

Background

The Frederick-Winchester Service Authority (FWSA) provides wastewater service to the City of Winchester and other communities in Frederick County, Virginia, and owns two wastewater facilities, including the Opequon Water Reclamation Facility. The Opequon facility was constructed in the 1980s as a 5 million gallon per day (MGD) activated sludge facility to replace smaller outlying plants. In 2010, the facility gained an additional 8.5 MGD of capacity when a biological nutrient removal (BNR) process was added to the treatment process, giving the facility its current flow capacity of 12.9 MGD.



Above: Piping at the FWSA's Opequon facility that delivers biogas generated through anaerobic digestion to the facility's cogeneration system to generate electricity.

The Problem

In 2013 the FWSA began exploring ways to address the Opequon plant's aging infrastructure and escalating treatment costs. The facility had several pieces of aging equipment that needed to be replaced, and the FWSA sought to increase the plant's operating efficiency while carrying out these upgrades. In addition, the FWSA recognized that the plant could tap into a revenue stream by giving local industries a reliable place to dispose of their organic waste. The plant needed further modifications to accept this material.

The Solution

In 2014 the FWSA partnered with Energy Systems Group (ESG) to assist in the development of a project that would address its aging equipment, allow the facility to take high strength organic waste (HSOW) from local businesses, improve the facility's operating efficiency, and address escalating costs. The first part of the project's design addressed the plant's aging infrastructure. Several pieces of old equipment were replaced, including a set of aeration blowers and frame and plate presses in the solids processing side of the plant that were more than 30 years old.

The second part of the design addressed co-digestion and accepting high strength waste. ESG developed a solution that would satisfy the disposal needs of local industry and provide a revenue stream that could offset some of the capital costs of the project and help to stabilize rates for users. To allow the facility to accept and co-digest HSOW, ESG designed and built:

- Two 1.25 million gallon primary anaerobic digesters
- One 1.25 million gallon secondary digester
- A 13,000 sq. ft. control building housing switchgear, lab, boilers, heat exchangers, grinders, pumps, and compressors
- Two HSOW receiving stations
- 848 kW biogas generator
- Biogas compression and conditioning infrastructure

The third part of the design addressed operational costs through facility efficiency improvements. ESG installed an Ostara Pearl® system that harvests phosphorus from the plant's filtrate and reduces its chemical treatment costs for the element. ESG also carried out lighting and mechanical system improvements, potable water system upgrades, and installed a new building control system.

Results

Today, the Frederick-Winchester Service Authority's Opequon Water Reclamation Facility is a state-of-the-art nutrient recovery facility with updated equipment and processes. ESG managed the feedstock acquisition for FWSA from July 2016 through October 2019, and the facility generated nearly \$2.8 million in revenue and accepted over 34.2 million gallons of liquid waste in that period.

Local wastewater utilities have very few ways of generating incremental revenue to address operating and capital costs outside of increasing user rates or growing their customer base. In the case of the FWSA, the number of houses and people in the region was not growing fast enough to keep pace with costs, so the revenue the Opequon facility receives from accepting organics is essential, allowing the FWSA to keep user rates stable.

The HSOW revenue also helped the FWSA complete substantial facility upgrades at a reduced cost. Before its collaboration with ESG, the FWSA was facing roughly \$34 million in base repairs. It spent \$47 million through its partnership with ESG, but with the new organics revenue from the project, the FWSA was able to carry out its facility improvements for significantly less, and it now has a state-of-the-art wastewater operation.

The plant's electrical costs have also decreased. Before the project, the facility's electric bills were close to \$55,000 a month, but the new combined heat and power system that ESG installed is now generating \$30,000 worth of electricity on-site for the facility per month.

Why ESG?

The FWSA selected ESG because of its ability to monetize the FWSA's assets, for its outcome-focused approach to projects, and because ESG could design and deliver every aspect of the project.

Monetizing a wastewater treatment plant through the acceptance of HSOW requires the time-intensive work of developing relationships with waste suppliers and managing the business operations of the acceptance program. ESG maintains a team solely dedicated to organics acquisition and management. ESG was able to connect the FWSA with HSOW suppliers in the region and developed and negotiated contracts with the providers on the FWSA's behalf. Over the long term, ESG will manage the operations of the program and keep the FWSA well positioned, ensuring that it has access to various streams of waste so it can continue generating new revenue.

ESG looks at projects in terms of outcomes as opposed to tasks. A typical firm would have designed the FWSA's infrastructure, installed it, then turned the project over to the plant's staff and moved on. In other words, it would have completed the tasks listed in the project's scope. ESG designed and constructed the project to make sure the FWSA was able to maximize the economic value of its assets, and it worked to ensure this outcome by making sure the systems worked properly after installation. For the FWSA's project, ESG stayed on-site after construction was finished to address transformer issues and redo aeration membranes that were not performing as designed.

Finally, ESG was able to design and deliver every aspect of the project. The FWSA's project was highly complex and involved the coordination of several disparate elements. Having ESG design and deliver the project eliminated the potential for confusion and additional work during the handoff from design to construction, and it ultimately helped to ensure that the project became a reality.