# East Alaska Lake Alum Treatment - One Year Post-treatment

2012 Update

Submitted by: Onterra, LLC

In the mid to late 1990's, the Tri-Lakes Association, with help from private consultants and town, county, and state agencies, discovered that the lake's poor water quality was not only brought on by existing external loads, but also by the on-going effects of historical external loads that had be shut off years earlier. The association worked to minimize the remaining external loads and by the mid-2000s, had met its objective, leaving only internal phosphorus loading as the primary culprit impacting the lake's health. At that point, the association set out to implement an alum treatment on the lake.

In 2010, the Tri-Lakes Association received its fourth grant from the State of Wisconsin to fund the development of an alum treatment plan for East Alaska Lake. The project entailed the utilization of bottom coring to develop an alum dosing plan for the lake, the creation of a cost estimate for the alum application and subsequent water quality monitoring, the presentation of the plan to the association and surrounding community, documentation of their support, and development of a fifth and final grant application to fund the treatment. Following the completion of the studies and the intense public participation component, The Tri-Lakes Association voted unanimously to proceed with the alum treatment. By mid-summer, the association was notified that their fifth grant application was successful and they would receive 75% funding from the State of Wisconsin to complete the alum application and post treatment monitoring.

After 20 plus years of study and planning, the East Alaska Lake alum treatment was implemented in mid-October 2011 and included the application of nearly 84,000 gallons of aluminum sulfate over a two-day period. A single growing season's data has been collected at East Alaska Lake post alum treatment. Casual observations throughout the summer were positive as no filamentous algae was noted and near surface total phosphorus values were lower than previously measured (Figure 1).

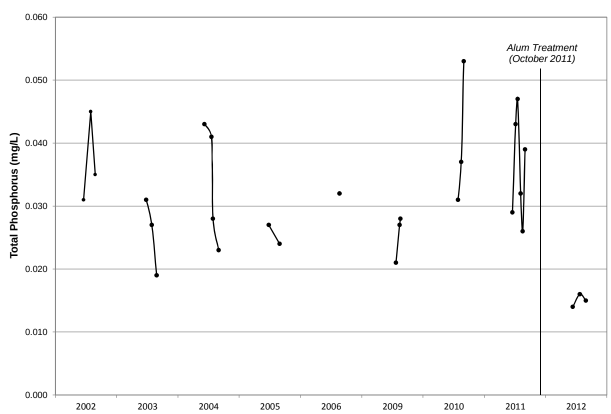


**Figure 1. East Alaska Lake summer (June, July, August) near surface total phosphorus values.**

In October just prior to stratification, East Alaska Lake is at its longest period of open-water stratification; and thus, phosphorus concentrations within the anoxic hypolimnion are near their maximum. During fall turnover, that phosphorus-rich water trapped all summer near the bottom of the lake is mixed throughout the water column where some of it can persist through the winter and be available to algae the following spring. In addition, phosphorus that builds up during winter stratification is mixed throughout the lake during spring turnover where it fuels algae throughout the summer. When the alum was applied in October of 2011, temperature/dissolved oxygen data indicated that the lake was still stratified; meaning the lake had not yet turned over and the phosphorus-rich water was still near the bottom of the lake. When the alum was applied, it bound much of the phosphorus within the hypolimnion and prevented it from being mixed throughout the water column during fall turnover. Likewise, the alum prevented sediment

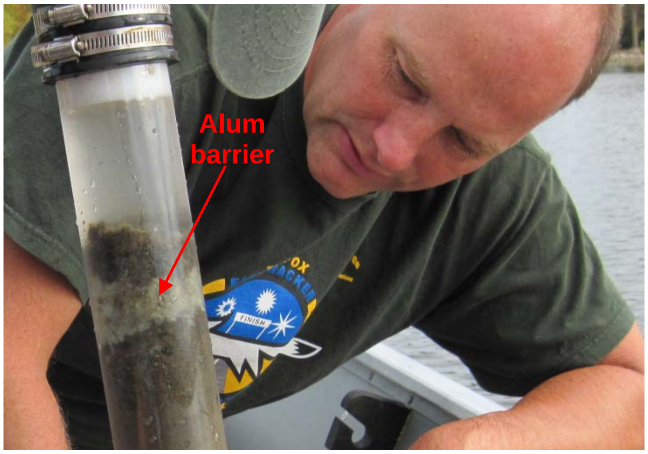


**Photo 1. Limnologists Tim Hoyman (Onterra) (pictured) and Paul Garrison (WDNR) inspect a sediment core taken at East Alaska Lake's deep hole in October 2012.**

phosphorus from being released during winter stratification which would have been mixed throughout the lake in spring. The prevention of hypolimnetic phosphorus from being released and mixed throughout the lake in the fall of 2011 and spring of 2012 is why near surface phosphorus concentrations in the summer of 2012 were lower than previously measured.

During early fall 2012, a core was extracted from the deep hole where the full dose rate of 132 g/m$^2$ was applied, and a distinct layer was found near the surface of the sediment, indicating a substantial barrier to sediment phosphorus flux had been created (Photo 1). While a sediment layer appears to have built up over the top of the alum barrier, this is actually a result of the higher-density alum sinking below a less-dense layer of sediment following application.

A phosphorus profile collected during the same October visit is also strong evidence of the success of the treatment, especially when compared to profiles collected the two previous years (Figure 2). As discussed earlier, phosphorus values within the hypolimnion in October are near their maximum. As illustrated in Figure 2, dissolved oxygen profiles (dashed lines) show that the lake was stratified during these sampling events in all three years. During the two years prior to the treatment, total phosphorus concentrations in the anoxic hypolimnion ranged from 0.1 to 1.24 mg/L, while the post treatment samples spanned from 0.040 to 0.088 mg/L. These data show that the alum treatment was successful in reducing the amount of phosphorus being released from bottom sediments during the summer of 2012.

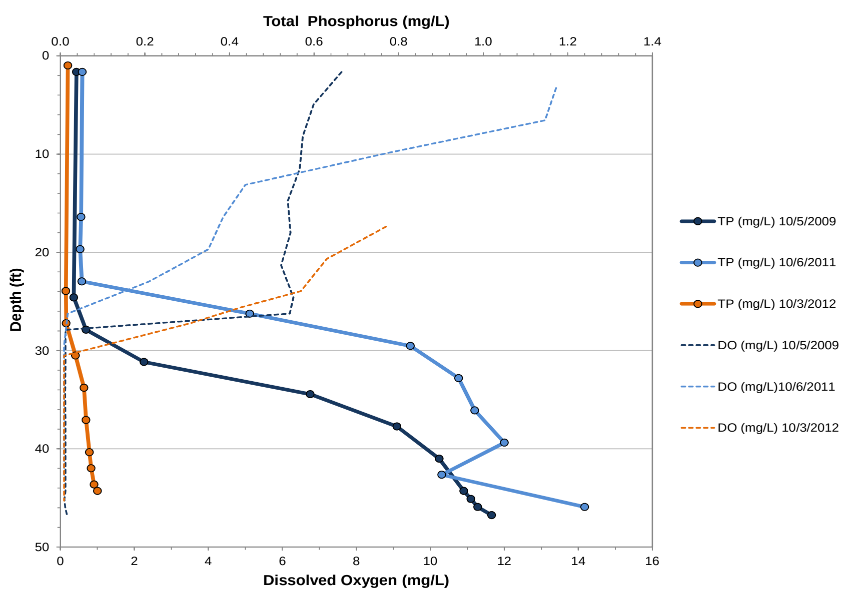


**Figure 2. East Alaska Lake 2009, 2010, and 2012 fall pre-turnover total phosphorus and dissolved oxygen profiles.**