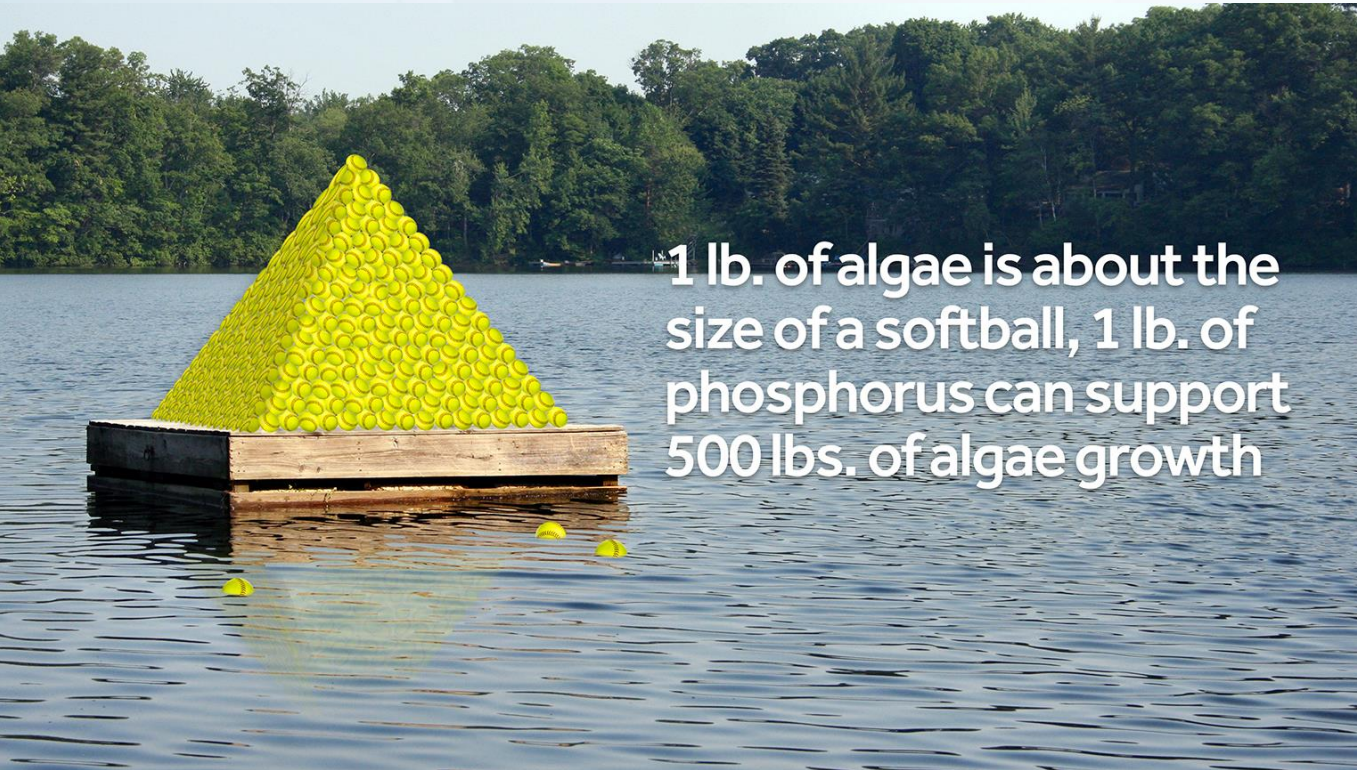
action if their condition is to be maintained; and,

- 3) Those lakes which have deteriorated to the extent that protective action is no longer sufficient and rehabilitation is required if satisfactory quality is to be re-established.

This report is an attempt to compile the information which is now available on lakes in the third category. It was made possible



Algae Types are Affected by Nutrients





WFTS NEWSCHANNEL 5 AT 11PM

NEW RESEARCH ON AIRBORNE TO

MARTIN COUNTY



Poor Water Quality Negatively Impacts Property Values

- Property losses for recurrent algal blooms on a single Ohio lake exceeded \$51 million
- “Adjacent properties lost 22% of their value when located near algal-infested waters

Source: Wolf, D., and Klaiber, A., (2017). Bloom and bust: Toxic algae's impact on nearby property values, *Ecological Economics*, 135, 209-221.

Article

A Comprehensive Review of the Evidence of the Impact of Surface Water Quality on Property Values

Sarah Nicholls ^{1,*} and John Crompton ^{2,*}

- One-foot increase in clarity was associated with a \$5207 increase in the price of the average property (Walworth County, WI)
- Lake Delavan conducted “an expansive, intensive, and historically unique \$7 million lake restoration between 1989 and 1993” resulting in a \$49,000 increase in assessed value between 1987 and 1995



 EutroPHIX™



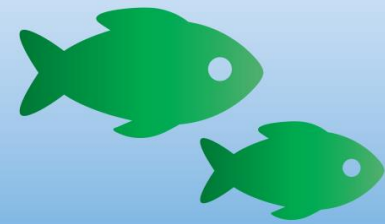
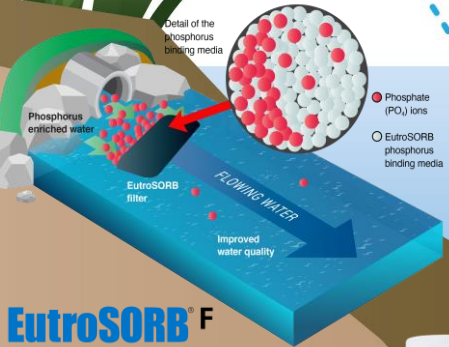
Phosphorus Pollution Inputs

Precipitation

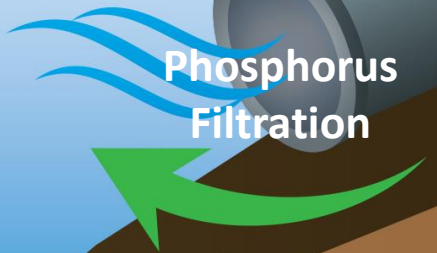
Nutrient Runoff



EuroSORB^F
Phosphorus Filtration Technology



EuroSORB WC
(Water Column Inactivation)



Discharge




EuroSORB SI
(Sediment Inactivation)


Sediment Reflux



EuroSORB G
(Water Dispersible Granule)

An aerial photograph of a white boat with a canopy moving across a large body of water, leaving a wide, dark wake. The boat is positioned in the upper right quadrant of the frame. The water is a deep, dark blue-grey color. The boat's wake is a prominent, dark, V-shaped trail that extends from the boat towards the bottom center of the image. The overall scene is captured from a high angle, looking down at the boat and its path.

Treated with
Phoslock

An oval-shaped inset image showing a rocky shoreline. The water on the left side of the rocks is clear and blue, while the water on the right side is a bright, opaque green. The rocks are grey and jagged, forming a barrier between the two water bodies.

No Phoslock
Treatment

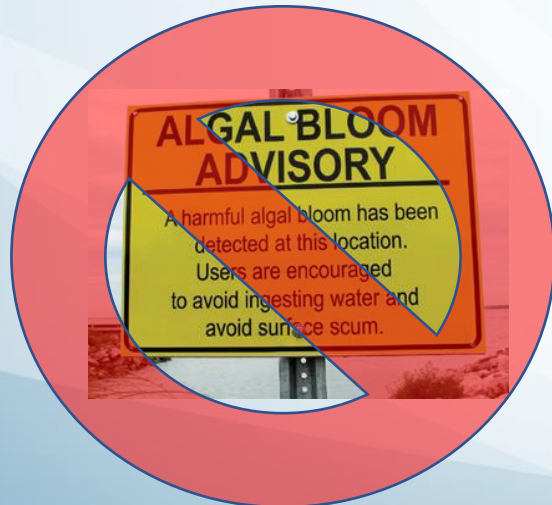
Accelerating Water Resource Restoration

Case Study - Morrison Lake, MI



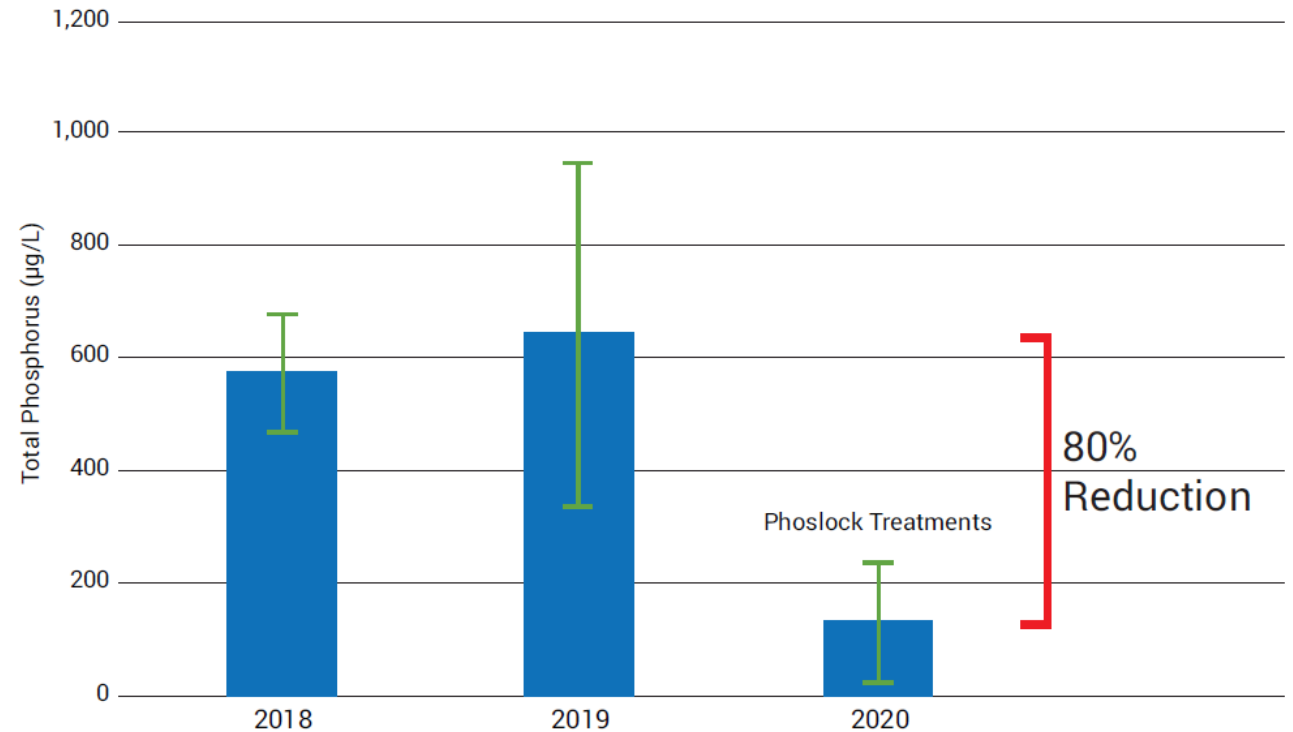
Morrison Lake, MI

Morrison Lake is a 330-acre lake located near Clarksville, Michigan. The lake is impaired for phosphorus pollution and struggles with harmful algal blooms (HABs) and associated cyanotoxins that threaten human health, pets, and wildlife. Total Maximum Daily Load (TMDL) criteria were established for the lake in 2006 by the Michigan Department of Environment, Great Lakes and Energy (EGLE).

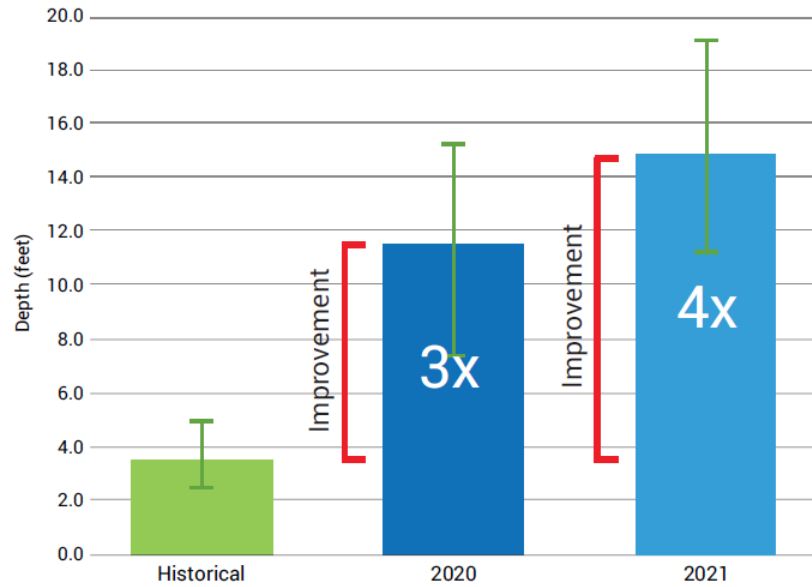


Morrison Lake - Michigan

Average Summer Total Phosphorus (10 meters)
June - September Samples
Error Bars = 1 SD



Kitsap Lake - Water Clarity

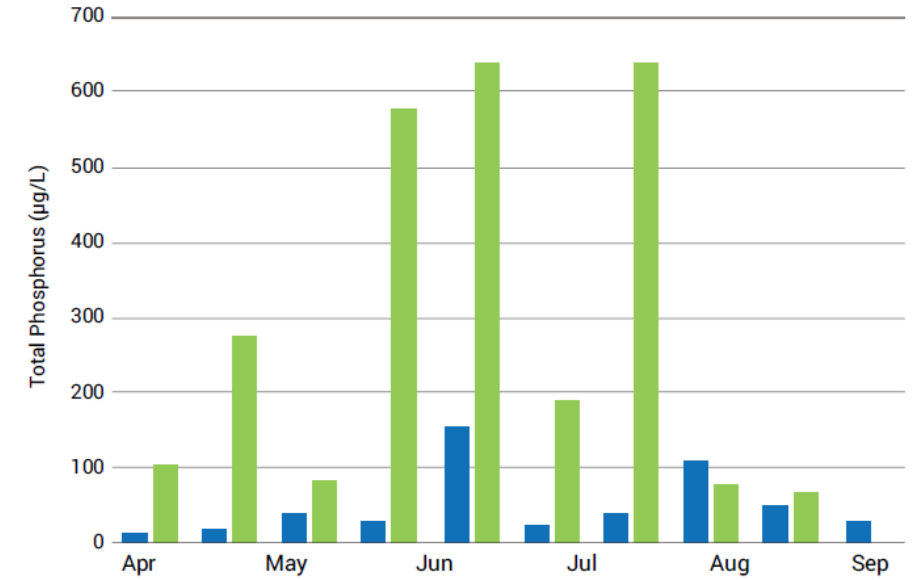


Average Secchi Disc Depth
 Error Bars = 1 SD (Historical Data: 1996 - 2017 n=36; 2020 n=13; 2021 n=6)



Kitsap Lake - Hypolimnetic (deep water)

Total phosphorus Levels 2020 & 2021



Accelerating Water Resource Restoration

Case Study - Kitsap Lake, WA



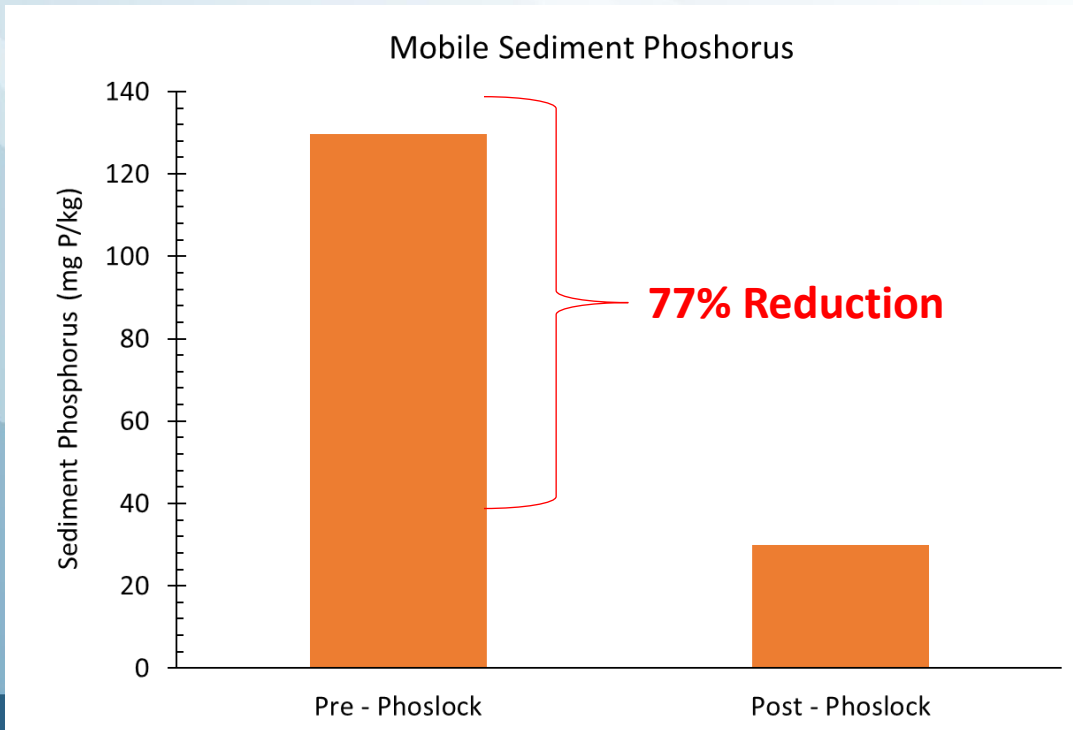
Kitsap Lake is a 246-acre waterbody located in Bremerton, WA. The lake is a recreational resource for the region, with two public parks and public boat launches. The surrounding community and public use the lake extensively for boating, water skiing, and recreational fishing for both bass and trout.

For over 40 years, AquaTechnex has been at the forefront of the fight to protect our water resources. They have a recognized expertise in the restoration of aquatic habitats impacted by invasive aquatic species.

Kitsap Lake, WA Results

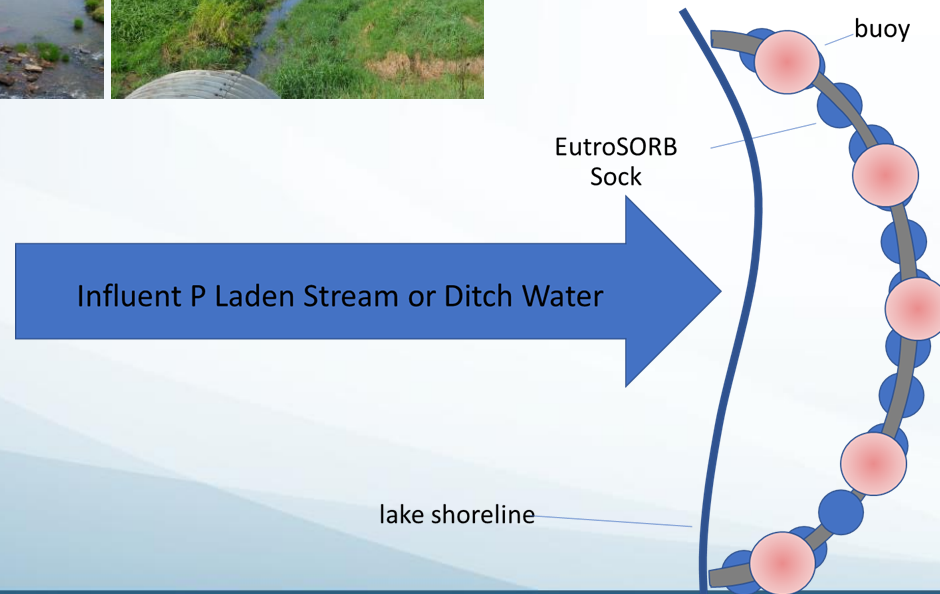
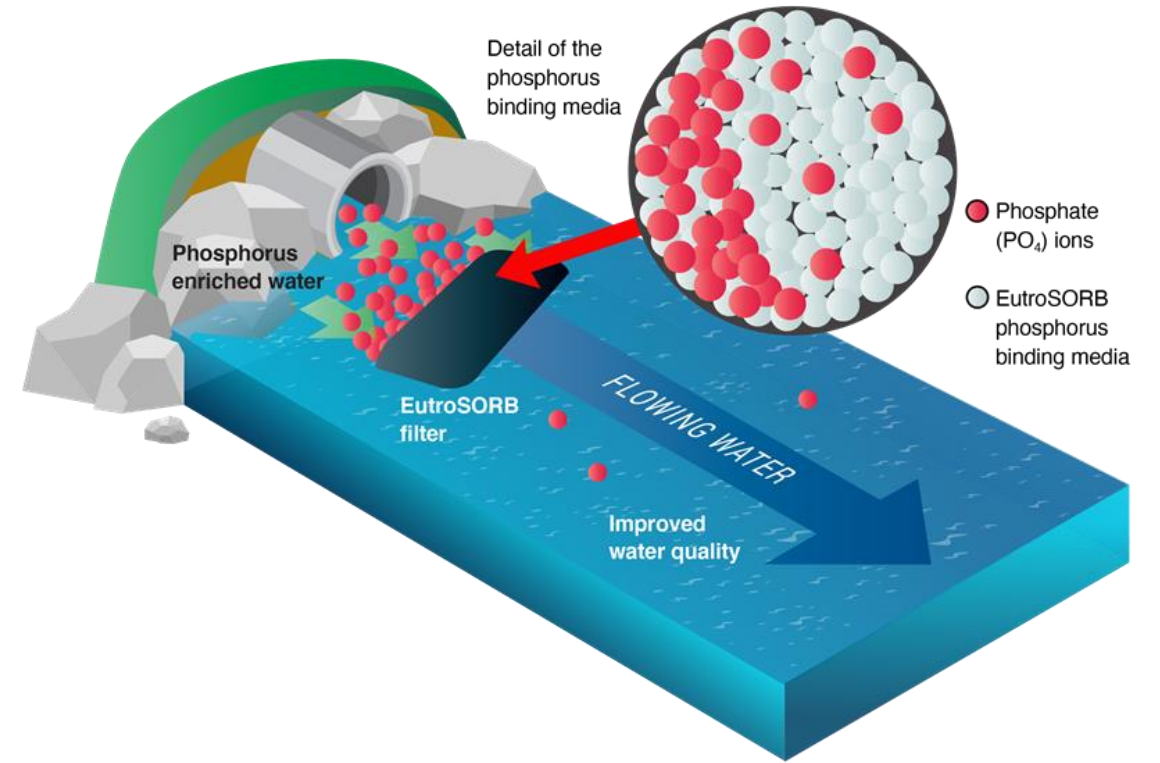
Ladybird Lake – Heart of Austin, TX

- 5 dogs died (August 2019)
- Worked with Watershed Protection Department to develop management strategy
- Project implemented (June 2021)
- 77% reduction in bioavailable sediment phosphorus



EutroSORB™

Phosphorus Filtration Technology



 EutroPHIX™

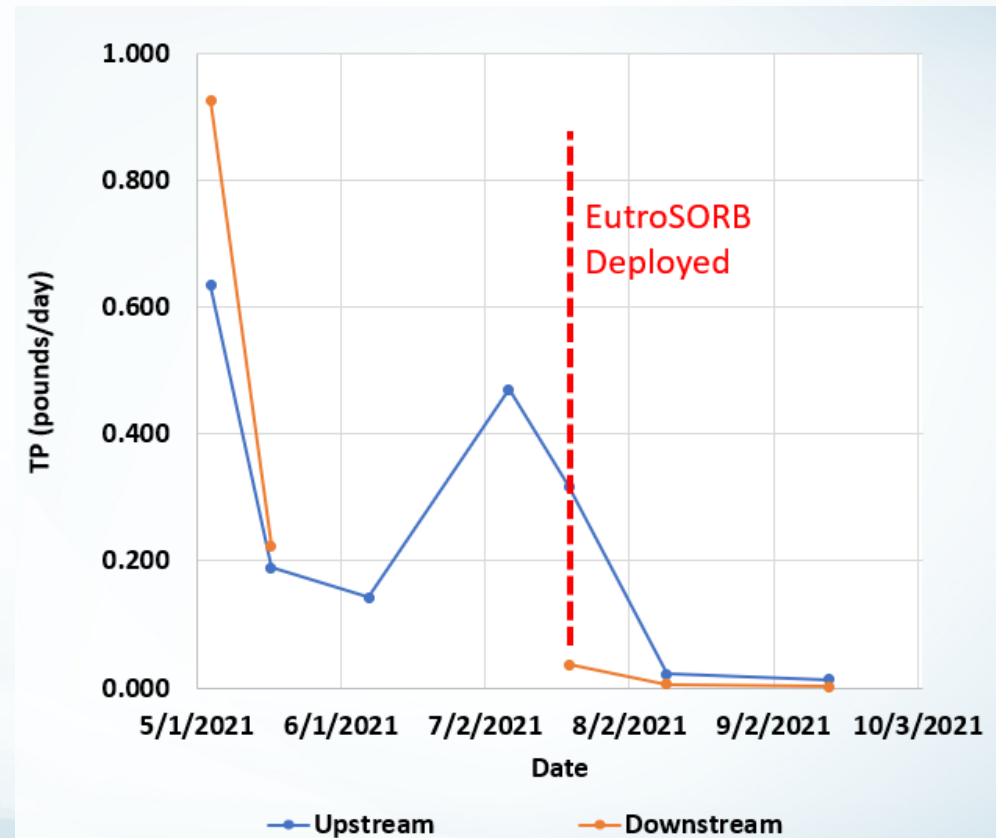
Post-use Disposal

- Does not bind heavy metals or toxins
- Filter media can be used as a soil amendment or landfilled



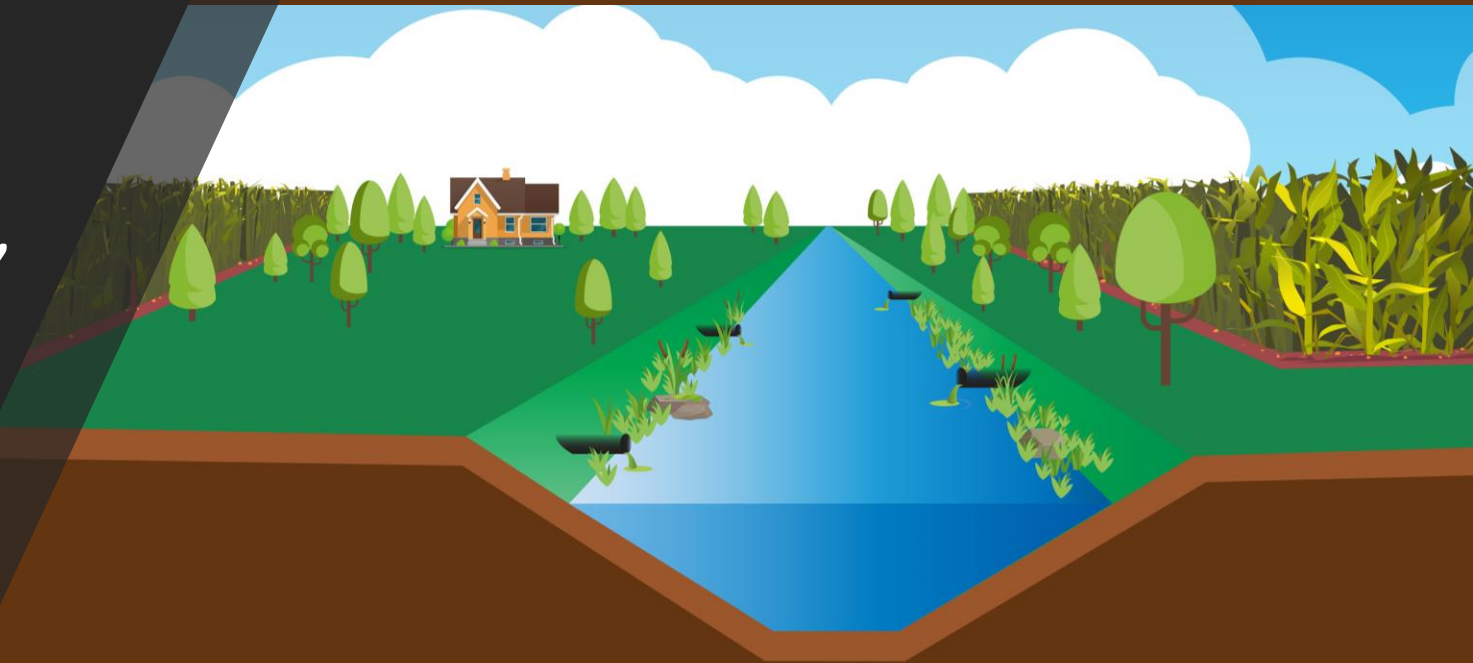
Bear Creek, CO

- Wilmot Creek
- ~0.1 CFS baseflow + stormflow
- 1000 lbs EutroSORB deployed over 900 linear feet (July 2021)
- 53% Removal (SRP)
- 76% Removal (TP)
- ~13 pounds removed
- Target: 20 pounds
 - 65% of target
 - Filters still in service
 - Low P levels (SRP << 25ppb)



Summary

- Flexible treatment options: Liquid and solid technologies
- Full-service R&D capabilities/implementation strategies
- Algae identification
- Sediment sampling/analysis
- Assist with securing funding (e.g., conservancy district formation)
- Work with regulatory agencies & permitting
- Develop prescription and budget based on project needs





Thank you!
Questions?
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Ecotoxicology – Aquatic Organisms

- Rare Earth Chemistries applied 2-3 orders of magnitude less than amounts which impact organisms (LOEC or EC₅₀)
- Extensive laboratory and field studies on ecotoxicity, over 150 peer-reviewed publications as references

