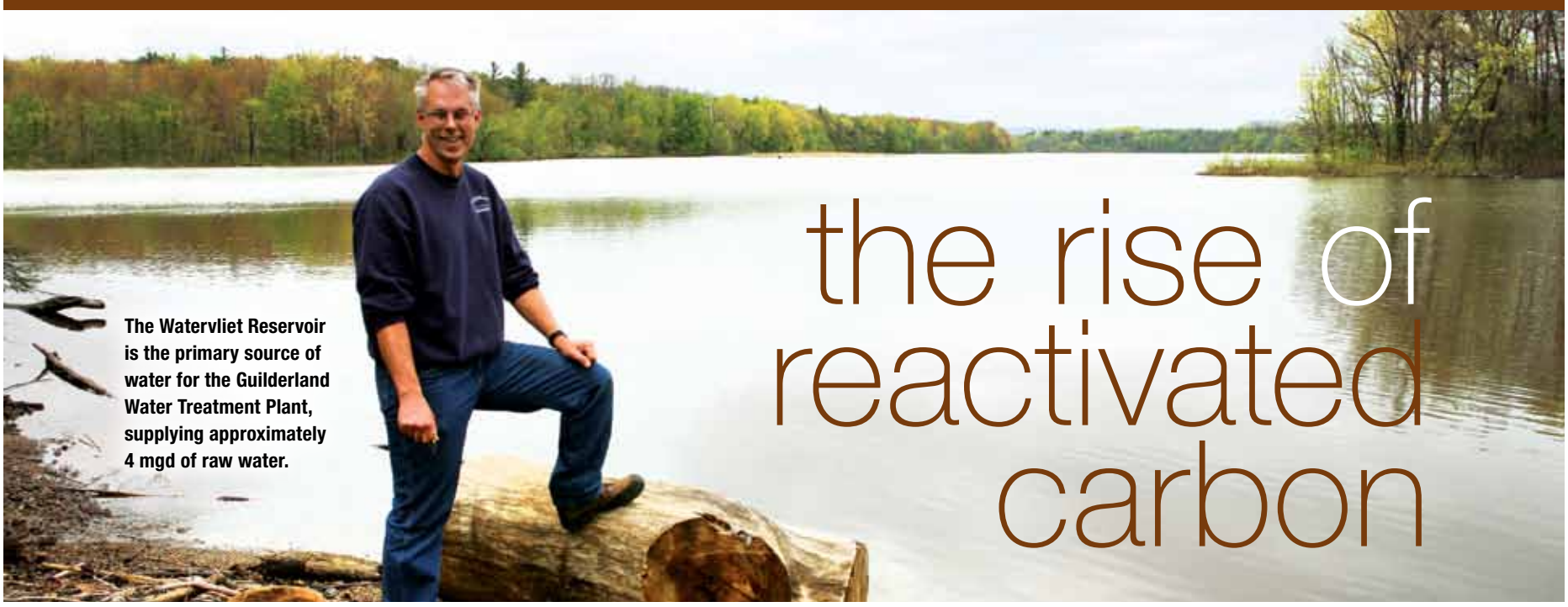

The Watervliet Reservoir is the primary source of water for the Guilderland Water Treatment Plant, supplying approximately 4 mgd of raw water.

the rise of reactivated carbon

By Leo Zappa

Increasing costs lead to shift from virgin carbon

The town of Guilderland and its water treatment plant are located in east-central New York, approximately 7 miles northwest of the state capital of Albany, and about 125 miles north of New York City.

In 2010, officials for the Guilderland Water District authorized a full-scale pilot program to determine the impact on cost and water quality associated with using reactivated carbon as a filtration medium instead of virgin granular activated carbon (GAC). Due to the success of the pilot program, the water treatment plant has transitioned over the past two years exclusively to reactivated carbon filtration, enabling the municipality to realize cost savings of more than 20% while maintaining the quality of its water.

Water Treatment Infrastructure

The Guilderland Water District supplies potable water to a growing population that was estimated to total between 28,500 and 30,000 people in 2012. The town has a projected growth rate of 50 to 100 homes, or 100 to 290 residents, per year. There are approximately 9,700 residential and commercial service connections.

The current water treatment plant was built in 1995 on a site that has hosted Guilderland's water treatment plants since 1971. It was designed as a fully automated facility to operate at a capacity of 6 million gal per day (mgd). The district draws its water from three different sources:

- A reservoir in Guilderland, which is owned and operated by the city of Watervliet;
- Three town-owned wells located near the Guilderland Water Treatment Plant; and
- Fully treated water from the city of Albany, which obtains its raw water from the nearby Alcove Reservoir.

Water Sources

The Watervliet Reservoir is the primary source of raw water for the Guilderland Water District. It supplies an average of 4 mgd to the treatment plant and has an estimated safe yield of 12 mgd with 99.8% reliability, meaning there is a potential reduction in safe yield due to severe drought once every 500 years. There has never been a drought emergency in the history of the reservoir.

The reservoir is located in the town of Guilderland, but is owned and maintained by the city of Watervliet. It has a volumetric capacity of approximately 1.4 billion gal and an impoundment area of 620 acres, capturing water from a 113-sq-mile basin drained by the Normans Kill, Bozen Kill and Black Creek.

Water from three wells adjacent to Guilderland Water Filtration Plant supplement the water drawn from the reservoir. The total combined withdrawal rate from the three wells is limited to 0.5 mgd by a mandate from the New York Department of Environmental Conservation.

There also is a permanent interconnect between the city of Albany and the town of Guilderland that allows transfers of up to 2 mgd. Water sourced from the town-owned wells and the city of Albany is treated with chlorine and sodium fluoride.

Water Treatment Challenges

Untreated water is drawn from the Watervliet Reservoir at the pumping station. As it enters the plant, polyaluminum chloride is added as a primary coagulant. Flocculation takes place in a series of stepped-type units for approximately 30 minutes, then the water flows from 60-degree tube settlers into mixed-media filters.

After the water is filtered in mixed media, it is refiltered through FiltraSorb 300, a high-activity GAC manufactured by Calgon Carbon Corp. from select grades of bituminous coal that have been pulverized, re-agglomerated with a binder, and activated and screened to an 8-by-30 U.S. sieve particle size distribution.

Final treatment of the filtered water includes disinfection with chlorine, pH adjustment with caustic soda and the addition of sodium fluoride for dental protection.

The primary challenge facing the Guilderland Water District is related to the quality of water brought to the plant for treatment. Suspended matter, consisting primarily of inorganic silts and clays, also contains a wide variety of organic carbon particles, particularly in the summer, when zooplankton, algal cells, filamentous organisms and bacterial cells combine to comprise a large fraction of the total organic carbon (TOC).

In addition to microorganisms, a range of amorphous fibrous matter from decaying vegetation adds to the composition of particulates. Microscopic examination of the drinking water reveals that additional particulate organic carbon is contributed by a wide range of organic debris.

In 1998, the U.S. Environmental Protection Agency (EPA) established two drinking water regulations that created specific challenges for the Guilderland Water District: the Stage 1 Disinfectants and Disinfection Byproducts Rule, which is designed to protect water consumers

from disinfection byproducts (DBPs), and the Interim Enhanced Surface Water Treatment Rule 1, which targets the reduction of microbial contamination.

The challenge for Guilderland officials was balancing the effects of each mandate. For instance, if the plant increased the disinfection doses to reduce microbial risk from *Cryptosporidium* and other waterborne pathogens, it faced the risk of violating the DBP mandate.

Conversely, the alternative—lower doses of disinfectant to reduce the potential for DBP violations—increased the chances for microbial contamination.

With the help of consulting engineers, Guilderland Water Treatment Plant officials discovered an answer to their problem: a treatment protocol incorporating enhanced coagulation and the use of GAC from Calgon Carbon. Together, they provided an ideal solution for concurrent treatment of microbial contamination and DBP risk.

Here is how: When free chlorine reacts with natural organic matter (NOM), such as humic and fulvic acids, it forms trihalomethanes (THMs), haloacetic acids (HAAs) and other DBPs. By reducing the amount of NOMs present in the untreated water before it was chlorinated through the introduction of enhanced coagulation and carbon filtration, the presence of DBPs was reduced. That, in turn, enabled the plant to use less chlorine for disinfection, thereby reducing the amount of chlorine byproducts in the water to well below acceptable levels.

Historical Use of GAC

In August 2005, the Guilderland Water Treatment Plant contracted with Calgon Carbon to install three Modular Model 10 adsorption systems using GAC. The units were purchased based on the recommendation of a local engineering firm after nearly two years of investigation, study and testing.

Each adsorption system incorporates two vertical-pressure vessels containing 20,000 lb of GAC, with the entire filtration system using six vessels and 120,000 lb of GAC. At present, the Guilderland Water Treatment Plant exchanges carbon every 14 to 16 months and follows a backwash protocol every three months.

In 2007, due to a significant increase in the cost of virgin GAC, plant officials began to look for alternative sources of filtration media. Calgon Carbon, which had supplied GAC exclusively to the facility until that point, suggested converting the plant to reactivated carbon. In 2009, after the use of reactivated carbon was approved by the New York State and Albany County Departments of Health, the plant converted two of its six pressure vessels as part of a pilot program.

When months of testing revealed no significant reduction in the levels of TOC adsorption in the two pilot vessels, two more vessels were outfitted with reactivated carbon in March 2011. The final two vessels were transitioned in May 2011, and now all six are functioning at performance levels that are virtually indistinguishable from virgin GAC.

The presence of TOC, HAA5 and THMs with reactivated carbon filtration has remained at levels comparable to those achieved with virgin GAC dating back to 2005. With the substitution of reactivated carbon, however, the Guilderland facility has reduced its carbon materials costs by nearly 23% while maintaining the same water treatment system and the same exchange schedule and costs.

Officials for the district expect to get five reactivation cycles from each 20,000-lb shipment of virgin GAC.

Chain of Custody Reporting

Calgon Carbon provides the Guilderland plant with a continuous chain of receipt for its original and reactivated carbon to help officials meet federal and state regulations. Virgin and reactivated carbon removed from the plant are stored and treated at the Calgon Carbon reactivation facility in Columbus, Ohio, which received certification from NSF Intl. under NSF/ANSI Standard 61: Drinking Water System Components – Health Effects for custom reactivated carbon for potable water applications. The Guilderland plant typically provides notification to Calgon Carbon one month before each reactivation and exchange is scheduled to take place.

While the use of reactivated carbon for different kinds of filtration has been common in Europe for 25 years, it is now becoming more popular in the U.S. due to the rising cost and limited supply of high-quality virgin carbon and the environmental benefits associated with recycling. WWD

Leo Zappa is director, municipal water market, for Calgon Carbon Corp. Zappa can be reached at lzappa@calgoncarbon-us.com.

For more information, write in 1110 on this issue's reader service form on page 45.

The Guilderland Water Treatment Plant serves about 30,000 people and has an operating capacity of about 6 mgd.

The primary challenge facing the Guilderland Water District is related to the quality of water brought to the plant for treatment.

Guilderland began using reactivated carbon for organics removal in 2009.

The Guilderland Water Treatment Plant uses three Modular Model 10 adsorption systems with reactivated carbon.

With the substitution of reactivated carbon, the Guilderland facility has reduced its carbon materials costs by almost 23% while maintaining the same water treatment system and the same exchange schedule and costs.