

# City of Hutchinson



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## Company Background

Hutchinson Wastewater Treatment Facility (WWTF) is administered by the Department of Water and Wastewater, City of Hutchinson. Built in 1988, the plant is designed to treat an average wet weather flow of 5.43 million gallons per day (MGD) and an average dry weather flow of 3.28 MGD. In 2008, plant upgrades were made in response to community growth and industrial expansion, as well as to meet a tighter regulation on phosphorus. From 2010-2012, the typical daily inflow was approximately 2.0-2.7 MGD.



*"I really enjoyed the challenge of this project. The internship also gave me an opportunity to apply what I learned in school and to gain hands-on experience in an industry that I am interested in. I now have a clearer image of the everyday responsibilities of a process engineer in a facility like this."*

## Project Background

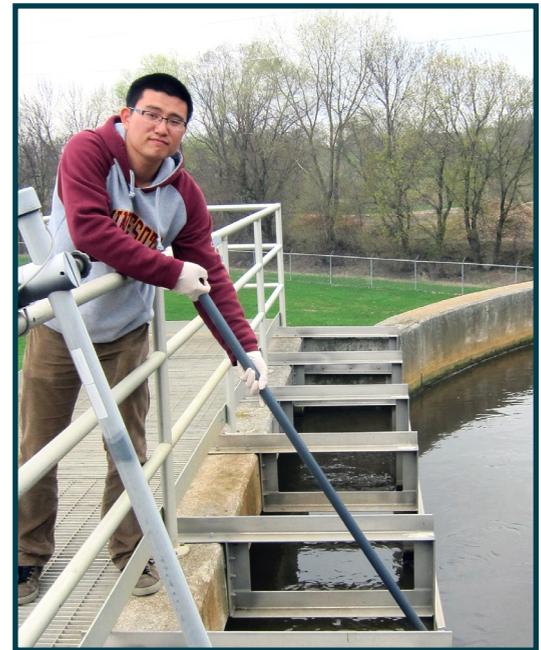
The facility is equipped with two oxidation ditches and a membrane bio-reactor (MBR) with a total treatment capacity of 7,000 lbs. biological oxygen demand per day. This project was initiated to evaluate changing the aeration strategy in the oxidation ditches, with the goal of both reducing energy costs and nitrate level in effluent without capital investment.

## Incentives to Change

Aeration in the activated sludge system is generally the biggest energy consumer in wastewater treatment plants. The oxidation ditch of Hutchinson WWTF employs extended aeration. This means oxygen is over-supplied to ensure that biological processes such as organics decomposition and nitrification are complete. This strategy provides constant and good effluent quality; however, it is not energy efficient.

Before the project began, typical plant-wide electrical consumption was between 8,000 and 10,000 kWh per day. The plant was running two surface aerators 24/7 in each ditch. One of the two aerators is on a variable

frequency drive (VFD), which changes aerator speed and power draw in response to operator input based on dissolved oxygen readings. The average speed of the VFD rotor was approximately 45% of full speed. The other rotor was not on VFD and ran at full speed. Two wall-mounted mixer-aerators were on a timer and only operated four hours a day. Running these devices drew 3,080 kWh/day (30-40% of the plant's total electricity usage), costing \$95,000 per year.



By optimizing aeration, there are opportunities to reduce the plant's energy bill. There also is a trend in Minnesota toward tighter nitrate limits in effluent. If it were possible to reduce nitrate levels voluntarily, tighter limits requiring capital plant changes might be delayed.



which results in \$39,230 yearly electricity savings, and biological operation appears to be improved. There is a question of whether single ditch operation will be effective during the coldest weather, so true yearly savings have yet to be determined.

### Meeting Future, Strict Nitrate Regulation

Although nitrate is only required to be monitored under the current discharge permit, a more stringent discharge limit is likely in the future.

### Options for Meeting Stricter Nitrate Limits

A separate anoxic reactor could be constructed before the oxidation ditches (using the MLE process); and there are two likely ways to operate a anoxic zone within the existing ditches that could be investigated for feasibility in the plant. The potential ways to maintain an anoxic zone in the existing ditches are to improve the non-aerated mixing in parallel ditch operations or use alternating aerated and anoxic periods with improved non-aerated mixing. In addition, a simple chemical, like methanol, could be added to the anoxic zone of either single or double ditch operation to speed up the biological denitrification reaction rates.

## Solutions

### Adopting Single-ditch Operation to Save Energy

Two plant trials were conducted to test the energy and nitrate reduction feasibility. Plant Trial 1 explored the feasibility of integrating an anoxic zone into the existing west oxidation ditch by converting its operation to the Modified Ludzack-Ettinger (MLE) process, while the east ditch was kept unchanged as an experiment control. Plant Trial 1 succeeded in achieving a 50% reduction in nitrate concentration and a 10% reduction in energy consumption, but within two weeks, the operation became unstable with signs of the activated sludge settling out and becoming septic.

In Plant Trial 2, the two ditch (parallel operation) was stopped and all wastewater flow was diverted to the east ditch, which had an anoxic zone. This trial resulted in a 43% reduction in energy consumption, but while there was evidence of denitrification occurring, the rate was not fast enough for a measurable reduction in nitrates.

The plant continues to run in single-ditch operation with electricity consumption reduced by 1860 kWh per day,



Recommendation	Reduction	Annual Savings	Status
Single-ditch operation	1860 kWh per day	\$39,230	Implemented