

Premier Blend

A LEED GOLD-CERTIFIED NANOFILTRATION PLANT SAVES ENERGY WHILE PRODUCING HIGH-QUALITY WATER FOR MIXING WITH A LIME-SOFTENED STREAM

By Doug Day

When it opened in 2012, the Dania Beach Nanofiltration Water Treatment Plant was the first LEED Gold-certified water plant in the world. Since then, the 5 mgd (2 mgd average) plant has run efficiently, yielding a better product for its 30,000 customers.

“The water quality has improved immensely,” says Phil Skidmore, treatment manager. “With the old lime softening filtration plant, it was a constant of jockeying pressures and levels in the two clearwells. Adding nanofiltration smoothed out a lot of that problem.”

The \$8.8 million plant upgrade allowed water with high organics from a regional wellfield to be treated in the nanofiltration plant and blended with water from the city’s 50-year-old lime softening process. The wellfield water has higher color and organics, making it hard to treat in the lime softening system.

The project was funded through the state’s revolving loan fund along with \$2.55 million from the American Recovery and Reinvestment Act (federal stimulus). Design assistance came from senior students of Dr. Fred Bloetscher, associate professor in the Department of Civil, Environmental and Geomatics Engineering in the College of Engineering and Computer Science at Florida Atlantic University.

HOW IT WORKS

The treatment process begins with a pair of 65-foot-deep wells that pump raw water from the Biscayne Aquifer. Source water is also purchased from a regional wellfield operated by Broward County. After going through sand strainers, half of the raw water is sent through cartridge filters before it enters the two-stage nanofiltration membrane system (BiWater). The plant also has third- and fourth-stage reverse osmosis membranes (all membranes from Hydranautics). The filtered water goes to two clearwells.

A student thesis led to the addition of reverse osmosis, which increases the finished water yield. “This plant can potentially get the highest recovery, 96 percent, of any nanofiltration plant in the world,” says Bloetscher.

The Dania Beach facility includes a washwater recovery pond.



The plant design pushed the envelope with a fourth stage in its nanofiltration membrane systems (Hydranautics).



One of two lime softening accelerators. A 2-million-gallon storage tank appears in the background.

WIDELY RECOGNIZED

The Dania Beach Nanofiltration Water Treatment Plant has won a string of awards in its short life span to date. They include:

- Florida Institute of Consulting Engineers Engineering Excellence, 2012 Grand Award
- Florida Design-Build Honor Award from the Design-Build Institute of America, Water/Wastewater Category
- Design Build Institute of America Grand Award
- U.S. EPA award for sustainable infrastructure
- National Council of Examiners for Engineering and Surveying Engineering Award for connecting professional practice and education
- 2012 Engineering Excellence Award National Recognition Winner from the American Council of Engineering Companies
- Consecutive honorable mentions in the Florida AWWA Region VI Drinking Water Taste Test

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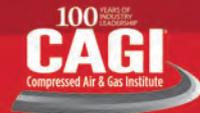
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Most nanofiltration plants use two stages and achieve a total recovery rate of about 85 percent. “We decided to see how far we could push recovery and got to 96 percent with a fourth stage,” says Bloetscher.

“It typically operates as a three-stage system and gets 93 percent recovery, but they can ratchet it up if they need to, such as if water supplies get tight. It takes a lot more operator observation because there is a narrow range in which the fourth stage will work efficiently. It’s easily fouled and gets saturated with barium sulfate.”

BLENDING STREAMS

The half of the raw water that doesn’t get nanofiltration treatment goes to the old 3 mgd lime softening system, where calcium and magnesium are precipitated out. After sodium hypochlorite addition, the finished water is sent to the two clearwells for blending with the nanofiltered water. Once blended, the finished product goes to a 2-million-gallon above-ground storage tank for distribution. The high-service pump stations that send the water to the distribution system have variable-frequency drives, as do all pumps and motors in the nanofiltration process.

The blending is important because nanofiltration removes too much alkalinity, while lime softening restores it. “We’ve figured out that if you mix the two finished waters, you actually get a better product, and you save huge dollars in post-treatment chemical costs,” Bloetscher says.

The raw groundwater has a pH of about 7; nanofiltration water is acidic (about pH 6). “That’s a little too corrosive to put out, so we have to raise the pH by blending the water,” says Skidmore. “Without blending, you’d be adding sodium hydroxide and other chemicals. Lime is a more natural chemical to use.”

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“This plant can potentially get the highest recovery, 96 percent, of any nanofiltration plant in the world.”

DR. FRED BLOETSCHER

The finished water goes into the distribution system with a pH of 8.5 to 8.8 and a Langelier Saturation Index slightly on the plus side to help prevent corrosion.

LEED CERTIFICATION

The LEED features of the building added about 3 percent to the construction cost, but the sustainable design saves enough energy to make up the difference in seven years. LEED certification through the U.S. Green Building Council promotes sustainable strategies and practices. “It has to do with using recycled material, ambient and efficient lighting, and sustainable building materials right down to the paint and carpet fibers,” says Skidmore. “It all comes into play. Overall, it’s a savings in electricity especially. Employees are very happy here.”

The idea to seek LEED Gold certification came from the students in Bloetscher’s senior design class, who developed the conceptual designs for the plant and provided them to the bidders. The general contractor was CDM Smith.

“The plant is a tour in itself,” says Bloetscher. “When you walk around, you see gold plaques to note places we got LEED points.” The building, with a white cool roof, was constructed with recycled steel and locally sourced concrete block. The windows are made of glass that allows light in but reflects heat to reduce the need for internal lighting and cooling.

Nearly five years after opening, the first-of-its-kind Dania Beach plant has presented few issues for the city. Says Bloetscher, “It operates just the way it’s supposed to.” **tpo**

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