Executive Summary

(Excerpts compiled by LRichard)

1. Project Background

Lake Auburn, the principal drinking water supply for the communities of Lewiston and Auburn, Maine, has been known for its excellent water quality as a result of a strong watershed protection program. In 2011 and 2012, however, water quality was degraded-- compromising the cold water fishery habitat and resulting in the death of some lake trout (Togue).

The Lake Auburn Watershed Protection Commission engaged CDM-Smith and CEI to determine causes of the events and to identify actions to prevent future occurrences.

This study was divided into two phases:

* Phase 1 – Examined available data to investigate the causes of the degradation in water quality, and made recommendations on short-term actions that could be taken if poor water quality recurred.
* Phase 2 – Used additional data from 2013 to re-assess short-term actions and recommend long-term actions to reduce the sources and mitigate the adverse impacts of excess phosphorus on the water quality of Lake Auburn.

2. Phase 1 Summary

Overall, the March 2013 Phase 1 report concluded that while the degraded water quality was a serious concern, and watershed management programs needed to be continued and strengthened, an immediate in-lake management action did not need to be implemented. Instead, the following short-term management actions were recommended:

* Implement an enhanced monitoring program in the watershed and lake, and
* Obtain permits to allow for application of algaecide to control nuisance algal blooms as a short-term contingency plan if turbidity levels were elevated.

AWD/LWD and LAWPC implemented these recommendations in 2013, in addition to making good progress in further strengthening the watershed management.

3. Key Findings from 2013 Water Quality Data

Overall many indicators showed significant improvement in 2013 compared to 2011/2012, but the water quality was still notably degraded from previous years.

Is Degraded Water Quality Likely to Continue?

Factors that would indicate if degraded conditions are likely to continue are:

* High spring total phosphorus in the surface water -- fuels early algal growth and result in early high turbidity values;
* Unusual warm temperatures -- strengthens stratification and possibly the magnitude and extent of oxygen depletion in the bottom water, and promotes blue-green algal blooms; and
* Large intense storms – increases phosphorus load to the lake spurring algal growth.

Of these factors, there was only evidence of the first one in 2013.

While 2013 saw improvements in many water quality indicators, it would take a long time for the lake to return to pre-2010 phosphorus concentrations. Lake Auburn has a 4.8-year residence time and additional total phosphorus mass that became present in the lake in 2011 and 2012 would require nearly a decade to be reduced.

4. Long-term Management Recommendations

The recommended long-term management plan for Lake Auburn consists of three elements:

* Continued Monitoring

On-going evaluation allows for identification of trends that need to be addressed immediately.

* Watershed Management

Continue and strengthen on-going watershed management program that serves as the first barrier in the multiple barrier approach to providing safe drinking water. Ultimately, the reserves of phosphorus in Lake Auburn’s sediments have their origin in the watershed and minimizing watershed loading is in the best interest of the lake and its users.

* In-lake Management

During Phase 2, a wide range of in-lake management options were assessed with respect to their ability to reduce or prevent future algal blooms, episodes of high turbidity and to protect the coldwater fishery in Lake Auburn. The short list is provided below.

* **Dredging** – this option was subsequently eliminated due to its much higher cost
* **Hypolimnetic oxygenation** – Among several systems, a diffused oxygen distributor system was selected for Lake Auburn based on its lower installation cost and simpler operation.
* **Phosphorus inactivation –** Among the techniques for inactivating phosphorus an aluminum sulfate (alum) application targeting the surficial sediments was selected for Lake Auburn.

Because recurrence of degraded water quality is heavily dependent climate and other factors outside of our control, it is sensible to begin planning now to implement an in-lake management system.

5. Proposed Action Plan

The proposed plan of action is as follows.

1. Continue to monitor the lake water quality with the modified monitoring program, and prepare an annual summary of the monitoring data.
2. Continue to maintain and strengthen the watershed management program to control external loads of phosphorus through both structural and non-structural BMPs.
3. Maintain the ability to apply algaecide (by renewing the permit as necessary) as a short-term measure to control a significant algal bloom before it develops.
4. Plan for the implementation of either a diffused oxygen distributor system to oxygenate a portion or all of the hypolimnion in Lake Auburn or an alum treatment to bind phosphorus in
5. If an algaecide treatment is required, immediately review water quality data and climatic events to determine a likely cause(s), and unless the cause(s) is highly unusual (e.g., 2011’s breakdown of stratification due to passage of Hurricane Irene) initiate design and permitting to implement either a diffused oxygen distributor system or alum application by July of the following year.

Undesirable

**2012**

**2011**

**2005**

**2005**