better BACKWASHING

By David LeBlanc

South Carolina plant improves capacity without additional structures

The city of Rock Hill, S.C., has a 24-million-gal-per-day (mgd) surface water treatment plant that had been struggling with a variety of filter performance and capacity issues. There were three generations of filter designs dating back as far as 1899. Upgrades in 1912, 1913, 1919 and 1994 were incorporated and additional cells added as capacity needs increased.

In the late 1990s, daily filter backwashes were required that used excessive amounts of precious water, especially during a drought season. With warm seasonal temperatures, particles and contaminants become sticky and difficult to remove from the dual-media filter bed. To effectively remove contaminants from the filter there was a tendency to increase the backwash duration, which resulted in the loss of some anthracite media in the filter. The media needed to be added or replaced periodically to maintain filtering performance. Effective backwashing, water used, wastewater produced and flow distribution were always a concern for the many filter cells installed over the years.

AIR & WATER SOLUTION

The city's engineer, Wiedeman and Singleton, Rock Hill, evaluated a number of treatment technologies and in 2004 selected both the Multiwash process and Multiblock with Laser Shield underdrains from Siemens Water Technologies. While cleaning the filter media using air and water, the engineers found that they could increase times between filter backwashes from once per day to once every 72 hours, improve online performance, minimize media loss and include this design as the basis for a final 60-mgd design buildout potential.

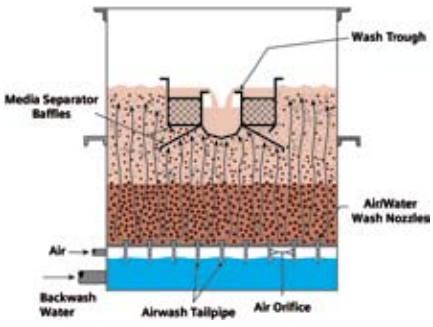
It has been proven that a sustained simultaneous air and water backwash process that provides a vigorous scouring action can effectively clean the filter media, even with the toughest fouling conditions. The high energy expended by this process promotes enhanced media grain collisions compared to alternative air-only or air-followed-by-water backwash processes. This results in higher percentages of adhered particles being dislodged from the media bed and the elimination of mud-balling. The combined water and air rates associated with this process fully expand the filter bed, thus enhancing the removal of the dislodged solids with the backwash water.

With the aggressive air water scouring action, the top layer of media is often agitated so much that it can flow with the backwash water into the wastewater wash troughs. The use of media-retaining baffles attached to the sides of the troughs prevents the media from entering the trough, letting it falls back into the filter basin. Only the backwash water laden with contaminants is allowed to leave the basin.

The high-density polyethylene dual-lateral block-style underdrains exhibit an even collection of the filtered water and even dispersion of the backwash water and air during the backwash process. The air for the backwash process is introduced through the bottom of the underdrain and distributed evenly along the length of the underdrain with minimal maldistribution. The open-slot design reduces media cap area in the filter by as much as 200 times when compared to porous bead designs, thus minimizing fouling potential.

The 12 refurbished filters were finished in Spring 2006. The combined total area of the filters is 4,295 sq ft, with five 18-by-20-ft filter cells, one 17-by-21-ft cell and six 17-by-20-ft cells. With the new Multiblock underdrains with Laser Shield and the Multiwash process, the filters are operated at higher filter rates (6 gal per minute/sq ft), increasing the Rock Hill plant's capacity from the previous 24 mgd to the city's new 36-mgd goal. With the Multiwash process, the water treatment plant is using

Figure 1. In the Multiwash process, media separator baffles prevent the media from entering the trough so that only backwash water laden with contaminants is allowed to leave the basin.



Multiblock underdrains with Laser Shield.

less water for backwashing and achieving cleaner filter beds following backwash. This has also resulted in decreased backwashing frequency and longer filter runs.

Previously, when backwashing one filter cell once per day, an estimated 54,000 gal of filtered water was consumed per backwash; over a three-day period, 162,000 gal would have been consumed for only one of the 12 filter cells. Now that the filter runs have increased to three days between backwashes, a savings of 108,000 gal of produced filtered water has been achieved for each filter backwash with less wastewater generated.

ROCK HILL'S RESULTS

The city of Rock Hill provides water service to more than 23,000 residential and commercial customers in the greater Rock Hill area. The city strives to: provide residents with an adequate high-quality supply of drinking water through the effective operation of its water filter plant and the installation, repair and replacement of water line infrastructure; to meet all criteria established by the U.S. Environmental Protection Agency and South Carolina Department of Health and Environmental Control for a water treatment facility to produce high-quality drinking water; and to produce enough clean, safe water to meet customers' needs.

"The upgrade of our filter beds to the Multiblock underdrains and Multiwash wash troughs has been one of our best investments in meeting our optimization goals," said Water Plant Superintendent Susan Featherstone. "This combination design reduced media loss, increased filter runs and consistently yields a finished water turbidity of around 0.02 NTUs."

The use of the underdrains and Multiwash process has provided substantial water savings. With less time spent offline and good cleaning of the filters, overall plant capacity has improved. This approach provided the city of Rock Hill with a cost-effective solution for expansion and enhancement of existing facilities without the need for additional structures. WWD

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