



Breathing New Life
Into Distressed Water Bodies

Lake Savers Project Results



Our Mission...

To make lakes and Reservoirs HEALTHIER using natural, sustainable technologies that work!

“When you give a lake what it needs to stay healthy, weed; muck and algae problems naturally disappear”





Lake Savers Success

2010 – 2015 Lake Restoration Projects

- ▶ Little Lakes, Frankfort, Indiana – 30 acres
- ▶ Maple Lake Paw Paw, MI – 40 acre treatment area
- ▶ Lake Greeley, Greeley, PA – 150 acres
- ▶ Turnberry Lakes, Village of Lakewood, IL – 100 acres
- ▶ Keeler Lake, Decatur, Michigan – 80 acres
- ▶ Podunk Lake, Hastings MI – 84 acres
- ▶ Austin Lake Portage, MI – 225 acres
- ▶ Indian Lake Dowagiac, MI – 500 acres
- ▶ Paradise Lake, Carp Lake MI – 400 acres
- ▶ Schmidt Lake, Plymouth, MN – 40 acres
- ▶ Pickerel Lake, Scots, MI – 140 acres
- ▶ Phipps Lake, Ortonville, MI – 80 acres
- ▶ Kassuba Lake , Gaylord, MI – 40 acres
- ▶ Paw Paw Lake, Watervliet, MI – 200 acres
- ▶ Sherman Lake, Richland, MI – 160 acres
- ▶ Sand Lake, Grant, MI – 80 acres
- ▶ Crooked Lake , Texas Township, MI.– 200 acres
- ▶ Lake Heritage, Gettysburg, PA – 120 acres
- ▶ Lake Tyrone, Fenton, MI – 120 acres
- ▶ Lake Ocie , MO – 60 acres



2010 – 2015 Reservoir Restoration Projects

- ▶ Lake Bridgeport Reservoir Fort Worth, Texas – 700+ acre treatment area
- ▶ Lake Benbrook Reservoir Fort Worth Texas – 800+ acre treatment area
- ▶ Toa Vaca Reservoir, Villalba, Puerto Rico – 800 acres
- ▶ Upper Tarrytown Reservoir, Tarrytown, NY – 30 acres
- ▶ Massabesic Reservoir, Manchester, NH – 225 acres
- ▶ Bear Gulch Reservoir, Atherton, CA – 45 acres
- ▶ Wenham Lake – Salem & Beverly Water Supply, Beverly, MA – 245 acres
- ▶ Glenmere Lake – Village of Florida Water Supply, Florida, NY – 150 acres



Lake Savers Results Highlights – Michigan

- ▶ Indian Lake – 500 Acres
- ▶ Crooked Lake – 200 Acres
- ▶ Pickerel Lake – 140 Acres
- ▶ Sherman Lake – 160 Acres
- ▶ Austin Lake – 200 Acre Bay



Indian Lake, Dowagiac Michigan

About the Lake

- ▶ 500 Acres, Max Depth 30 feet
- ▶ Classified as Eutrophic (impaired) in 2009
- ▶ Excessive Eurasian Water Milfoil
- ▶ Harmful Algal Blooms developed in 2011 & 2012

About the Project

- ▶ Selected aeration for muck reduction and milfoil reduction. Looking to reduce or eliminate chemical treatment.
- ▶ 88 Acre South Bay Aeration System installed in 2010 with Biological treatment
- ▶ 400 Acre Whole Lake System installed in 2012 with Biological Treatment
- ▶ Nutrient Filtration Technology installed on the Mann Drain inlet in Spring of 2014





Indian Lake Dowagiac, Michigan

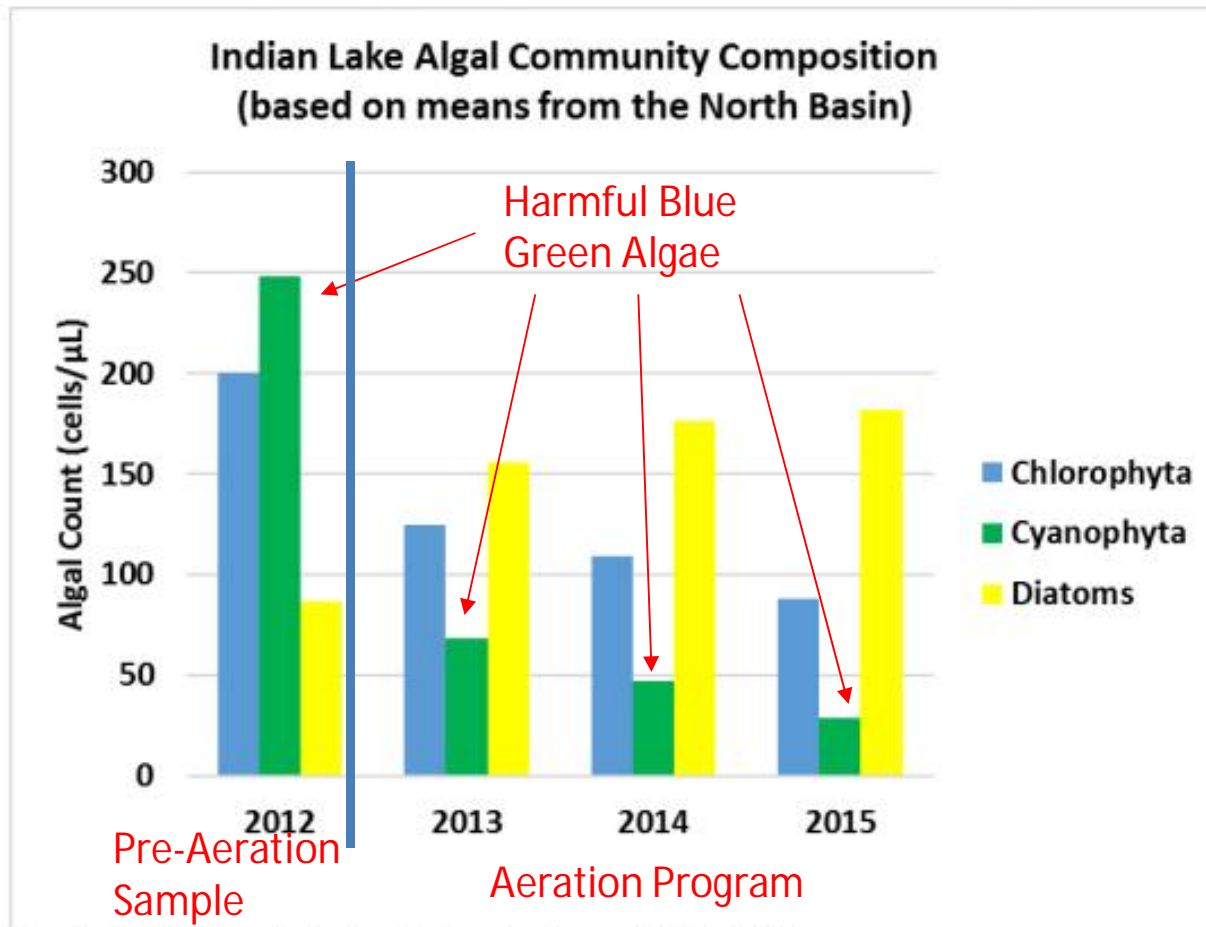
Results Summary

- ▶ 2 Foot muck reduction measured using permanent stakes in the lake bottom and divers to measure in 88 acre South Basin in 2010 & 2011. Cost to dredge this material out of lake would have been more than \$2 Million.
- ▶ Harmful Blue-Green Algae Blooms eliminated in one season after implementation of whole lake system.
- ▶ Water Clarity improved by 5.5 feet from 2012 to 2015.
- ▶ Sediment Total Phosphorus reduced by 25% from 2012 to 2015.
- ▶ 25% Reduction in area of Soft Bottom from 2014 to 2015 using ciBiobase Lake Scanning technology.
- ▶ No Treatment required for Eurasian Water Milfoil in 2015 after installation of Nutrient Barriers in the Mann Drain Inlet in 2014.



Indian Lake Dowagiac, Michigan

Algal Community Composition

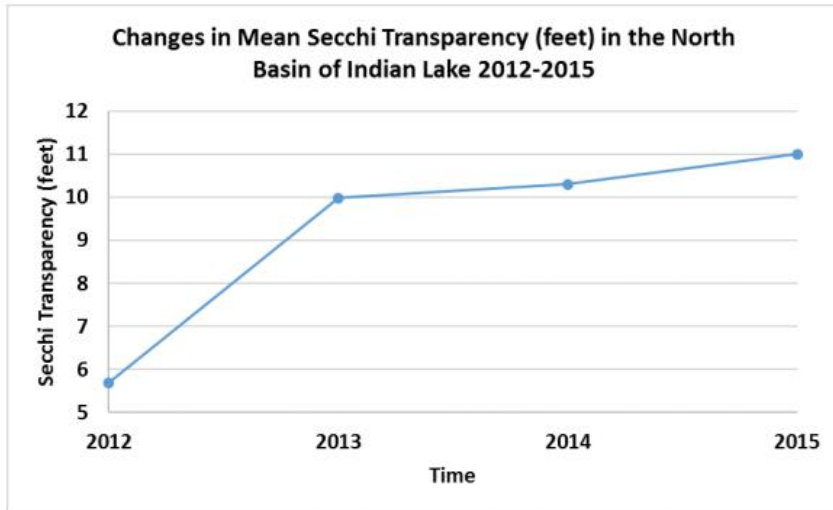


Graph 9. Changes in Indian Lake algal taxa 2012-2015.



Indian Lake Dowagiac, Michigan

Water Clarity

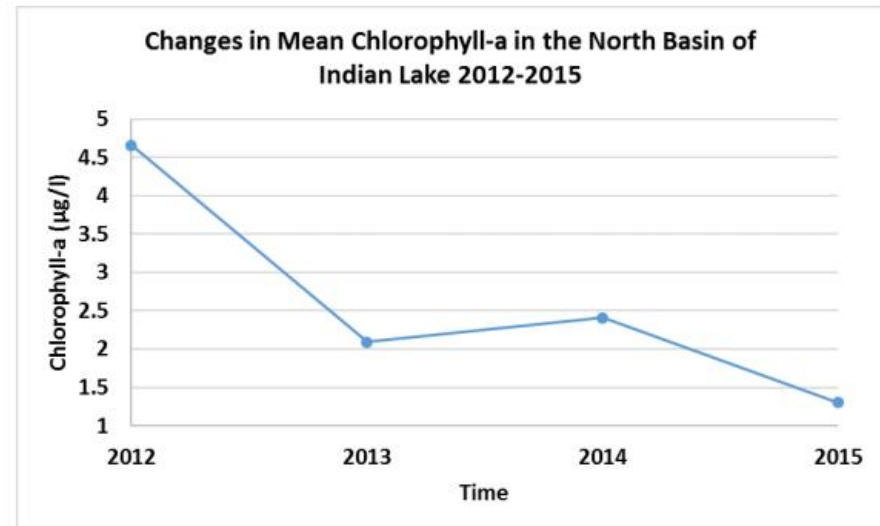


Graph 8. Changes in North Basin secchi transparency 2012-2015.

*Water Clarity
Improved by 5.5
Feet*

Chlorophyll-a

*Chlorophyll-a
Reduced 70%*

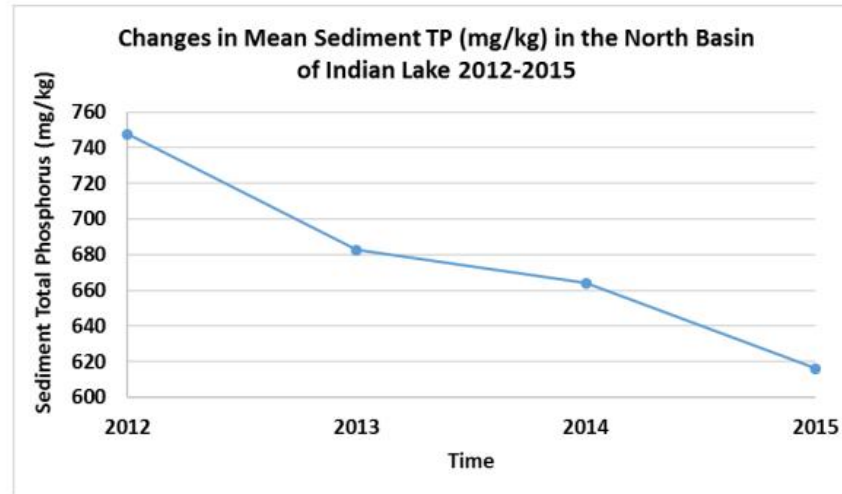


Graph 10. Changes in North Basin Chlorophyll-a 2012-2015.



Indian Lake Dowagiac, Michigan

Change in Sediment Total Phosphorus



Graph 7. Changes in North Basin sediment TP 2012-2015.

Change in Sediment Bottom Hardness

Parameter	May 2014	August 2015	Net Loss or Gain
Total Sonar Points	16,766	16,765	NA
Very Soft Bottom (0-0.15)	0.04%	0.04%	0
Soft Bottom (.15 to .25)	25.5%	0.30%	-25.2%
Medium Bottom (.25 to .35)	53.23%	66.32%	+13.09%
Hard Bottom (.35 to .45)	12.19%	21.97%	+9.78%
Very Hard Bottom (>.45)	6.37%	11.37%	+5.0%

Table 1. Changes in Indian Lake sediment hardness before (May, 2014) and after (August, 2015) aeration began. The percentages represent categories of bottom hardness. There has been a significant loss of soft bottom throughout the lake since the aeration program began.



Indian Lake Dowagiac, Michigan

Change in Sediment Bottom Hardness Maps Tan is Soft Bottom (Muck) Red is Hard Bottom

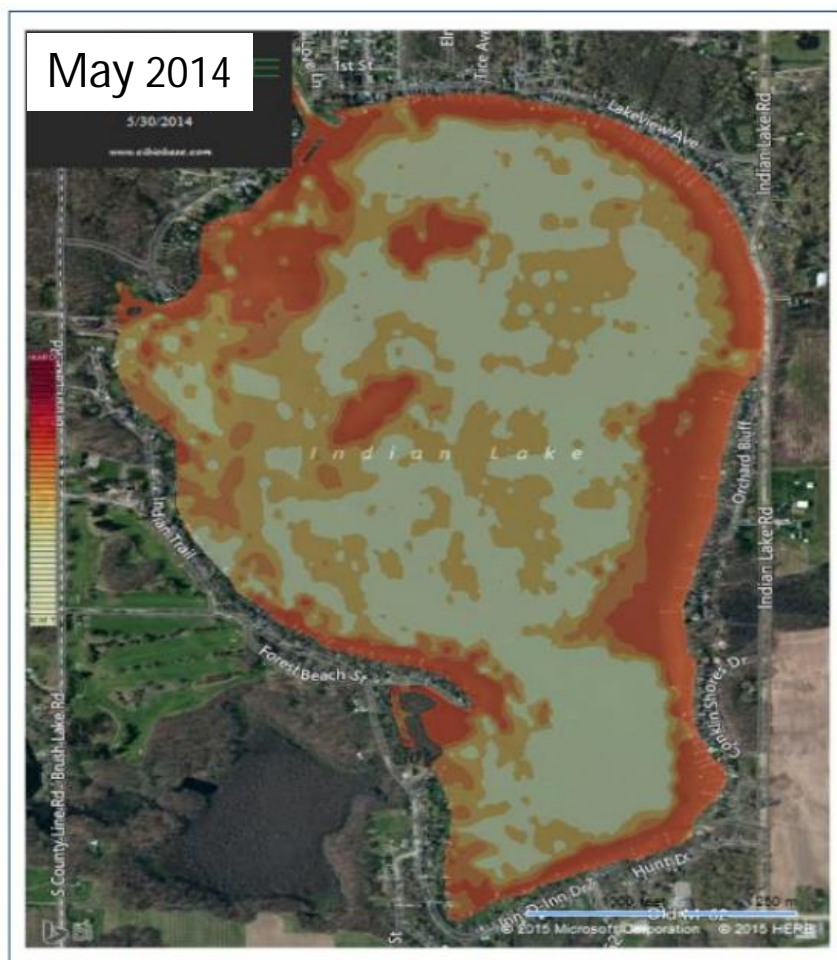


Figure 2. Indian Lake bottom hardness map (May 30, 2014).

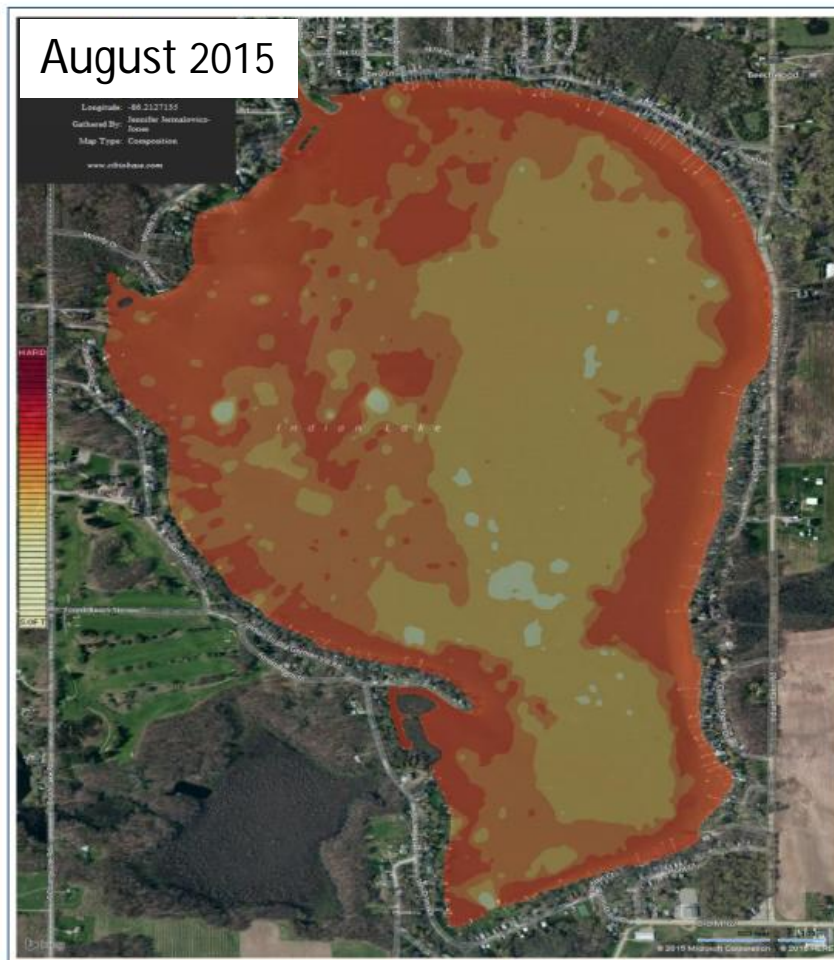


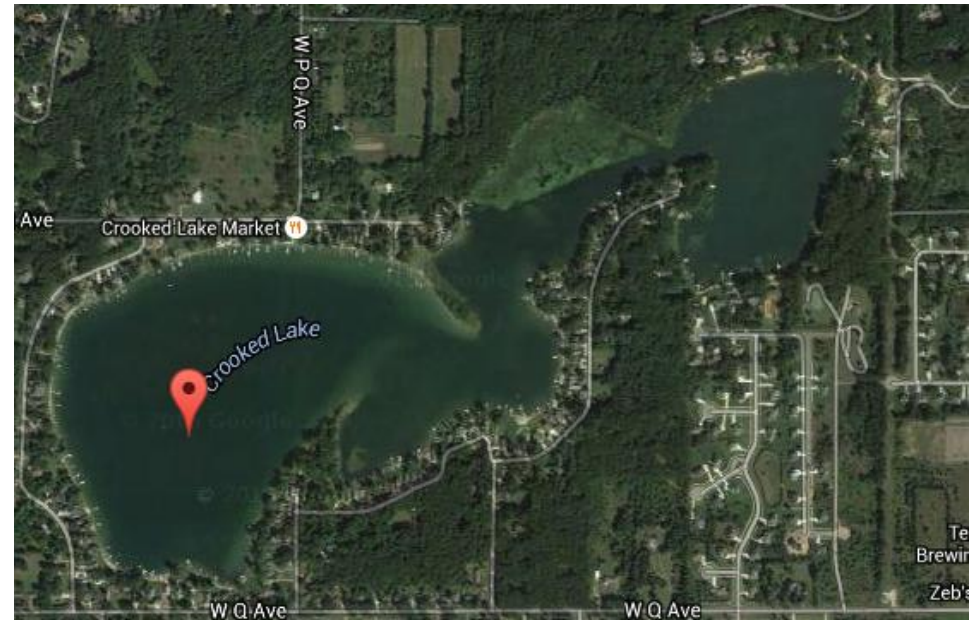
Figure 3. Indian Lake bottom hardness map (August 11, 2015).



Crooked Lake Texas Township, Michigan

About the Lake

- ▶ 171 Acres, Max Depth 50 feet
- ▶ Bad native weed problems in upper end of lake.
- ▶ Excessive organic sediment in upper end of the lake and in the deep basin.
- ▶ Lake runs out of oxygen in the deep basin at 25 – 30 feet each Summer



About the Project

- ▶ Whole Lake Aeration System installed in Fall of 2014
- ▶ Extensive Biological Treatment implemented in 2015



Crooked Lake Texas Township, Michigan

Results Summary

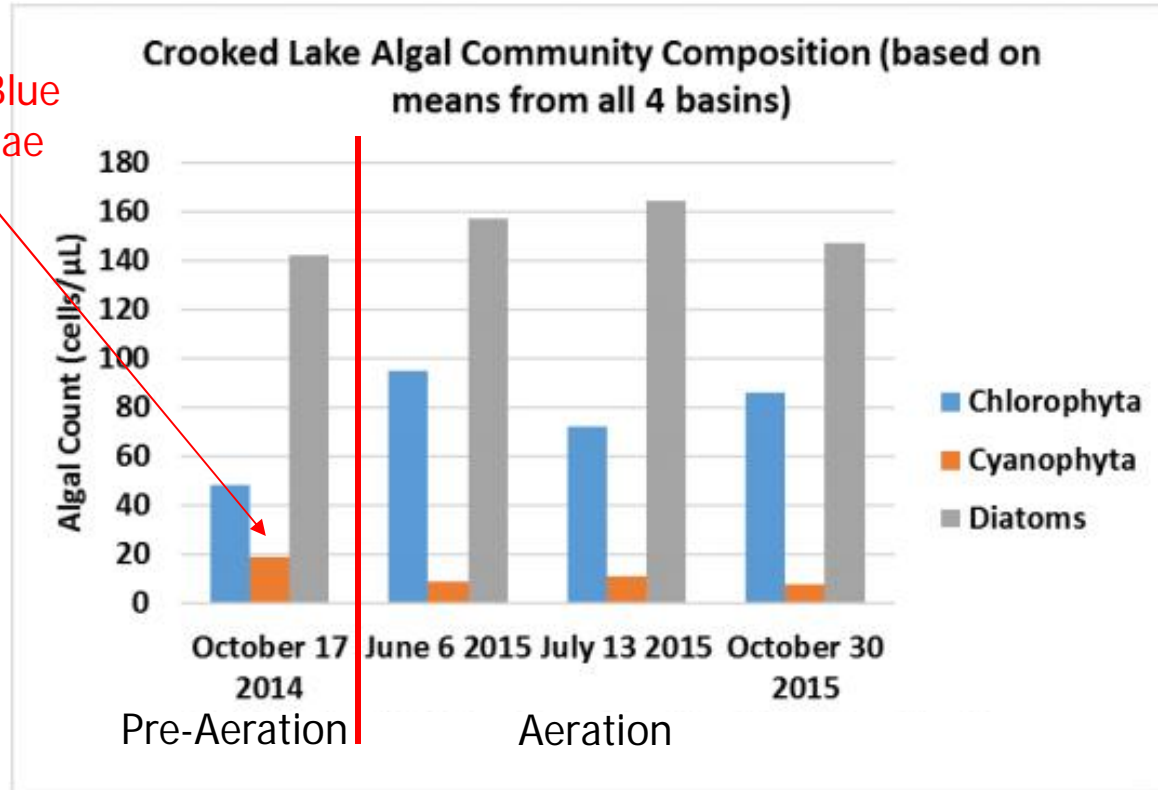
- ▶ All four lake basins showed significant muck reductions with 3 of the 4 basins achieving a 9+” average muck reduction and the middle basin achieving a 3.6” reduction. An area of input of new sediment was identified in this basin near a wetland area which is likely to account for the lower reduction.
- ▶ An overall 16.74% reduction in soft bottom areas was recorded with the whole lake ciBiobase scanning technology.
- ▶ Dissolved oxygen maintained above 6.0 mg/l in 50 foot basin.
- ▶ Blue-green algae reduced by 57% in the first year of operation.
- ▶ Significant milfoil reduction and an increase in native plant species recorded.



Crooked Lake Texas Township, Michigan

Algal Community Composition

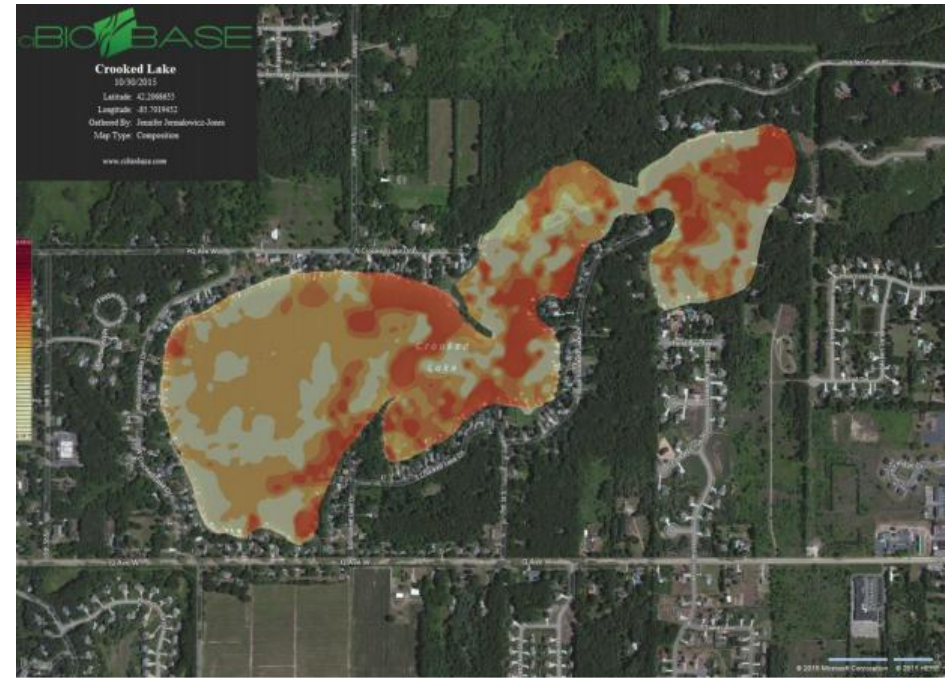
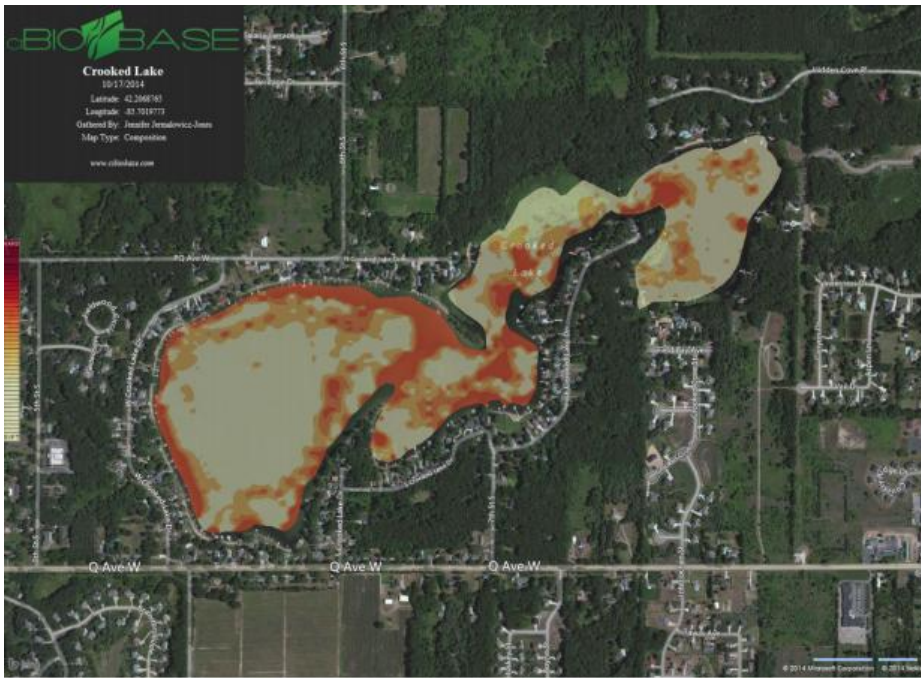
Harmful Blue
Green Algae





Crooked Lake Texas Township, Michigan

Change in Sediment Bottom Hardness Maps Tan is Soft Bottom (Muck) Red is Hard Bottom





Sherman Lake Ross Township, Michigan

About the Lake

- ▶ 160 Acres, Max Depth 36 feet
- ▶ Explosive Hybrid Eurasian Water Milfoil Growth.
- ▶ Worsening Blue-Green Algae Problem prior to Aeration.

About the Project

- ▶ Whole Lake Aeration System installed in June of 2013
- ▶ Extensive Biological Treatment implemented in 2014 & 2015.
- ▶ Problem Storm Drains identified in 2015. Filtration Project initiated in Fall of 2015 with completion in Spring of 2016.





Sherman Lake Ross Township, Michigan

Results Summary

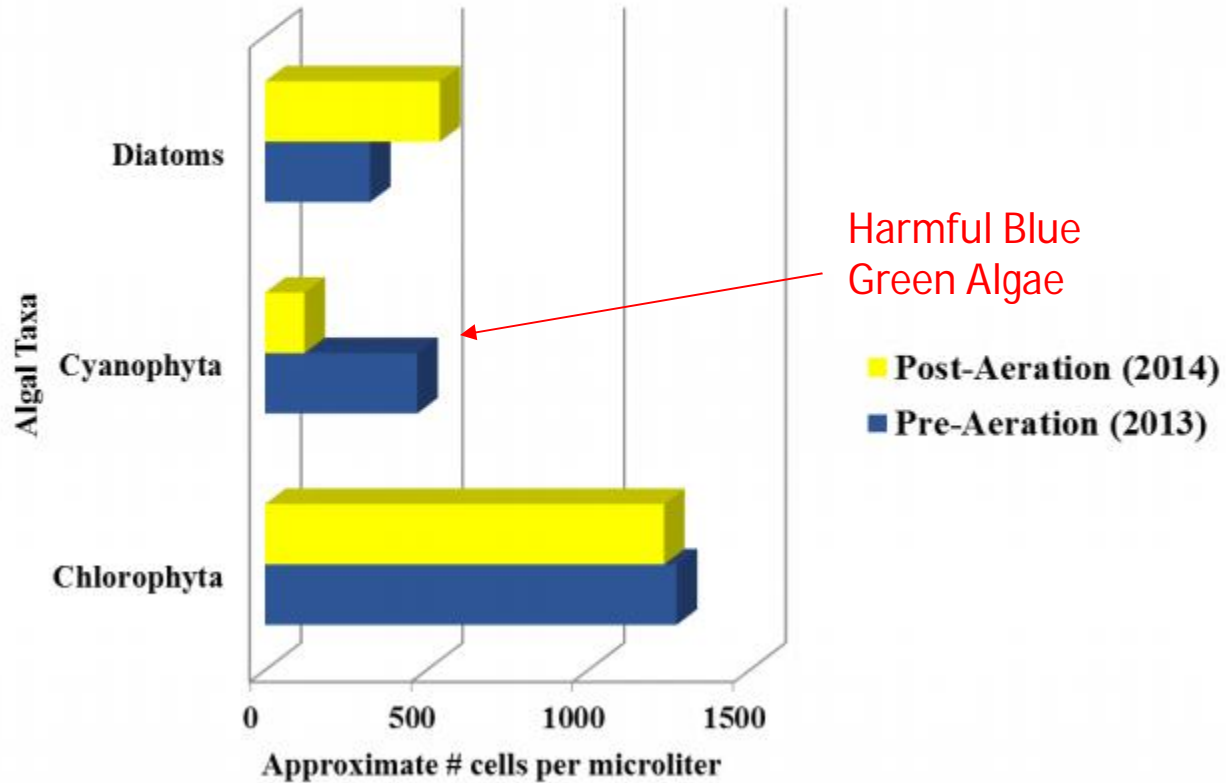
- ▶ Significant reductions in Eurasian Water Milfoil in 2014. More than expected regrowth in 2015. Likely cause traced to problem drains in 2 areas of the lake.
- ▶ Significant reductions in Blue-Green algae growth from pre-aeration levels.
- ▶ Significant reduction in soft bottom areas was recorded with the whole lake ciBiobase scanning technology.
- ▶ Results of drain filtration project will be monitored in 2016.



Sherman Lake Ross Township, Michigan

Algal Community Composition

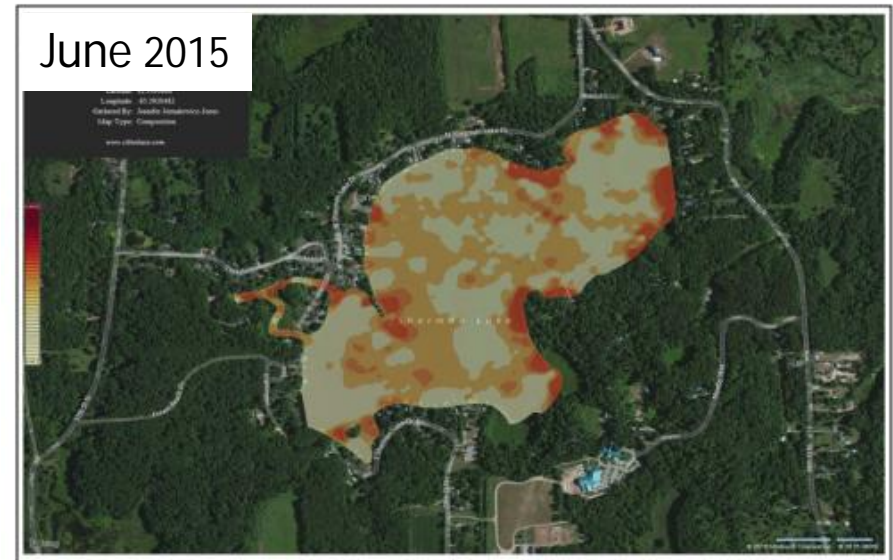
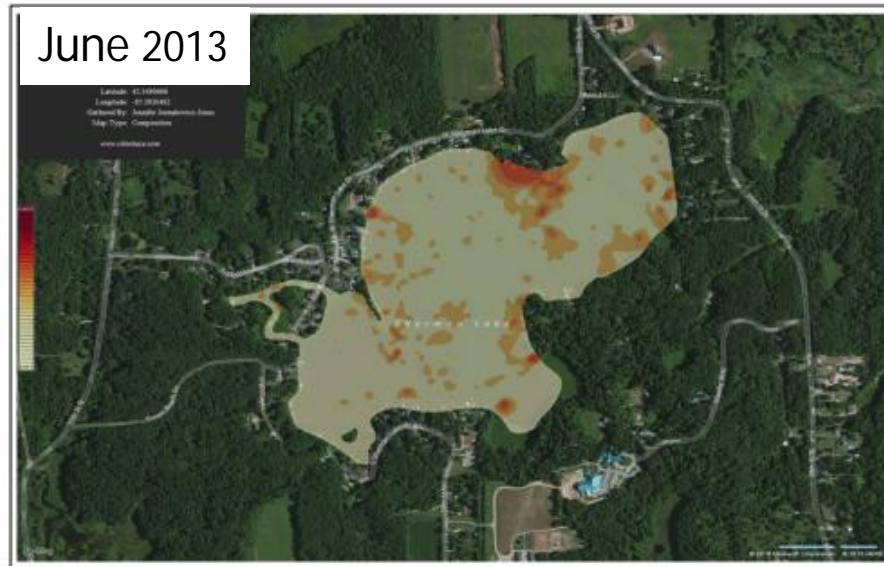
Pre and Post Aeration Algal Composition Comparisons in Sherman Lake





Sherman Lake Ross Township, Michigan

Change in Sediment Bottom Hardness Maps Tan is Soft Bottom (Muck) Red is Hard Bottom





Lake Savers Results Update

Other Lake Savers Projects With Similar Results

- ▶ Paradise Lake, 400 Acre treatment area on 1800 acre lake
- ▶ Austin Lake, 200 Acre treatment area on 1000 acre lake
- ▶ Sand Lake 80 Acres, Whole Lake
- ▶ Pickerel Lake, 150 Acres, Whole Lake
- ▶ Kassuba Lake, 60 acres, Whole Lake
- ▶ Glenmere Lake, 250 Acres, Whole Lake
- ▶ Schmidt Lake 40 acres, Whole Lake