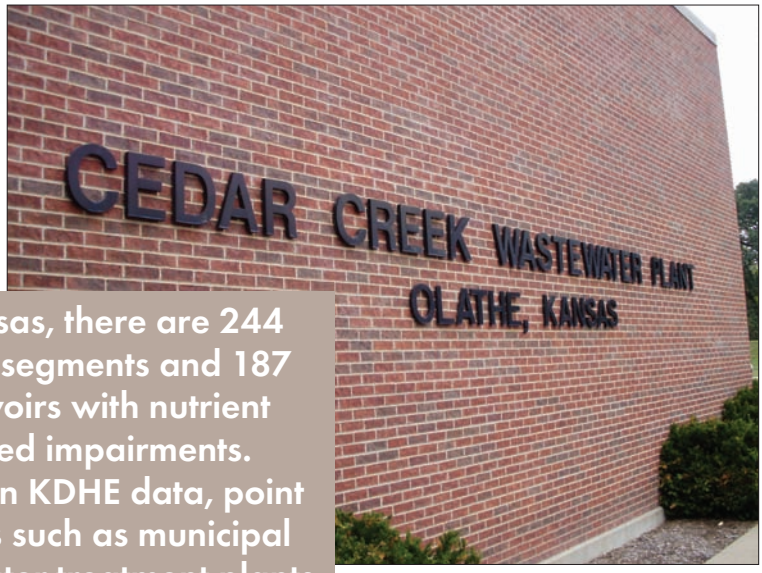
By Jeff Lamfers, KRWA Consultant

Olathe Expands Cedar Creek Wastewater Treatment Facility to Provide Biological Nutrient Removal



The buzzword these days in wastewater treatment is "nutrient removal." And more often than not, we are referring to Biological Nutrient Removal (BNR). Studies have shown that elevated levels of nutrients such as nitrogen and phosphorous can cause a condition known as eutrophication in bodies of water such as lakes, reservoirs and even the oceans. Eutrophication is basically the over-fertilization of water with nutrients. The negative effect is the loss of oxygen that is needed to sustain aquatic life. While eutrophication can cause algal blooms that result in elevated oxygen levels during daylight hours, algae also undergo respiration during nighttime hours that can deplete water of available oxygen. Excessive algal blooms also eventually die off, using addition oxygen for decomposition of the bloom itself. This decomposition process further lowers the oxygen concentration in the affected water body.

Since the Gulf of Mexico has an area that is considered hypoxic (low oxygen) or a dead zone, the U.S. Environmental Protection Agency (EPA) began an initiative several years ago in the Mississippi River basin to control nutrients from both point and non-point sources. In Kansas, there are 244 stream segments and 187 reservoirs with nutrient related impairments. Based on KDHE data, point sources such as municipal wastewater treatment plants collectively account for eighteen percent of total nitrogen and twenty-five percent of total phosphorus loading in the state. Consequently, many of the larger wastewater treatment facilities in Kansas are now examining their treatment processes and evaluating ways to remove nutrients from their plant effluents. The city of Olathe is one of those systems in the process of upgrading their treatment facilities to remove both nitrogen and phosphorous to prevent eutrophication.

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In June 2010, the city of Olathe broke ground on expansion of their Cedar Creek Wastewater Treatment Plant. The plant is located on 119th Street about 1.5 miles west of Highway K-7 in the northwest part of Olathe. The city is pursuing the plant expansion for several reasons, including service area growth, reducing the frequency of wet-weather discharges and providing biological nutrient removal. The total cost of the project is $32 million. Olathe is using the design-build approach for this project. The design engineer is Black and Veatch and the contractor is Grimm Construction. The plant should be substantially completed by October 2012.

The Olathe Cedar Creek Plant was built in 1984 with and original design capacity of 2.5 million gallons per day (MGD). It is an extended aeration facility. The original plant had a headworks building with bar screening and grit removal, two oxidation basins equipped with mechanical aerators and two 50-foot diameter final clarifiers. In 1997, a 70-foot diameter final clarifier and UV disinfection were added, increasing plant capacity to 3.0 MGD. In 2005, solids handling was improved with addition of a centrifuge dewatering system and aerated sludge

Grimm Construction employees prepare the foundation for new headworks building that will house mechanical bar screens and grit removal facility.

holding basins. In 2008, an effluent pumping station was added to prevent flooding. Currently, the plant is hydraulically overloaded with average flows around 375,000 gpd, but continues to consistently meet effluent limits.

The centerpiece of the city's upgrade is to provide Biological Nutrient Removal (BNR). Once completed, the upgraded plant will have two parallel trains: the existing extended aeration activated sludge plant and the new BNR plant. Design capacities for each train will be 2.5 MGD and 5.25 MGD, respectively. Effluent from both processes will flow to a common outfall structure with the goal of meeting 8.0 mg/L total nitrogen and 1.5 mg/L total phosphorous in the combined effluent.

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The upgraded plant will have a new influent pump station and new headworks building that includes mechanical bar screens and grit removal. This will replace the exiting headworks building. The BNR side of the plant will have a new five-stage biological process for removing nitrogen and phosphorous. The process uses nitrification/denitrification to remove nitrogen compounds and the biological luxury uptake process to remove phosphorus.

The first two stages will include anaerobic and anoxic zones in which microorganisms will release phosphorus while assimilating volatile fatty acids (VFAs). A waste activated sludge (WAS) fermenter will produce additional VFAs. An oxic or aerobic zone will then follow in which the microorganisms use the VFAs and uptake significant amounts of phosphorous. The amount of phosphorous uptake in this zone exceeds the amount released in the anaerobic/anoxic zone. The oxygen concentration in this aerobic zone will decrease gradually across the basin.

Olathe began using this centrifuge to dewater sludge in 2005. Until recently, dewatered sludge from both the Cedar Creek and Harold Street plants was composted to produce a Class A sludge. The city continues to produce Class A sludge with sludge from the Harold Street Plant. However sludge from the Cedar Creek Plant is now taken to a local landfill due to odor complaints at the composting site. The city hopes to resume composting of Cedar Creek sludge in the future. A future phase at the Cedar Creek Plant will provide an improved sludge digestion process that should resolve the odor problem.

This will ensure that wastewater entering the second anoxic zone will be void of oxygen. A finally, second oxic zone will follow to ensure sufficient removal of organic nitrogen.

The plant upgrade also includes expansion of the existing extraneous flow basin to hopefully eliminate future wet-weather discharges. The existing plant has a 3.0 MG extraneous flow basin with an outfall to Cedar Creek. A new 6.0 MG basin is currently under construction, giving the city total storage of 9.0 MG during wet-weather events. This new basin will not have an outfall, but instead will divert stored flow back to the existing 3.0 MG basin which will be equipped with disinfection capabilities. Chlorination and dechlorination will be used if discharging is necessary. The additional storage should dramatically reduce the frequency of wet-weather discharges. And if discharging is necessary, extraneous flow basin effluent quality will be improved as now both primary treatment (which is not provided currently) and disinfection will be provided. Olathe is also close to awarding a contract for work in the collection system to eliminate infiltration and inflow sources.

Joe Foster, Olathe Wastewater Superintendent, summarizes the city's philosophy regarding this project. "This plant expansion will serve the needs of Olathe residents now and into the future. The design of the expansion incorporates innovative technologies, combining a traditional oxidation ditch with a five-stage biological nutrient removal facility. The City looks forward to completion of the project in 2012."

Kansas Rural Water Association is available to meet with any community wishing to discuss wastewater utility operations or improvements. Call KRWA at 785-336-3760 or email directly to me at jeff@krwa.net or to Charlie Schwindamann at charlie@krwa.net.

Jeff Lamfers began work for KRWA in November 2008. Jeff has more than thirty years of regulatory experience in the oversight and operation of water and wastewater systems with the Kansas Department of Health and Environment. He is a graduate of the University of Kansas with a degree in Environmental Studies with an emphasis in aquatic biology.