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PLANT

Pleasing Alternative

A NEW OXIDATION DITCH TREATMENT PLANT PRODUCES
HIGH-QUALITY EFFLUENT AND HELPS BRING AN OHIO VILLAGE
INTO MORE CONSISTENT PERMIT COMPLIANCE

STORY: **Steve Frank**
PHOTOGRAPHY: **Amy Voigt**





Jeff Smith, plant operator, measures the final clarifier sludge blanket at the Ohio City treatment plant.

IN THE LATE 1990s AND EARLY 2000s, THE VILLAGE of Ohio City's 150,000 gpd trickling filter plant routinely bypassed 270,000 gpd of its 620,000 gpd peak daily flow.

"Our old plant couldn't meet permit, especially during heavy rains," says Jeff Krugh, village administrator. But a new 0.8 mgd (design) Orbal oxidation ditch plant (Evoqua Water Technologies) that came online in summer 2011 now meets its permit more than 95 percent of the time. It has even handled a peak flow event of 930,000 gpd.

The northwestern Ohio community of Ohio City (population 750) built its old trickling filter plant in 1968. Though it underwent several upgrades between 1993 and 2001, it routinely failed to meet BOD and ammonia limits by 2003.

In addition, the plant was creeping up on 40 years old as it approached its 2007 NPDES permit renewal. Advancing age made it difficult to keep the plant in good repair. The trickling filter design represented a bygone era, and with only one of each process unit, operators could not take a unit out of service for repairs when a maintenance issue reared its head.

SEEKING FUNDING

As permit renewal time approached, the village sought grants to help fund a new facility.

"Our grant writer said it would be easier to get grants if we were under Ohio EPA Findings and Orders," says Krugh. "As an operator, you never want to be under Findings and Orders." But that's where the village ended up.

"We're still operating under Findings and Orders, but we're meeting permit 95 percent or more of the time," Krugh says. Although the village has a \$1.5 million stormwater detention pond project underway, "We still have a lot of infiltration we can't afford to take care of at this moment, and that's where we stand today."

Ohio City engaged Jones & Henry Engineers to investigate and propose design alternatives for the new plant.

“An inch of rain is nice, but not an inch an hour. With a rain of 2 inches or more, we have to watch our solids because with a plant this small, the solids could get washed into the clarifiers.”

JEFF SMITH

The firm looked at several options before the village selected an oxidation ditch/clarifier combination.

The heavy rains Ohio City sees in spring and sometimes fall favored the oxidation ditch: Such systems can typically handle peak-to-average flow ratios of up to 5-to-1. Jones & Henry's life cycle cost analysis showed that the oxidation ditch design had the lowest net present worth and the lowest maintenance, replacement and labor costs, even though the installation cost was the highest of the three options considered.

SHOPPING AROUND

During plant design, Jones & Henry Engineers took Krugh and Jeff Smith, chief plant operator, to see a number of plants of similar size. What they saw nudged them toward the oxidation ditch concept.

Maintenance and operations costs are important because Smith is usually the sole operator. He runs the plant, does the lab work, maintains the equipment, buildings and grounds, and fills in at the water treatment plant, at which Krugh is the primary operator. Since the oxidation ditch design

usually needs less maintenance and operator attention than other configurations, it works out well, Smith says.

The new plant's \$2.236 million cost included a \$1 million loan and a \$1 million grant from the Ohio Water Development Authority, and a \$1,236,900 loan from the Ohio Public Works Commission. Wastewater rates went from \$41 per month to \$56 per month per household inside the village limits.

Two years before building the new wastewater treatment plant, the village undertook a \$5 million drinking water project that included a new treatment plant, a water tank and waterlines. Fees for residents rose from \$41 per month to \$51 for debt service and \$4.50 per 1,000 gallons used.

FLEXIBLE PERFORMANCE

As Krugh and Smith had hoped, the Orbal oxidation ditch (Evoqua) can accommodate a wide range of operating conditions, including handling five times the normal flows without washing out solids and degrading treatment.

The oxidation ditch has a 31,020-gallon inner channel and a 48,560-gallon outer channel. It provides 12.7 hours of detention time and has two 7.5 hp drives. In the normal operating mode, influent flows into the system's outer channel, runs around that channel, and then passes to the inner channel through a submerged conduit. Both channels have surface aeration. Aerated wastewater goes from the inner channel to the clarifiers for settling. Dissolved oxygen is typically zero in the outer ring and 2 mg/L in the inner ring.

“When a big storm is predicted, I can switch to storm mode the night before,” says Smith. “If the rain doesn't come as predicted, we can switch it back to normal operation the next morning with little or no noticeable effect on the treatment process. But in storm mode, we shut down the outer ring and all the influent goes to the inner ring.

Village of Ohio City Wastewater Treatment Plant

BUILT: | 2011

POPULATION SERVED: | 750

FLOWS: | 0.8 mgd design; 0.089 mgd average

TREATMENT LEVEL: | Secondary

TREATMENT PROCESS: | Oxidation ditch

RECEIVING WATER: | Prairie Creek

BIOSOLIDS: | Drying beds; future land application

ANNUAL BUDGET: | \$41,000 (operations)

WEBSITE: | www.villageofohiocity.org

GPS COORDINATES: | Latitude: 40°46'16.45"N; longitude: 84°36'56.00"W



Ohio City Wastewater Treatment Plant PERMIT AND PERFORMANCE

	EFFLUENT	PERMIT
TSS	3.20 mg/L	18 mg/L weekly 12 mg/L monthly
CBOD	1.80 mg/L	18 mg/L monthly 10 mg/L weekly
NH3-N	Not detected	1.5 mg/ weekly 1.0 mg/L monthly
Phosphorus	0.0877 mg/L	N/A
pH	7.46	6.5 minimum/9.0 maximum

SHARED DUTIES

In a small community, running the water and wastewater treatment plants means wearing different hats from time to time.


In Ohio City, Jeff Krugh, village administrator, shares those duties with Jeff Smith, chief wastewater plant operator. Both fill in now and then with other maintenance duties. Smith and Krugh hold Class 3 wastewater treatment and Class 1 drinking water treatment licenses. The village also has two part-time electricians who run the municipal electric power plant.

“The water plant needs someone about half a day every day, so I usually do that,” Krugh says.

Smith runs the wastewater treatment plant. What do the villagers think of their dynamic duo? The two agree that “about 80 percent of the people don't know” what they do.

Outreach consists of giving tours when asked. “But we don't look for them because we're too thin-staffed,” says Krugh. They hosted an Ohio AWWA meeting a few years ago when the water treatment plant came online. Both are active in Ohio AWWA and the Ohio WEA.





The plant upgrade includes a TrojanUV3000 PTP disinfection system.


“Two-and-a-half to 3 inches of rain in an hour or two can overwhelm a plant. An inch of rain is nice, but not an inch an hour. With a rain of 2 inches or more, we have to watch our solids because with a plant this small, the solids could get washed into the clarifiers. With 3 inches, you have to really pay attention.”

In storm mode, Smith sends all the influent through Muffin Monster grinders (JWC Environmental) in the lift station. Any overflow goes to a bar screen chamber attached to the side of the Muffin Monster used for heavy flows. From there it enters a 6,950-gallon anoxic tank where raw wastewater and return mixed liquor are mixed (WILO mixer). The wastewater then goes into the inner channel.

MANAGING SOLIDS

An 18-inch sewer line brings influent to the plant. The lift station has three 7.5 hp, 400 gpm submersible pumps (Gorman-Rupp Company). “If we get a 3-inch rain, it’ll call for all three of those pumps,” says Smith. The lift station screen has an inclined auger cylindrical screen (also JWC) with a 1.5 mgd peak flow capacity.

The two 20-foot-diameter clarifiers have scrapers from Monroe Environmental and drives from DBS Manufacturing. The clarifiers have bridge mechanisms that push the settling sludge toward the center, where it is withdrawn to a common return and waste activated sludge pump station. A timed valve there either returns sludge to the oxidation ditch or wastes it to the aerobic digesters.



The Village of Ohio City Wastewater Treatment Plant.



Shown on the grounds of the new treatment plant are, from left, Joseph Hotz, consulting engineer; Ohio City Mayor Carol Miller; and Jeff Smith, plant operator.

The return and waste activated sludge pumps with variable-speed drives are 2-foot ABS submersibles (Sulzer) capable of 1,765 gpm at 12 feet of head. Although the plant design calls for running only one clarifier at a time, Smith usually operates both to improve detention time.

Each of the two 51,900-gallon aerobic digester tanks has a 20 hp, 270 scfm blower (Aerzen). The UV disinfection system uses a 24-bulb low-pressure system (TrojanUV) that can disinfect a peak flow of 1 mgd.

The process yields Class B biosolids, but no material has been removed since the new plant came online. Drying beds are used in summer, but it's too wet to use them in winter. "We expect to land-apply some soon," says Smith. "There's a former village councilman who understands the nutrient value, and his fields are only about 1,000 yards away."



Jeff Smith checks on a lift station (pumps from Gorman-Rupp Co.).

“Being under the gun like we were is not a good feeling. With the old plant, the water came in and the water went out. Now we can do a better job of cleaning it.”

JEFF KRUGH

CHEMICAL-FREE

One thing Smith likes about the plant is the UV disinfection: “We add no chemicals during treatment. This is a completely natural process.” The receiving stream is Prairie Creek, and the plant is the primary contributor to the stream in summer.

An Ohio EPA regulator visits about twice a year; Smith and Krugh self-report on permit compliance. Krugh observes, “Being under the gun like we were is not a good feeling. With the old plant, the water came in and the water went out. Now we can do a better job of cleaning it.”

Smith adds: “Now we need better weather forecasting. The weather is our biggest enemy. The ability to accurately predict storms would help us the most.” tpo

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