

Restoration of Water Quality in Lake Lorene



Case Study

August 1, 2013



Aerial photo of the Lake Lorene, August 2011

Project Overview

Location: Federal Way, Washington

Lake: 8 surface acres, 5 foot average depth

Management Objective: Address eutrophication and restore water quality by reducing in-lake phosphorus pollution.

Solution: Application of Phoslock® phosphorus locking technology.

Results: Significant reduction in phosphorus and improved water quality.

The Problem

AquaTechnex, LLC has completed water quality and aquatic plant maintenance activities at Twin Lakes Homeowners Associations (HOA), Lake Lorene and Lake Jeanne, for more than ten years. Management practices include periodic assessment of water quality conditions and reactive algaecide treatments as needed. An aeration system was also installed in Lake Lorene within the last decade. In recent years, there has been a growing frequency of complaints from the community about the poor water quality, green color, surface algae blooms (cyanobacteria), foul odor and potential decline in waterfront property value.

The primary concern here is hyper-eutrophic status (phosphorus pollution) of Lake Lorene and the potential for health impacts (cyano toxins) and death of fish and wildlife if cyanobacteria blooms continue to persist in the lake. Laboratory analysis of samples collected by City of Federal Way personnel from Lake Lorene have historically documented extremely high microcystin toxin levels (up to 2,160 ug/L, 8/12/09) which is a thousand fold above the drinking water and recreational threshold levels in the State (Washington State Recreational Guidance for Microcystins and Anatoxin-a, 2008).

The Solution

AquaTechnex, LLC biologists along with Twin Lake HOA concluded the excessive phosphorus concentrations in Lake Lorene needed to be addressed in order to improve water quality. The project objectives to mitigate the hyper-eutrophic conditions in Lake Lorene were two fold; 1) bind and inactivate the free reactive phosphorus in the water column and 2) break the internal phosphorus cycling via inactivation of available phosphorus in the sediments. The recommended in-situ approach for Lorene was the application of the phosphorus locking technology Phoslock.

The Phoslock application to Lake Lorene was scheduled for split applications over a two year period. The initial application (70% of the total) was conducted on June 11, 2012 and the remaining balance of Phoslock was applied on April 22, 2013. The applications were conducted using a custom application system equipped with Global Positioning System technology. Local media coverage of the project can be viewed by going to the following link, <http://aquatechnex.wordpress.com/2012/06/12/king-5-tv-coverage-of-first-phoslock-application-in-washington-state/>

This was the first application of Phoslock to a public water body in Washington state and was implemented and monitored according to conditions of a permit issued by the Washington Department of Ecology. Water quality was monitored prior to and for 12 months after the Phoslock application.



Cyanobacteria blooms at Lake Jeanne, August 2012.



Phoslock applied to the lake by boat as a dilute slurry.

The Results

One week following the 2012 Phoslock application, there was a 34% decrease, 48.8 to 32.3 $\mu\text{g/L}$, in the average concentration of Total Phosphorus (TP) and 24% decrease, 29.3 to 22.4 $\mu\text{g/L}$ reduction in Free Reactive Phosphorus (FRP) (Figure 4). One month following application, TP concentrations continued to decline to 32.3 $\mu\text{g/L}$ and FRP dropping to 9.3 $\mu\text{g/L}$. The average twelve month TP concentration in Lake Lorene has been 33.9 $\mu\text{g/L}$. The following is a summary of the key water quality improvements and observations in 2012-2013.

- 12 month lake average TP concentration is 34 $\mu\text{g/L}$
- No cyanobacteria blooms in 2012 and 2013
- Water clarity has remained to or near bottom
- No adverse impacts to aquatic organisms



Aerial photos of Lake Lorene August 2011 (top) and July 2012 (bottom) Phoslock Application.

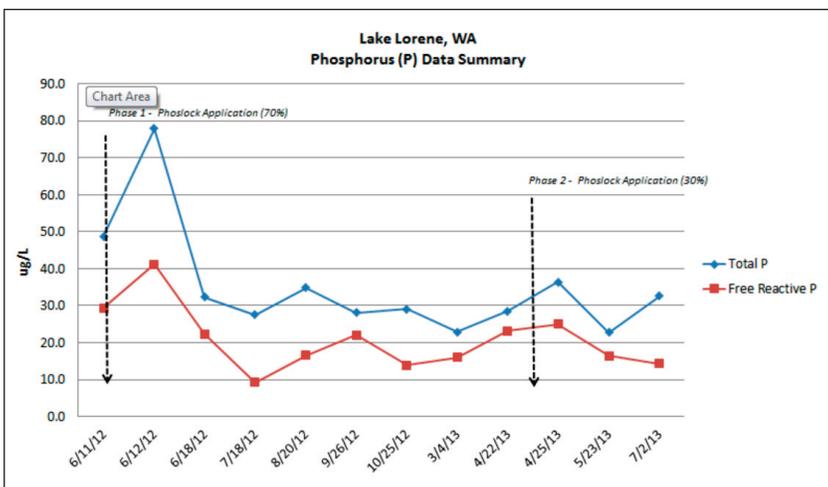


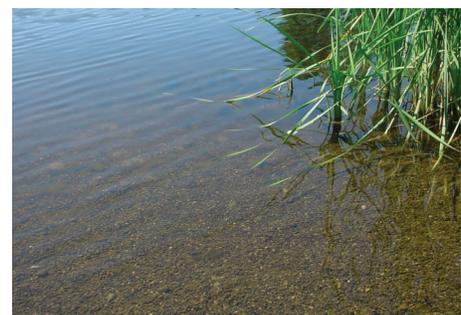
Figure 1. Average concentration of Total Phosphorus (TP) ($\mu\text{g/L}$) and Free Reactive Phosphorus (FRP) ($\mu\text{g/L}$) in Lake Lorene.

As for other beneficial water quality parameters, pH and dissolved oxygen remained stable during and after application. Outside of the typical short-term (< 48 hours) turbidity spike following the Phoslock slurry application, good water clarity was observed with secchi depth readings to or near the bottom throughout the season. There was no observed stress or impact to aquatic organisms and wildlife during this project.

Conclusion

The application of Phoslock has been effective in significantly reducing phosphorus pollution and restoring water quality in Lake Lorene. The sustained reduction of phosphorus concentrations in Lake Lorene demonstrates the ability Phoslock to initially inactivate FRP in the water column, bind available phosphorus in the sediments and break the annual cycling of phosphorus from the sediments.

Lake Jeanne continued to experience poor water quality and dense cyanobacteria blooms in 2012 and 2013. Having observed the benefits of a phosphorus mitigation program at Lake Lorene, Lake Jeanne HOA planning to implement a Phoslock program in the near future.



Lake Lorene, August 2012

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