

## Memorandum

**To:** Bassett Creek Watershed Management Commission  
**From:** Barr Engineering Co.  
**Subject:** Item 6G. Consider Moving Forward with Twin Lake Alum Treatment  
BCWMC September 18, 2014 Commission Meeting  
**Date:** September 10, 2014  
**Project:** 23270051 2014 628

### 6G. Consider Moving Forward with Twin Lake Alum Treatment

#### Recommendations:

1. Develop a public outreach plan that can be used to communicate with homeowners and the public about an in-lake alum treatment of Twin Lake.
2. Enter into a cooperative agreement with the City of Golden Valley to proceed with the first phase of an in-lake alum treatment of Twin Lake, upon completion of the following tasks:
  - Determine alum dosage plan, including modeling of pH conditions and mapping of application area(s) and contractor staging area
  - Develop Engineer's estimate of costs
  - Submit background documentation and notify MPCA and DNR of intent to proceed with the alum application; respond to questions/comments
  - Develop contract documents specifying the dose and areal extent of the alum application, as well as the terms of payment and bid quantities
  - Oversee bid solicitation, bid opening and award, as well as alum application and compliance monitoring

#### Background and Basis for Recommendations

Historically, the water quality of Twin Lake in Golden Valley has been excellent with high clarity and low phosphorus levels. However, following consecutive years of poor water quality during 2008 and 2009, the Commission authorized an evaluation of the cause and the development of feasible management options. (The BCWMC 2004 Watershed Management Plan includes a policy stating "the Commission will continue to identify opportunities to maintain or improve the excellent water quality in Twin Lake.") The water quality evaluation concluded that internal phosphorus loading had increased, largely due to increased water temperature and greater oxygen depletion in the bottom waters of the lake. Based on the *Feasibility*

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*Report for Water Quality Improvements in Twin Lake* (February 2013 at <http://www.bassettcreekwmo.org/Meetings/2013/2013-February/6B-TwinLakeFeasibilityStudy-Final.pdf>), the Commission's 2014 CIP projects included an in-lake alum treatment of Twin Lake. The in-lake alum application is intended to seal off the bottom sediments, which is the source of internal phosphorus loading in Twin Lake. It was recommended that half of the prescribed alum dosage should be applied in 2014 and the other half should be applied in a subsequent year to avoid adversely affecting aquatic life and to maximize the lifespan of the treatment.

Due to questions about the fish community in Twin Lake and whether or not it might impact the longevity of the alum treatment, the Commission ordered a fish survey by Blue Water Science and also requested that the DNR conduct a survey. The results of those surveys were presented in reports to the Commission in October 2013. The consultant indicated that fish communities in Twin Lake should not pose a threat to the longevity of the alum treatment.

Another factor contributing to a delay in implementing the project was the apparently improving water quality of Twin Lake, which called into question the need for an alum treatment. Results of detailed BCWMC water quality monitoring from 2014 (not including samples from 8/20 and 9/2) and the Citizen Assisted Monitoring Program (CAMP) water quality monitoring completed for Twin Lake in 2010 and 2011 show good water quality. The following table shows the mean summer water quality over the past ten years and compares it to the Minnesota Pollution Control Agency's (MPCA) water quality standard for Secchi disc transparency (SD), and total phosphorus (TP) and chlorophyll-a (Chl-a) concentrations.

	TP	Chl-a	SD
<u>Year</u>	<u>µg/L</u>	<u>µg/L</u>	<u>meters</u>
2005	21	3.1	3.7
2008	43	8.6	1.9
2009	70	25.4	1.2
2010	19	2.5	3.2
2011	13	2.3	2.8
2014 (to-date)	20	4.0	4.0
Ten-Year Average (all readings)	34	8.3	2.7
MPCA Water Quality Standards	< 40	< 14	> 1.4

The results of the summer water quality monitoring from the last ten years show that Twin Lake would not be considered an impaired water body based on the MPCA's criteria for deep lakes in this region of the state. However, the water quality observations from 2009, and 2008 to a lesser extent, indicate poor water quality and do not meet MPCA's anti-degradation rules for high quality water bodies. A detailed analysis

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of the water quality monitoring data indicates that the poor water quality was brought on by the winter internal phosphorus load becoming fully mixed in the spring, which results in initially higher surface water phosphorus concentrations followed by increased water temperatures and potentially greater extent of oxygen depletion in the bottom waters of the lake throughout 2008 and 2009. It appears that, depending on climatic conditions, this deteriorating effect on water quality in Twin Lake could be expected to occur often enough in some years to stimulate persistent algal blooms and discourage recreational use of the lake. An in-lake alum treatment would greatly limit the source of the nutrients and ensure that water quality in Twin Lake is consistently as good as, or better than, the observations from 2005, 2010, 2011 and/or 2014.