Woodland Wonder

Vancouver Island plant uses ultrafiltration to curb turbidity

By Sara Samovalov

Name: South Fork Water Treatment Plant
Location: Nanaimo, B.C., Canada
Size: 30 mgd
Infrastructure: Coarse and fine screens, flocculation tanks, GE ZeeWeed 500 and ZeeWeed 1000 membranes, gravity-fed siphoning system, clear well

The South Fork Water Treatment Plant's rural location demanded a facility with a small footprint.

Nestled in the forests of Vancouver Island in British Columbia, Canada, sits the South Fork Water Treatment Plant. Inside this structure, which has been operating since December 2015, unique processes and technologies are at work.

The 30-million-gal-per-day plant serves the 90,000-person town of Nanaimo, as well as very small "improvement districts"—local authorities that supply water services to rural residential areas—and employs ultrafiltration membrane technology and gravity-driven siphoning to tackle the difficulties of rural operation.

Gaining From Gravity

New regulations from British Columbia's provincial government guided the decision to build the South Fork Water Treatment Plant. Previously, Nanaimo's water treatment was limited to coarse and fine straining and chlorine addition, but the city struggled with turbidity during Vancouver Island's winters.

"On Vancouver Island, the winters are the challenging times. We have very intense rainfalls or very intense snowfalls that disrupt water quality pretty rapidly," explained Bill Sims, manager of water resources for the city of Nanaimo.

Treatment at the plant begins when water from the south fork of the Nanaimo River—about 15 miles southwest of the city of Nanaimo—is piped a little more than a mile to the plant. Following an inlet, the water flows through coarse and fine screens. If needed, soda ash is added to increase pH, as is aluminum chlorohydrate for coagulation. If necessary, the water also might enter two flocculation tanks. After making its way through a distribution channel, it flows via automatic control valve into seven membrane tanks containing GE's ZeeWeed 1000 modules before being siphoned via gravity into a clear well. When membranes require backwashing and aeration—approximately every hour and a half—the dirty water is drained and pumped to a second set of membranes, GE ZeeWeed 500s. Gravity again pulls the water through the membranes before it enters the clear wells. The water is injected with chlorine for residual disinfection prior to leaving the building.

Before the water leaves the building, The South Fork Water Treatment Plant's gravity-based siphoning system differentiates it not only from other Canadian plants, but also from plants throughout the North American continent. The difference in water levels between the clear well and the membrane tank determines the amount of vacuum or siphon that gets applied to the membranes.

"This design is quite rare and it's extremely effective," Sims noted.

Rural Remedies

While the plant's location provides a picturesque backdrop to the water treatment process, it presented some trials for its designers. Using the ZeeWeed membranes enabled the plant to speed up its treatment processes and lessen its footprint.

"In conventional technologies that use clarifiers or settling or flotation mechanisms, you really have to wait for those things to settle out of the water or float out of the water. That can take a longer time, which usually means larger concrete basins or larger-footprint plants," said Rob Hacking, regional manager of water and process technologies for GE Power. Using the membranes, the process takes around an hour from start to finish.

The plant's location also eliminated many options when it came to disposing of the wastewater generated by backwashing: "We don't have the luxury, like many water treatment plants around North America, of being able to dump a waste stream to a sewer," Sims said.

The secondary membranes allow the facility to treat the wastewater on site. According to Sims, "Ninety-nine percent of the water that comes into the plant gets filtered, treated and sent to the city."

In its eight months of operation, the plant has already received rave reviews from Nanaimo's citizens—"everything from, 'It tastes better' to [noticing] how much clearer the water is," Sims said. Even the plant operators are pleased—since membranes do the work, "there's not a lot of intervention required on the part of the operators to adjust chemicals, as [there] would be in a conventional filtration plant," Sims said.

While the plant's capacity currently is adequate for Nanaimo, upgrade opportunities were built into its design. Membrane tanks contain enough room to add more modules to gain up to 10% capacity. The plant's builders also pre-blasted the rock surrounding the plant and installed piping in the event that the plant expands "30 or 40 or 50 years down the road," Sims said. W&WD

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