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Heads Together: Engineers and Operators Plan a Huge Upgrade

Operations and maintenance team members are key players in designing and building a \$184 million facility upgrade in Prince William County

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 How We Do It





Using special virtual reality headsets, operators were able to “walk through” a 3D design of the upgraded H.L. Mooney facility and experience the layout and the environment in which they will work when construction is complete.

A \$184 million upgrade of the H.L. Mooney Advanced Water Reclamation Facility won’t be completed until 2027.

Still, operations and maintenance team members have experienced the finished facility through virtual reality. Wearing special headsets, and thanks to a 3D facility design, they’ve been able to “walk through” the upgraded plant, observing details like the spacing between pumps and the locations of valves.

That’s just one of the ways in which the people who will run and service the plant have been part of the planning and design process from the beginning. And their input will continue all the way through nearly four years of construction, according to Rachel Carlson, water reclamation superintendent for the Prince William County Service Authority in Virginia.

“Throughout this process there has been full transparency with staff,” says Carlson. “They’ve had access to everything from the preliminary engineering reports all the way through the design deliverables and specifications. Their input has been not only heard but seriously incorporated into the design.

“That’s important because the plant staff will own the new equipment and processes after construction is done. There shouldn’t be any questions about why this was installed, or why that was put there, because they will have had a voice throughout the whole project.”

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Making the old new

Close coordination between engineers and the operations and maintenance teams is essential in major projects like this one, according to Meredith Welle, P.E., design-build engineer and project design manager with HDR, the consulting engineers on the upgrade.

“We value the input of the operators and the plant staff very highly,” Welle says. “We make initial recommendations for what we regard as good equipment selections for particular processes, but we review the recommendations with the project team and get their buy-in on specific manufacturers or equipment models, especially for the more major equipment. We especially want their buy-in on electrical equipment and instrumentation. We have those conversations, we take their feedback, and we put that into our specifications and contract drawings.”

The 24 mgd (design) H.L. Mooney plant needs extensive modernizing that will affect most of the facility, even though the plant capacity and the activated sludge treatment process will not change. “The project has 19 components, mostly rehabilitating existing infrastructure,” Carlson says. “The plant went online in 1981 and we have a lot of original equipment.”

The most significant components of the upgrade are construction of a new preliminary treatment facility and expansion and centralization of the odor control system. The original headworks has not kept up with two plant expansions that increased capacity from 12 mgd to 18 mgd (early 2000s) and to 24 mgd (2010).

“With the more intense storms that are happening, we are getting higher flows to the plant,” observes Maureen O’Shaughnessy, water reclamation process engineer. “So, after study and hydraulic modeling, we decided that we needed a new headworks designed for both today’s and future flows.”

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The headworks will have screens with several channels, providing flexibility to adjust to wet-weather flows. It will also include a HeadCell enhanced grit removal system (Hydro International) along with screenings management and grit washing technologies.

The new centralized odor-control facilities will relocate two packed-media chemical scrubbers and add a third, raising capacity to 95,000 cfm. The existing odor-control system captures air from the headworks, pre-aeration chambers and gravity thickeners. The new system will also capture air from the five primary clarifiers, which will be covered, and from the solids building.

The progressive design-build project is scheduled to start construction in later 2024 for completion in August 2027. The general contractor is Ulliman Schutte.

Starting early

Plant operations and maintenance personnel were brought in at the start of the design phase. “We thought it was important for them to have input into the design,” says Carlson. “Another driver behind that decision was that we’ve had a lot of our staff retire. We have quite a few staff members with only a few years of experience at the plant. Their early involvement helps fast-track their knowledge and their understanding of the process equipment.”

Early in the process, service authority leaders identified the key plant staff members who would be involved in the design and offloaded some of their day-to-day work to make them available for what would be a demanding task.

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“Once we got into discussing the design, we held weekly internal meetings to review the drawings and provide input,” Carlson says. “We also had weekly meetings where the contractor came on site to meet with the field staff. Using virtual reality, they could walk through the 3D model. During those workshops the contractor captured feedback to take back to the design engineers.”

An added benefit of involving O&M staff in the design is that they will be familiar with the project heading into the construction phase: “The project will include a lot of rehabilitation of existing equipment,” Carlson says. “We’ll be taking tanks and equipment in and out of service, and that will involve a lot of effort and coordination with the contractor.”


Staff members grateful

Leaders of the plant operations and maintenance teams embraced the transparent and inclusive design process. “It has been a good learning experience for everybody,” notes John Madaris, water reclamation maintenance manager, who leads the mechanical, electrical and instrumentation group.

“It was nice to be part of decisions about the equipment that’s being added and to be able to share our experience with what was previously here and what works well on the instrumentation and mechanical side. Our team will have a chance to learn about the new equipment and get some good training from the contractors. We’re happy that we’re going to get some new equipment that will have a better life span without any problems.”

Doug Chapman, water reclamation operations manager, adds, “It has been very beneficial for us to be in from the start, looking over the drawings and giving our comments. We had regular weekly meetings and additional meetings in groups that covered all our shifts.


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“The drawings were in the control rooms to review, and we were able to comment from experience on what we have found works or doesn’t work here. The operators are really glad that their comments are being heard and considered. We very much look forward to seeing the new equipment come in and the improvements from the headworks to the UV.”

He envisions the plant upgrade making life easier for the operations team. One example is the alkalinity system by which lime is fed to primary clarifier effluent. The existing labor-intensive and high-maintenance lime slaking system will be replaced by an automated process that feeds a liquid lime slurry.

Moving ahead

O’Shaughnessy adds that input from O&M teams is important for integrating new equipment with the process: “The new design will be much more seamless with the existing plant as a result. It’s very impressive how seriously the staff took the review of the design and providing detailed input. It’s a better project having them on the team.”

Next on the project schedule is finalizing the design for construction, and O&M staff involvement will continue. Carlson observes, “The big piece will be maintenance of plant operations during construction. Obviously plant staff members have the most experience with what can happen and when. Their input into the construction sequence will be invaluable.”

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