A Picture-Perfect Project

Geneva's new water treatment facility is inside a facility made to look like a large barn.

By Barney Fullington, Bob Van Gyseghem, and Mike Martens

Most people in the vicinity of Geneva, IL, a far-western suburb of Chicago, would mistake the city's new water treatment facility for a large red barn complete with a silo—but without livestock, crops, and tractors. Nestled on a piece of farmland on the outskirts of town, the facility certainly doesn't conjure up thoughts of reverse osmosis (RO), filtration, disinfection, or anything close to water treatment. And that's just one of the reasons why it's magical.

Growing public concern about high quality drinking water and impending regulatory requirements for radium levels spurred design and construction of the eight-mgd water treatment facility. The Black & Veatch-designed facility was part of a complete revamp of the city's water supply and treatment system, which also included new wells, well water transmission mains, and a new transmission main to convey finished water to the existing distribution system. The Black & Veatch (www.bv.com) team included local subconsultant, Rempe-Sharpe and Associates, Inc. (Geneva), which assisted with site development services. The city separately contracted with a local instrumentation and control integrator, Tri-R Systems, to perform all programming work for the project.

The $22-million water treatment facility incorporates RO for hardness reduction and radium removal; greensand filtration for iron and manganese removal; nine chemical feed systems, which include bulk delivery of sodium hypochlorite for iron/manganese oxidation; and disinfection. The end result is softer water with levels of radium—a naturally occurring radioactive element in the deep aquifer utilized by the city—that are substantially below regulatory limits.

Geneva's new water treatment facility honors the local agricultural heritage of the area and provides open space, bike trails, and wetlands for the community.
Photo credit: Black & Veatch

Construction of the treatment plant began in June 2006 and lasted about 21 months; Williams Brothers Construction, Inc. (Peoria, IL) served as general contractor. Although the industry change order average can range from four to five percent of construction costs, Geneva's new water treatment plant was completed with project change orders that totaled less than one percent of total construction costs. The low total cost of change orders is primarily attributable to the lack of conflicts due to the use of 3D design and drafting as well as the cooperative spirit among the owner, designer, and contractor. Startup of the treatment facility began in January 2008, with substantial completion awarded April 1, 2008.

"Throughout the planning, design, and construction of the new facility, we worked closely with Black & Veatch to make the project a success and a major asset for the city," said Dan Dinges, P.E., Geneva Director of Public Works. "Not only are we providing the community with safe, high-quality drinking water, but the new treatment facility is also an architectural showcase for the city."

Although the westward expansion of

residential development in the Chicagoland area has begun to fully encompass Geneva, the town has a rich agricultural heritage including several historic farms on the city's western edge. So when it was time to consider the architecture for a new water treatment facility, the city's public works officials knew they wanted something that would blend in with the rural setting. Black & Veatch was selected to provide planning and design for the new treatment facility, and the company worked closely with public works staff at every stage of the project to fulfill the city's vision. The collaboration culminated in a picture-perfect plant that incorporates advanced water treatment processes and a high degree of automation in what appears to be a large agricultural barn.

In 2007, the city finalized a comprehensive Strategic Master Plan for 2017 that outlined guiding principles and vision for the future of the community. Key tenets of the plan included:

- Honoring and preserving the community's heritage and character.
- Maintaining a strong commitment to community health and wholeness.
- Balancing community needs and desires with required resources.
- Valuing open space and environmental awareness.

All of these principles were reflected in the design and construction of the new treatment facility, which was constructed on 40 acres of land that also includes bike paths, wetlands, and open space. The site is part of Geneva's overall vision of providing a greenway along its western border that enhances the natural ecosystem and provides recreation opportunities for the community while also serving as a buffer against future development to the west.

A Hard Look at Water Softening

Before the new facility was brought online, Geneva's water system consisted of direct use of water from deep wells coupled with removal of iron and manganese from the local shallow aquifer. When new regulations made it imperative to reduce levels of radium from the deep aquifer, the city seized the opportunity to build a new treatment facility that not only removed radium, but also provided softened water for the community.

Planning for the new facility included a conceptual study to determine the best softening process from among the most commonly used options: membrane softening, ion exchange softening, and lime softening. The city selected membrane softening using RO. The decision to use membrane softening was based on the following factors:

- The process could be highly automated to reduce labor costs.
- The system could be housed entirely inside for security and aesthetics.
- RO provides the city with a greater ability to address future regulatory requirements and future deterioration of the aquifer water quality.
- Membrane softening was cost competitive with lime softening and does not require lime and the resulting lime sludge management issues associated with it.
- Membrane-softened water does not pose health concerns by introducing higher levels of sodium into the finished water as with ion exchange softening.

Planning led to the decision to use a combination of the local shallow, sand and gravel aquifer as well as the deep sandstone aquifer for the new water treatment facility. The city honored its guiding principle of selecting sustainable practices by choosing conjunctive use of the aquifers to minimize impacts on the area's water resources.

Finalization of the treatment process employed at the new water treatment facility followed extensive pilot testing and consists of the following steps:

- Pretreatment of the shallow well water using sodium hypochlorite for iron and manganese oxidation followed by pressure greensand filters for iron removal to less than 0.05 ppm and manganese removal to less than 0.02 ppm. Residual chlorine is then quenched with sodium bisulfite addition.
- The filtered shallow well water combines with untreated water from the deep wells and is sent through five-micron cartridge filters to protect the membranes from suspended solids. Once through the cartridge filters, the water is then pumped through RO membrane units.
- Permeate (clean water) from the RO units is sent through a forced draft aerator (decarbonator) to provide stripping of carbon dioxide (CO2), raising the pH of the permeate to minimize chemical pH adjustment requirements.
- A portion of the filtered shallow well water bypasses the RO units and combines with stabilized permeate where it undergoes final pH adjustment, fluoride addition, and corrosion inhibitor addition before being sent by gravity to a one-MG above-ground finished water reservoir.
- A series of high service pumps conveys water from the reservoir to the distribution system via a dedicated finished water transmission main.

A strong public outreach effort was a big reason that this project has been deemed so successful. The city effectively promoted public involvement and participation to get the word out about the benefits of the new treatment facility.

In a way, pulling off a successful public works project is like pulling a rabbit out of a hat: There's more to it than meets the eye. Geneva's new water treatment facility came together as a result of extensive planning and hard work on the part of all parties involved. The new water treatment facility has produced high quality, radium-free drinking water on a full-time basis for the community for over a year now. And, as anyone in the water industry can tell you, that's not an easy trick. GE

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