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DECEMBER 2024

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Wastewater Division Superintendent
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An Inside Job

REPURPOSED BUILDINGS AND A NEW BIOSOLIDS PROCESS HIGHLIGHT WAUSAU'S $80 MILLION UPGRADE

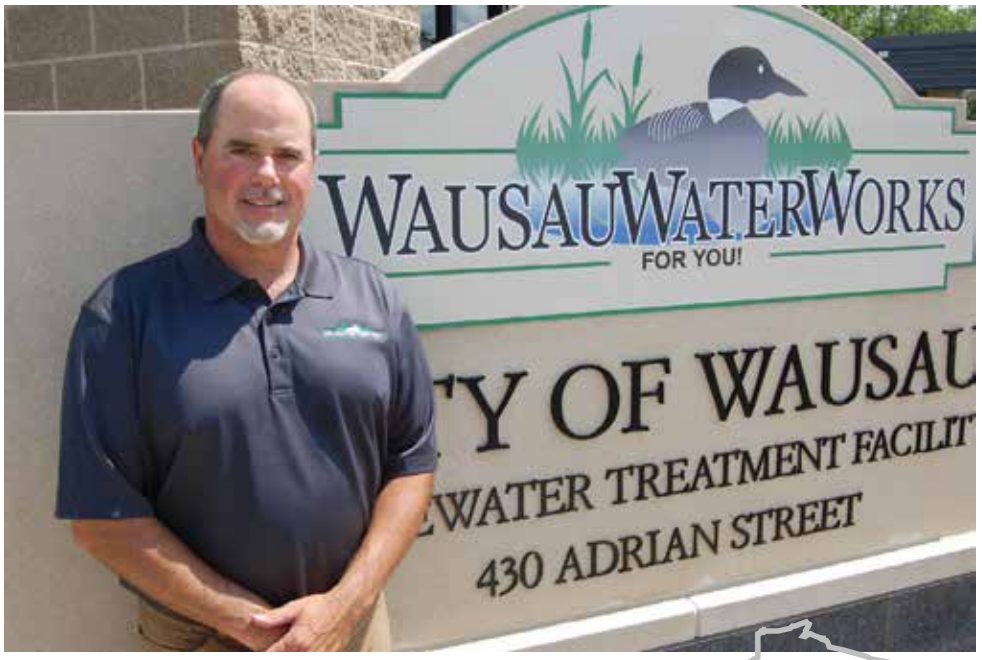
An Inside Job

FROM OUTSIDE, THIS CLEAN-WATER PLANT'S BUILDINGS MOSTLY LOOK THE SAME. INSIDE IS A DIFFERENT STORY: SOME $80 MILLION IN PROCESS EXPANSION AND IMPROVEMENTS.

STORY AND PHOTOGRAPHY: **Ted J. Rulseh**

Microscopy is essential to process monitoring at the Wausau Wastewater Treatment Facility. Jason Schill, lab technician, views microorganisms on a large-screen display.

Ben Brooks, superintendent, Wastewater Division, Wausau Water Works



If you walk the grounds at the Wausau Wastewater Treatment Facility, you might not notice a great deal that looks new.

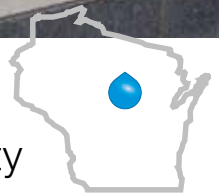
Those handsome old brick buildings remain, but inside a great deal has changed — and more change is on the way. Last year, work was completed on an $80 million upgrade that boosted wet-weather treatment capacity and improved treatment effectiveness and efficiency.

Many improvements took place inside existing buildings, but the project also added a new administration building, a solids facility with a thermal dryer to produce Class A Exceptional Quality biosolids for beneficial use and more.

The outdoor spaces also saw improvements, including updating of the primary and secondary clarifiers, the addition of a fourth secondary clarifier for greater wet-weather capacity and multiple improvements to the aeration process.

"It was actually a huge maintenance project," says Ben Brooks, superintendent of the Wastewater Division of the Wausau (Wisconsin) Water Works. "There hadn't been any upgrades since 1991. We were still meeting permit, although there were some low-pH violations. And in wet-weather events, inflow and infiltration would overcome what the plant could handle."

Today the plant (8.2 mgd design, 5.0- 6.0 mgd average) consistently meets permit limits for effluent discharged to the Wisconsin River.



Wausau (Wisconsin) Wastewater Treatment Facility

wausauwi.gov/your-government/water-sewer

BUILT:
1939; upgrades 1969, 1989, 2010, 2020-24

POPULATION SERVED:
45,000

FLOWS:
8.2 mgd design, 5.0-6.0 mgd average

TREATMENT LEVEL:
Tertiary

TREATMENT PROCESS:
Activated sludge, disc filtration

RECEIVING WATER:
Wisconsin River

BIOSOLIDS PROCESS:
Dewatered, thermal dried

BIOSOLIDS DISPOSITION:
Land-applied

ANNUAL BUDGET:
$11.3 million (operations)

IN MIDSTREAM

Wausau (population 40,000) is the economic and cultural center of central Wisconsin. The Wisconsin River is a centerpiece, a scenic and recreational resource. The downtown Wausau Whitewater Park hosts canoe and kayak competitions and is an attraction for casual paddlers.

Brooks arrived in Wausau in December 2021, around the halfway point of the plant upgrade. Previously he had been plant superintendent at Medford, a city about one hour northwest and his first job after he earned an associate degree in water and wastewater resources from Vermilion Community College in Ely, Minnesota.

> "Right now our biosolids are technically not Class A, even though they meet all the requirements. It just takes time for the DNR to approve it."
>
> **BEN BROOKS**

The plant receives about 10% industrial flow, mainly from metal plating industries and food and dairy processors. "We take in holding tank waste, septage and some grease trap waste," says Brooks. "Right now we're not accepting any landfill leachate." Waste haulers unload at a receiving station designed as part of the upgrade by the Becher Hoppe engineering firm.

Brooks came on board midway through the upgrade. He calls managing that and stepping up to a much larger plant "a huge challenge," although the two plants have basically similar activated sludge processes.

Brooks has his office in the new administration building, which includes a multifunction laboratory, training and meeting facilities, a control room with SCADA (created by Donohue & Associates engineers), a break room and locker rooms. An eight-stall vehicle garage is attached.

REFINING THE PROCESS

On the wastewater treatment side, operations technicians perform maintenance at the plant and at 26 lift stations. Team members are Brad Wendtland, operations supervisor; Jason Schill, lab technician and operations; and Jeremy Steinman, Jason Ladwig, Austin Trinko, Mike Bradberry and Austin Uttech, operations technicians.

Operations technicians Austin Uttech (left) and Jason Ladwig with the plant's primary sludge thickener (Walker Process Equipment).

Collections system team members are Ryan Dwelly, supervisor; and Bill Olsen, Steve Celona, Matt Stockman, Benn Her and Jared Johnson, technicians. They maintain miles of gravity sewer main and nine miles of force main and assist with lift station cleaning using a Vactor truck. A TV inspection van (IBAK) with lateral launch was recently added.

Among Brooks' first initiatives was to address the pH violations. "For pH control, we have a chemical building where we have the ability to dose magnesium hydroxide," he says. "We experimented with the dosing rates to achieve the correct pH and alkalinity concentrations.

"We maintain the alkalinity at around 60-90 mg/L. Besides controlling pH, the alkalinity enhances biological phosphorus removal and also simultaneous nitrification/denitrification. Everything is automated through SCADA. Dosing is driven off our pH probe (YSI, a Xylem brand)." Magnesium hydroxide is metered by Bredel APEX peristaltic pumps (Watson-Marlow Fluid Technology Solutions) and is dosed in the selector zone effluent flow.

Secondary treatment is enhanced by a new anoxic selector zone basin with four Invent mixers upstream of the aeration basins. There, primary effluent and return activated sludge are mixed to encourage biological nutrient removal and to control filamentous organisms.

Austin Trinko, operations technician, with one of the facility's two belt filter presses (Charter Machine Co.) that dewater biosolids to 18-22% before transfer to the thermal dryer.

> "The filters take out enough TSS along with about 2-3% of phosphorus with the solids. Every little bit of phosphorus removal helps, obviously."
> **BEN BROOKS**

The upgrade also converted six single-pass aeration basins into two trains with three-pass serpentine flow pattern that also can run in a plug-flow pattern. Coarse-bubble diffusers were replaced by a fine-bubble membrane diffusion system (SSI). For air supply, aging blowers were replaced with three high-speed turbo blowers (Aerzen).

The upgraded system uses dual drop legs that feed duplicate grids for each aeration zone. Each basin has three aeration zones and thus six drop legs and grids per tank. This enables the basins to operate with tapered aeration, either in the designed three-pass mode or in single-pass mode in the event one or more basins is out of service for maintenance.

Aeration is controlled on a feedback loop to the blowers by way of SCADA. Each basin has a dissolved oxygen probe (YSI) that can be set to achieve and maintain the desired DO level in each of the six passes.

Influent passes through step screens (HUBER Technology) followed by a PISTA Grit system (Smith & Loveless) and a grit washer and classifier (SAVECO).

After primary settling, selector zones and aeration, the flow is dosed with alum before passing through four secondary clarifiers and then onto three Hydrotech disc filters (Kruger, a Veolia company). "The filters take out enough TSS along with about 2-3% of phosphorus with the solids," says Brooks. "Every little bit of phosphorus removal helps, obviously."

READY FOR STORM FLOWS

As of last summer, the Wausau Wastewater Treatment Facility team was awaiting a real-life test of a mechanism to handle large wet-weather flows. A new channel diverts a portion of the excess primary effluent around the aeration basins; it is discharged into the aeration basin effluent and then into the secondary clarifiers.

The channel includes a wet-weather bypass that can divert a portion of the primary effluent flow around the entry to the aeration basins. The bypass knife gate is actuated automatically by way of a water level sensor that is triggered when influent flow hits 12 mgd, significantly above the plant's dry-weather design flow of 8.2 mgd.

"At 11 mgd of flow, the system initiates an alarm that says we're getting close to that 12 mgd level, and so the wet-weather gate is probably going to become active," says Ben Brooks, Wausau Water Works Wastewater Division superintendent.

In a storm event all influent receives primary treatment, but at 12 mgd flow and above, up to 7 mgd goes through the wet-weather channel and is mixed in at the far end of the aeration basins. The flow then passes to the secondary clarifiers. The process was designed by consulting engineers Donohue & Associates.

As for a trial in a major rain event, back in mid-July 2024 Brooks observed, "We haven't experienced a full-fledged event yet."

Wausau Wastewater Treatment Facility PERMIT AND PERFORMANCE			
	INFLUENT	EFFLUENT	PERMIT
BOD	150-300 mg/L	<5.0 mg/L	30 mg/L monthly average 45 mg/L weekly average
TSS	150-200 mg/L	<6.0 mg/L	30 mg/L monthly average 45 mg/L weekly average
Ammonia	20-60 mg/L	< 1 mg/L	Monitor and report
Phosphorus	6-4 mg/L	0.6 mg/L	Average 34 pounds/month

HANDLING SOLIDS

Arguably the biggest change to the plant is in solids processing. The plant used to produce Class B cake biosolids for land application but now uses a BioCon thermal drying system (Veolia Water Technologies).

"Every spring biosolids were hard to get rid of," says Brooks. "We have a small window when the land becomes dry enough to haul on. In winter, biosolids cake is frozen, and when it thaws it gets mushy. It's just not a good product to deal with. Now we can haul out our biosolids in about a week where before we were looking at a month of hauling."

The storage building is required to provide at least 180 days of storage through winter. "With the dry product, we've seen an 80-90% reduction in volume," Brooks says. "We now have probably two to three years of storage." Plant team members haul about 1,400 dry tons per year to farms in tandem-axle trucks equipped with spreaders that apply it at agronomic rates. About 2,500 acres within a 20-mile radius are permitted for application.

Brooks has received inquiries about bagging the product for sale as fertilizer: "Right now our biosolids are technically not Class A, even though they meet all the requirements. It just takes time for the DNR to approve it. With recent concerns about PFAS, we have chosen to keep track of the biosolids so we know its disposition. We've done some testing and our numbers look very good, so we will pursue other options once we become certified with Class A biosolids."

The biosolids dryer takes in primary and waste activated sludge after thickening, screening (Hydro International) and anaerobic digestion. The material is first dewatered to 18-22% solids on two belt filter presses (Charter Machine Co.). Inside the BioCon system, the biosolids are dried by indirect convective heating. The drying air is recycled in a closed loop to minimize odor and make-up air requirements.

Mike Bradberry, operations technician, at the display for the facility's SCADA system, created by the Donohue & Associates engineering firm.

After about 90 in the dryer, the finished material at 95-96% solids is conveyed into trucks in a fully automated process. The trucks transfer the product to a three-sided storage building on the plant property.

The drying process is fueled by natural gas, but Brooks hopes eventually to feed high-strength waste to the digesters to boost production of biogas and replace at least some of the purchased gas, which was budgeted at $250,000 for 2024.

As it is, biogas fuels a pair of 65 kW microturbines (Capstone). The electricity typically offsets $8,000 to $10,000 in utility power each month. Remaining biogas fired two dual-fuel boilers (Walker Process) for digester heating.

The team at the Wausau Wastewater Treatment Facility includes, front row, from left, Matt Stockman, Steve Celona, Bill Olsen, Ryan Dwelly (collections supervisor), Mike Bradberry, Jason Ladwig, Austin Trinko and Austin Uttech; back row, Benn Her, Jared Johnson, Ben Brooks (wastewater and collections superintendent), Brad Wendtland (wastewater supervisor), Jeremy Steinman, and Jason Schill (lab technician). Not pictured is Craig Czerwinski, plant electrician. Team members wearing safety-yellow shirts are the collections crew; those in the blue shirts are the wastewater crew.

Biosolids are processed in a BioCon thermal drying system (Veolia Water Technologies). The inset photo shows biosolids being dried by indirect convective heating.

> "The wastewater operations team played a crucial role during the upgrade."
> **BEN BROOKS**

MORE WORK TO COME

On top of all those improvements, the upgrade included a host of projects throughout the facility, including among others:

- An upgraded and more efficient TrojanUVSigna UV disinfections system (Trojan Technologies)
- New pumps for primary sludge, return and waste activated sludge, and other materials
- A new primary sludge gravity thickener (Walker Process)
- Two gravity belt thickeners (Charter Machine Co.) for waste activated sludge
- New roofs on the primary and secondary digesters and all existing buildings
- A new digester gas handling room and rotary vane digester gas storage compressor (Rolair)
- Two new 1 MW diesel-fueled emergency generators (Caterpillar) that are equipped with a soft transfer that doesn't disrupt line power during monthly nighttime exercising and in anticipation of storm events.

ORDER FROM CHAOS

Brooks and Wendtland recall the upgrade as a challenging process enabled by effective communication among facility team members and construction workers under general contractor Miron Construction. At the peak of activity, some 90 electricians and construction workers were on site.

"The wastewater operations team played a crucial role during the upgrade," says Brooks. "The team ensured that the plant continued to function smoothly and collaborated daily to minimize disruptions to the treatment process. The team collaborated to ensure that all regulatory standards and safety protocols were met."

Wendtland adds, "There was a lot of communication to make sure everybody was clear. Nothing was left up to, 'We thought this' or 'We assumed that.' When anything looked like an issue, we brought it up and hashed it out."

To the greatest extent possible, the contractors worked around plant processes to minimize interference. For example, the new UV disinfection system upgrade was undertaken during fall and winter when the facility is not required to disinfect.

Training was essential. As each new device or process came online, team members received a walk-through followed by classroom and hands-on instruction. The training regimen also included:

- Documentation with detailed operation and maintenance manuals and standard operating procedures that explained the new systems and technologies in a clear and accessible manner
- A support system so that team members could seek help and clarification when needed from plant management, engineers and vendors
- Daily feedback sessions to gather observations from team members about operation of the new technology and systems
- Ongoing discussions about trials and errors with the new equipment to helped team members optimize performance

In all, the upgrade was demanding, but very rewarding. Brooks observes, "Although the team was resilient in most aspects, they were torn in every direction imaginable and became worn out toward the end of the project. But they maintained a positive attitude throughout and did what they do best: Protect human health and the environment."

MORE TO COME

Next on the agenda for the Wausau facility is a headworks upgrade that went out for bid last fall; the estimated cost is $3.0 million. A new headworks building was planned as part of the 2020-24 upgrade, but it was delayed for budget reasons.

The work will include replacement of existing step screens and various improvements to make the facility more maintenance-friendly. One challenge is fitting the new equipment within the small footprint of the existing headworks building,

When all is said and done, plant visitors might not readily see everything that is new. But the plant team will be operating a more efficient and effective plant that delivers clean effluent to the Wisconsin River. tpo

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