

**American Water Resources Association
2015 SUMMER SPECIALTY CONFERENCE
Climate Change Adaptation
June 15 - 17, 2015
New Orleans, LA**

Wednesday, June 17

8:30 AM – 10:00 AM

SESSION 14: Water Supply and Adaptation 1

Lake Auburn: The Effect of Climate Drivers on Lake Water Quality - Zachary Eichenwald, CDM Smith, Boston, MA (co-authors: M. J. Dillingham, K. Wagner , B. Kolb)

Lake Auburn, the principal drinking water supply for the communities of Lewiston and Auburn, Maine, is a 2,260-acre reservoir with a maximum depth of 120 feet. The water has historically been known for its excellent quality, and the Auburn Water District and the Lewiston Water Division (AWD/LWD) were granted a filtration waiver in 1991 due in part to the lake's excellent water quality and the utility's strong watershed protection program. In 2011 and 2012, water quality in Lake Auburn was degraded due to climate drivers that caused increased algal activity, turbidity, and hypolimnetic anoxia. Turbidity approached the 5 NTU limit allowed under the utility's filtration requirement waiver and in 2012 a fish kill occurred due to unusually warm surface water and anoxia in the bottom waters. These water quality changes put the utility's filtration requirement waiver at risk and threaten the viability of Lake Auburn's cold-water fishery. The drastic shift in Lake Auburn's water quality in recent years prompted us to ask whether these changes are indicative of a current year events or a long-term trend. Such an analysis is complex because the main drivers behind water quality can experience wide interannual variations and lakes are complex physical, chemical, and biological systems. We found that single year events, such as destabilization of stratification due to passage of Hurricane Irene in 2011, atypical spring rains in June 2012, along with long-term trends such as increased stratification strength may have contributed to these water quality changes. This presentation will detail significant trends on water quality in the lake, and drivers for these trends including climate change effects on external phosphorus load, water temperature, and stratification stability. The implications of our analysis for Lake Auburn and other unfiltered supply reservoirs suggest that the utilities need to prepare for variable climatic conditions that could cause degraded water quality in the future. Such degradation, if not mitigated, could put AWD/LWD's filtration requirement waiver at risk. To lessen this risk, the following mitigation steps were recommended: * A short-term mitigation strategy to successfully obtain Maine's first permit to apply a copper sulfate algaecide in a water supply. The algaecide would be applied in the event that an algae bloom yet again threatens water quality. The 2013 algal community was reduced from 2011-12 and did not require an algaecide application. *

Continue the enhanced monitoring program started in 2013. * Continue to strengthen the watershed management program and phosphorus controls. * Begin planning for a long-term in-lake solution, if or when it is needed. This will be either hypolimnetic oxygenation or an

aluminum treatment, both of which would significantly reduce the internal phosphorus that would be released under anoxic conditions. Through this multi-pronged treatment approach, AWD/LWD should be able to continue to provide low-cost high quality water to its customers and preserve Lake Auburn's revered cold-water fishery.

Adaptation challenges in complex river basins: the Colorado and the Guadiana - Roger Pulwarty, NOAA, Boulder, CO (co-author: R. Maia)

Integrated water resources management provides an often-recommended governance framework to manage water resources in a sustainable way. The application of this framework on Transboundary Rivers brings additional challenges, which can be exacerbated due to climate changes and extremes (such as droughts). These changes affect the operation of water infrastructures and will affect water management practices. Thus, the understanding and development of adaptation measures (across socio-economic, environmental and administrative systems) is very important, mainly on drought prone transboundary river basins. The paper draws on research conducted to 1) assess climatic risks in those watersheds, 2) describe the challenges in water resources management in the context of climate change, and 3) draw lessons for improving the use of research-based information. Two case studies were selected, the Colorado River Basin (North America) and the Guadiana River (Iberian Peninsula), the latter being one of five river basins shared between Portugal and Spain. Research and experience in these Basins show that several paradoxes in multistate water management and governance across borders militate against the accurate assessment of socio-economic impacts and the effective use of scientific information for meeting short-term needs in reducing longer-term vulnerabilities. Lessons drawn from both studies, but not always learned in practice, abound. These lessons include an expanded use of incentives for improving collaboration, water-use efficiency, demand management and for the development of climate services to inform water-related management as new threats arise. Recommendations are made for more effectively linking risk assessment approaches with resilience strategies that are applicable in practice and available to decision makers in a changing climate.