

Algae Control in New Jersey Raw Water Reservoir

Since the spring of 2014, four solar-powered algae control buoys are operating in the Canoe Brook Reservoir #1 in Short Hills, New Jersey to control algae and cyanobacteria in the raw water reservoir. The reservoir is managed by American Water, America's largest publicly traded water and wastewater utility company.

Drinking Water Reservoir, Short Hills NJ, United States of America



- ✔ Improvement in the water quality
- ✔ 22% reduction in chemicals
- ✔ ROI of 1.8 years



"Extensive testing conducted during 2014 showed that the buoys had a significant impact on the algae, allowing the plant to reduce chemical consumption by more than 20 percent, and reducing the concentration of undesirable taste and odor causing compounds in the treated water delivered to customers".

Orren Schneider, Manager Water Technology American Water



Figure 1: MPC-Buoy algae control system installed in Canoe Brook reservoir #1

This case study is based on a research report executed by American Water Service Company that assessed the impact of the system for controlling algae and cyanobacteria in the raw water reservoir. The data was collected and analysed over a period of 5 months in the spring/summer of 2014. Authors of this research report are: Orren D. Schneider, Ph.D., P.E. Lauren A. Weinrich, Scott Brezinski.

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The Challenge: Address Episodic Taste and Odor events

As much of North America has seen warmer summers, growth of algae in many surface water supplies has increased. Additionally, the 2009 National Lakes Assessment from the Environmental Protection Agency has estimated that 20 percent of the nation's lakes are highly impacted by algae, and one-third contain some level of harmful algal toxins. This presents a challenge for water treatment plants trying to control algal blooms, which can create problems for performance and increasing operating expenditure for cleaning and maintenance activities (Dr. Orren Schneider, water technology manager, American Water)

The Canoe Brook Water Treatment Plant is located in Short Hills, NJ. The plant treats water from three reservoirs as shown in Figure 2. Water from the Passaic River is pumped into Reservoir #2 except during the summer. Water from Reservoir #2 then drains by gravity into Reservoir #1, which also is fed by the small Canoe Brook diversion. Water from Reservoir #1 then feeds the treatment plant via a pump station located on a pier on the most southwestern corner of the reservoir. Reservoir #1 is shallow (maximum 17 feet deep), and due to moderate-high levels of nutrients, also eutrophic. This combination of factors leads to seasonally severe algal blooms. In the past, the reservoirs were treated with copper sulfate or Cutrine®-Plus (copperethanolamine complex) to eliminate the algae. Additionally, the treatment plant was reconstructed in 2012 and includes preozonation, coagulation, dissolved air flotation, and GAC filters to deal with the algae and the accompanying



Figure 2: Canoe Brook Water Treatment Plant

tastes and odors. Despite the presence of the new treatment processes, the plant is still plagued by high concentrations of algae, which lead to excessive coagulant requirements, and impaired filter runs.

The primary objective of this study is to reduce algae concentrations in Reservoir #1 with secondary objectives to reduce the concentration of taste and odors causing compounds (geosmin and MIB), in the reservoir water and also to increase the efficiency of the plant by decreasing chemical doses and increasing filter run times.



Figure 3: 20 percent of the nation's lakes are highly impacted by algae

The Solution: Monitor, Predict and Control Algal Blooms

As an alternative to copper-based algaecides, American Water decided to use LG Sonic's ultrasonic algae control systems to control the algae growth. The LG Sonic systems emit specific ultrasonic sound waves based on real-time water quality data to control algae in lakes and reservoirs.

Based on the dimensions of the reservoir, 4 MPC-Buoy systems are installed. The MPC-Buoy is a floating, solar powered, platform that combines continuous online water quality monitoring, web-based software, and ultrasonic technology to effectively control harmful algal blooms in large water surfaces, such as lakes and larger ponds.



Figure 5: MPC-Buoy algae control system

As an alternative to copper-based algaecides, four MPC-buoy systems were purchased and installed in Reservoir #1 to control algal growth.

[Learn more about ultrasonic algae control](#)

The Treatment Process: Improvement in the Water Quality after Ultrasonic Program Change

The 4 Buoy system were installed on May 13, 2014. The plant and system was operated normally during the testing period. Because of the dry spring and summer, the inlet from Reservoir #2 was opened on August 13, allowing water to flow into Reservoir #1. This inlet was closed on August 26.

From the start of the testing program until August 25, the buoys operated using a generic program. On August 25, the program was changed remotely by LG Sonic to target cyanobacteria. September 9, the program was changed yet again to target the cyanobacterium, Aphanizomenon.

As shown in Figure 6, the optical data do not show any clear trends until early September, approximately 10 days after the inlet to Reservoir #2 was closed. At that point, the phycocyanin and chlorophyll concentrations rapidly rose. After the second program change on September 9, the chlorophyll and phycocyanin levels dropped almost immediately.

Similar to the optical data, the water quality data showed a rapid improvement in water quality after the second ultrasonic program change. Unlike the data collected at the intake, these improvements

were almost immediate and are likely related to the water quality at the point of highest ultrasonic energy intensity.

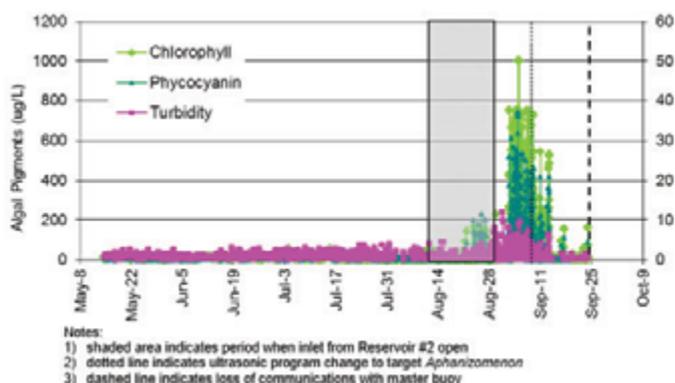


Figure 6: Data shows are rapid improvement in the water quality after September 9

The Results: Reduction of Chemical Consumption, Odor, and Taste Problems

As a result of the treatment, the concentrations of taste and odor compounds entering the plant were lower than in previous years. Additionally, the lower algal loads required significantly lower alum doses to treat (~20% lower dosage), which in turn resulted in improved DAF effluent turbidity (37% lower), lower combined filter effluent turbidities (19% lower), longer filter runs (127% better), and higher unit filter run volumes (83% higher) as compared to the same time period in 2013.

Reduced chemical use resulted in lower filter effluent turbidity and significantly increased filter run lengths over the same period in 2013, all while pumping approximately 20 percent more water than the previous year. Based on the cost of the equipment and savings realized, it is estimated that the payback period for the buoys is less than two years. Satellite imagery showing chlorophyll levels in Reservoir #1 was

provided by LG Sonic based on freely available data furnished by NOAA through Landsat-7 and Landsat-8 satellites. The imagery from 2013 shows Reservoir #1 to have nearly complete coverage by algae, with chlorophyll-a concentrations greater than 60 ug/L in August 2013 (Figure 7). The image from June 2014 (Figure 8) shows significantly lower concentrations.

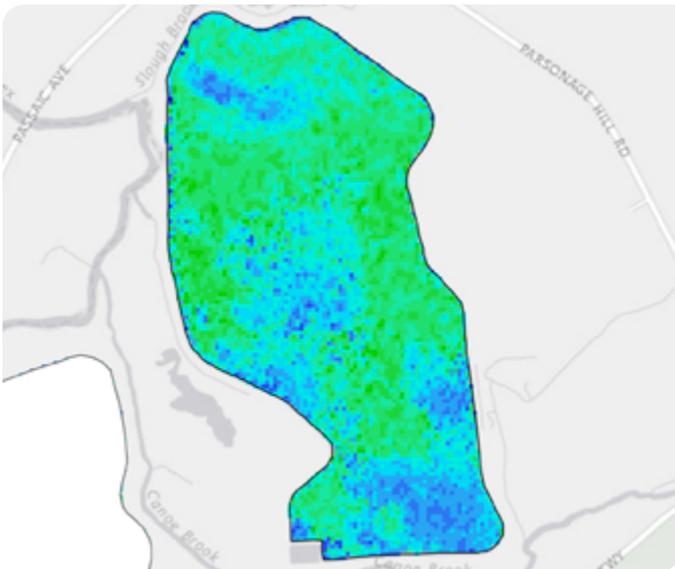


Figure 7: Satellite imagery showing chlorophyll levels in August 2013

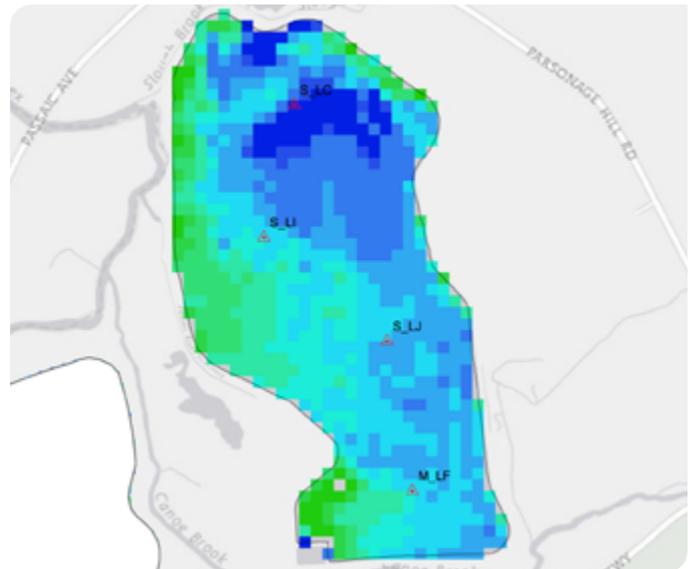


Figure 8: Satellite imagery showing chlorophyll levels in June 2014

Extensive testing conducted during 2014 showed that the buoys had a significant impact on the algae, reducing algal counts, raw water turbidity and total organic carbon in the water. This improved water quality, enabled the plant operations staff to reduce coagulant consumption by more than 20 percent and reduced the concentration of undesirable T&O-causing compounds in the raw water entering the plant.

Based on the results of this study, American Water plans to purchase buoys for other reservoirs impacted by algae and is looking at other uses including, clarification basins, waste backwash lagoons and wastewater/reuse applications. In March 2015 American Water and LG Sonic received a Business Achievement Award from Environmental Business Journal (EBJ) for this algae control project.