YSI Environmental

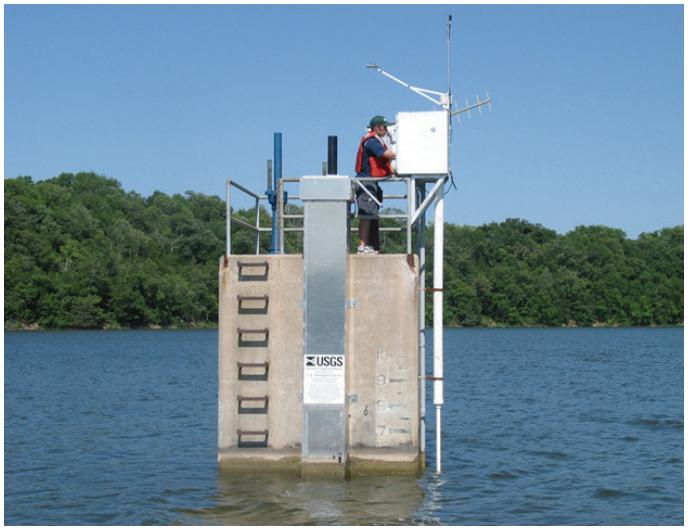
Pure Data for a Healthy Planet.®

Application Note

Monitoring the Water Quality of Lake Olathe and Protecting Drinking Water for Olathe Residents

Lake Olathe, located in northeast Kansas, is an important source water resource for the city of Olathe. The lake serves as a drinking-water supply, contributing about 10 percent of the city's water needs, with the remaining supply coming from wells in the Kansas River alluvium near DeSoto, Kansas. The reservoir was built in 1956 in response to the increased sediment deposition occurring in an upstream lake, Cedar Lake. Following completion of Lake Olathe, Cedar Lake was removed from service as a water supply. Both Lake Olathe and Cedar Lake also provide recreational boating and fishing activities to area residents.

Taste-and-odor occurrences in the drinking water from Lake Olathe have happened periodically during the past 20 years. These occurrences are probably a result of algal blooms that occur during autumn, but also may be derived from algal conditions in the shallow water of Cedar Lake that is discharged during storm runoff to Lake Olathe via Cedar Creek.



Automated vertical profiling station is attached to the drinking water intake structure at Lake Olathe.

In addition, increased residential and commercial development in the 16.9 square mile watershed has created sources of potential contaminants, especially nutrients, that can migrate by surface-water or groundwater flow to either Cedar Lake or Lake Olathe. Nutrients serve as a food source to algae and bacteria, but increased nutrient concentrations in water can shift the balance from stable algae and bacteria populations to an enriched environment that leads to algal blooms and a reduction in the dissolved oxygen concentration. This condition, known as eutrophication, causes many problems in lakes and reservoirs, from taste-and-odor occurrences in the water supply, to the reduction in fish populations, to the elimination of the water body as a resource to the community.

Studying the Water

In response to these concerns, the U.S. Geological Survey, in cooperation with the city of Olathe, and with support from the Kansas Department of Health and Environment and the U.S. Environmental Protection Agency, conducted studies in 2000 and 2002 to evaluate the water quality, sediment, and chemical transport through the Lake Olathe watershed and at Lake Olathe. This was part of a larger real-time monitoring study by the USGS of four major water resource areas in Kansas.

Results from this study indicate that phosphorus concentrations in the bottom sediment of Cedar Lake and Lake Olathe are some of the largest values for small reservoirs surveyed in eastern Kansas. Also microscopic blue-green algae observed in the bottom sediment indicate conditions that were favorable to taste-and-odor occurrences throughout much of Lake Olathe's life.

Monitoring Olathe's Drinking Water

Only in the past decade has it been possible to quickly and easily obtain real-time data about water quality. Timely water quality data is useful to immediately assess the effects of urbanization and agriculture on water resources. This is particularly important for managing drinking water supplies where human health is a concern.

Drinking water for Olathe residents comes from aquifers recharged by the Kansas River, with Lake Olathe supplementing the water supply during high-use, summer months. Ninety percent of Olathe's drinking water is pumped from wells in the Kansas River alluvium and treated and distributed at a water treatment plant. Typically, from July to September, a second water treatment plant treats and distributes water from Lake Olathe. Since 2000, lake levels have been drawn down as much as 8.5 feet during the summer months. However, intakes at two different elevations on an intake structure allow water to be pumped from the lake when lake levels decline. The intake structure also can be operated according to water-quality conditions. In June 2004, elevated manganese concentrations in the deeper part of the lake prompted the city to close the lower intake and open the upper intake. Taste and odor caused by algae has been an issue for water pumped from the upper intake and the city can close this intake when data suggests an algal bloom is in progress.

(continued)

+1 508 748 0336 Fax +1 508 748 2453 systems@ysi.com www.ysi.com
0306 A538

A monitoring station was installed at Lake Olathe's intake structure in 2004; it uses a YSI fixed vertical profiler. Additionally, a YSI 6600EDS water quality sonde – with sensors that measure specific conductance, pH, water temperature, turbidity, dissolved oxygen, chlorophyll, and PAR (photosynthetically-active radiation) – was submerged in the lake and programmed to move up and down the water column at regular intervals. The sonde takes continuous measurements of water conditions and relays this data via satellite to the internet so that water-treatment managers can view the data in real-time.

The managers use this information to adjust water-treatment operations at Lake Olathe. For example, models were developed to estimate the nutrient and taste-and-odor compounds at Lake Olathe and Cedar Creek in real time (http://ks.water.usgs.gov/Kansas/rtqw). They have determined that algal blooms are best explained by lake-residence time, turbidity, light penetration, and nutrient concentrations.

The YSI sonde has a unique wiping feature that allows it to remain deployed in the lake for up to 80 days without compromising data quality. The wiper removes fouling on the sensors caused by plant and organism build-up. This is particularly useful in water resources with active levels of algae.

Benefits of Continuous Monitoring

The city of Olathe is working to develop a watershed protection plan that will help ensure the long-term environmental health of Lake Olathe. The USGS studies provide a comprehensive assessment for the city with which to manage development and water quality in the Lake Olathe watershed and reservoir. Historical changes in nutrient and sediment loads have been evaluated from the results of bathymetric surveys and will be used to evaluate the effects of changes in land and chemical use in the watershed.

Results from this study have national benefit, developing tools and approaches that can be applied throughout the country for small watershed water-supply reservoirs and the effects of urbanization on these water bodies. Eutrophication of lakes and taste-and-odor problems are widespread; they can be addressed through information on the watershed in addition to engineering approaches. Results of this study have broad application in eastern Kansas and the Midwest where there are a large number of small impoundments with similar concerns and problems, as well as citizen groups interested in watershed protection.

In 2005, USGS is monitoring lake water quality by periodically collecting samples from Cedar Creek and Lake Olathe and by continuously monitoring various water-quality characteristics, including dissolved oxygen, at both intake elevations in the lake. Dissolved-oxygen concentrations less than 1.0 milligram per liter indicate the increased possibility of elevated manganese concentrations. With real-time water-quality profile measurements, water-treatment managers evaluate and determine which intake to use and how to optimize water treatment. The measured changes in water quality allow the city to provide improved drinking water.

For additional information please contact
Endeco/YSI
Tel.+1 508 748 0366
US 800 363 3269
Fax +1 508 748 2543
Email. systems@ysi.com
Web. www.ysi.com

Note: Reference to the USGS in this article does not constitute US Government endorsement of this product.