

Dodge City golf course irrigated by reuse.

New \$17-million Wastewater Plant Completed at Dodge City

Dodge City, Kansas may be better known for Boot Hill and its cowboys than for its innovation. But innovative is the only way to describe the vision the city's leaders had when they began to plan for a new water reclamation facility. With a goal for sustainability and conservation firmly established, the city has now realized facilities that will serve both its citizenry and the environment.

The new plant's concept, design and process technology are cutting edge. From the unique integrated design-build approach, to an accelerated construction schedule, to advanced technology and a goal of achieving 100 percent reuse of effluent – the city has demonstrated a commitment to sustainable practices that make Dodge City a standout, not only in Kansas but nationally.

Dodge City, with a population of 27,000, is the county seat of Ford County in southwest Kansas. Beef packing is its primary industry; National Beef and Cargill are Dodge

City's two largest employers. Thanks to this thriving industry, Dodge City has been growing rapidly, but that growth brings strain to the city's infrastructure. Population growth is not expected to subside anytime soon, and is in fact projected to almost double to over 44,000 by the year 2030. Growth trends, combined with construction of a casino, hotel, and events center, spurred city leaders to take action to expand their wastewater infrastructure.

Drawing on a strong past working relationship, the city chose Professional Engineering Consultants (PEC), in Wichita, KS as its engineering firm. The first step in solving Dodge City's wastewater handling challenge was to determine whether the city's existing facility could be expanded, or whether an entirely new facility should be built.

Because the existing facility was a lagoon system, expanding it carried



The plant's aerobic digesters are the first step in solids handling. Combined, their capacity is more than one million gallons.

significant costs in land acquisition, and in pumping costs. A new plant would be cheaper by nearly half – \$44 million versus \$75 million. But retiring the old plant was not considered, since its lagoon system is well suited to handle the heavy industrial flows that originate from the nearby National Beef packing plant.

Once the decision to build a new treatment plant had been made, getting it designed and built as quickly as possible became the overriding goal. Sarah Unruh, PEC’s Dodge City project manager recalls, “The city’s main 27-inch transmission line, from the city to the treatment plant, was full or nearly full all the time. Everyone knew we had to do all we could to get that plant online . . . yesterday.”

In order to streamline design and shorten the construction timeline, an integrated design/build approach was adopted, which would enable the plant’s construction to begin before all design work was completed. As a result, the mass grading, on-site pump station, biological basins and digesters were being built at the same time the design work for the process technology was taking place.



In addition to housing offices and a laboratory, the treatment plant’s administration building has a public meeting room that can be used by community groups.

came with the integrated approach. But all our team members made it come together very smoothly. And there’s no question it got the plant online faster.”

The plant was complete by August of 2011, and the city celebrated with a ribbon cutting three months later. “We started construction in the snow, and finished in the middle of the hottest summer on record,” recalls Unruh. “Normal design and construction time

for a plant of this type would have been three and a half to four years. We did it in two and a half years. We’re pretty proud of that we were able to make that happen for Dodge City.”

Over and above all else, the new facility’s reclamation and beneficial reuse capacity is the true point of pride for Dodge City. For more than 30 years, the city has been reusing 100 percent of wastewater effluent

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The integrated approach cut a full year off the \$17 million plant’s completion timeline.

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The integrated approach cut a full year off the \$17 million plant’s completion timeline. Design work began in 2008, the contractor (UCI in Wichita) was chosen in March 2009; the contractor was onsite January of 2010; excavation began the following month. Ray Slattery, Dodge City’s director of engineering services, recalls, “The approach was out of the norm. City staff felt some anxiety about it going into the project.” Unruh recalls, “There were challenges that

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The lagoons from the old south-side treatment plant take up 192 acres of land, in contrast to the new plant's 20-acre footprint.



The biological basin removes organic material (nutrients) from wastewater.

generated by its existing plant, by using it to irrigate approximately 2900 acres of farmland. This forward-thinking, sustainable practice is an achievement that most cities, even those with considerably more resources than Dodge City, have not even attempted. The new plant's capability to support and even expand this water reuse policy is what sets it apart.

Reuse of wastewater means that the outflow (effluent) from the facility is treated and used more than one time before it is allowed to return to the natural water cycle. Dodge City treats effluent from the new facility so that it

is safe and reuses the water for irrigation of a city-owned golf course. This not only provides the city with lush green turf in the heat of the summer, it conserves precious groundwater and potable (drinking) water that can be better used for human consumption.

Due to the typically dry summers found in western Kansas, beneficial reuse will likely rise to the top of the priority list for many communities. Dodge City had the foresight to get the necessary infrastructure in place to preserve precious water resources, before being forced to do so by

shortages or other crises. City leaders have made water reclamation and beneficial reuse a priority since the 1980s when the last wastewater treatment facility was built. The city's dedication to water conservation puts it into an elite category of cities like Tucson, AZ; Austin, TX; and Las Vegas, NV that have incorporated significant reuse of non-potable water into their public works planning and water treatment policies.

Dodge City's Slattery recounts the city's first initiative to reclaim water some thirty years ago, when a partnership was formed with local



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The city agreed to provide them with crop irrigation in return for their water rights.

farmers. The city agreed to provide them with crop irrigation in return for their water rights. "City leaders have always known that a plentiful water supply would assure our future growth," he explains. Water reclamation at the new facility gives the city the added option to convert an existing irrigation well over to domestic use when future demand requires it. "Reuse is key to Dodge City's sustainability," Slattery concludes.

Although some discharge of effluent will be necessary at the new plant during the coldest winter months, the city's goal is to eventually achieve the 100 percent beneficial reuse level that has been established at the older facility. Transmission line infrastructure for the new plant was designed to enable the city to expand its beneficial reuse of effluent to several other locations throughout Dodge City.

Though the practice of beneficial reuse may not immediately sound appealing for communities who have yet to consider it, it's important to understand the extensive treatment this non-potable water receives before it is reused. Water is directed to a biological treatment basin, where pollutants first begin to be removed. From there, it travels through a membrane bioreactor, where water is filtered through microscopic holes, removing solid particulate matter and some bacteria and viruses.

The choice to use membrane technology was driven by the city's desire to achieve 100 percent reuse of effluent because membrane



Membrane technology clarified and filters wastewater. This level of technology is rare within the state.

technology is highly effective and thorough at filtering out contaminants and pollutants. Adoption of membrane technology is rare within the state of Kansas, which further distinguishes Dodge City as a municipal leader.

As a final precaution before water is used for irrigation it is disinfected with ultraviolet radiation, inactivating viruses and killing bacteria that may have made it through the membrane filter. As a result of the treatment process, reclaimed water, although not

considered of drinking water (potable) quality, can be safely used by the city for irrigation of public recreational areas.

Treated water is held in a 4.3 million-gallon pond until it is needed. In the coldest winter months when irrigation isn't possible, water is permitted to flow over the cascade and discharge into nearby Duck Creek. Once new irrigation venues have been approved, water reuse should once again reach the 100 percent goal desired by the city.

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Dodge City wastewater plant

Another sustainable feature of the new facility is its compact physical footprint. At full capacity, the plant will be able to treat 2.5 million gallons per day (MGD) of flow while occupying only 20 acres. This contrasts with the older 6.8 MGD plant, which requires 192 acres for the lagoons alone. Although presently equipped for only half its total capacity, it is designed to easily achieve full capacity as the city's growing population and industry require.

Despite its relatively small size, the facility's specifications are impressive. It contains enough cubic yards of concrete to pour a four-foot sidewalk for 41 miles. Reinforcing steel was used in a quantity that could span the breadth of the state of Kansas. The biological treatment basin is equal to the size of an Olympic swimming pool, and would require over 32 million glasses of water to fill it to the brim.

The location of the plant on the city's fast-growing north side was strategic, and brings efficiency as well as increased capacity to Dodge City's infrastructure. All residents on the north end of town will have service through the new plant, while the older

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“The city was fabulous. Everyone worked so well together. The entire project was remarkably problem-free.”

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facility on the city's south side will continue to handle two-thirds of the municipal flow, plus the heavy industrial flows for which it is uniquely suited.

Reflecting on the recently completed project, PEC's Unruh gives the city and the design/build team glowing reviews. “This was truly the best group of people I've ever worked with,” she recounts. “The city was fabulous. Everyone worked so well together. The entire project was remarkably problem-free.” Ray Slattery adds, “This team put our fears to rest. The level of communication was high, and probably contributed to the project finishing ahead of schedule.”

So, although Dodge City may evoke visions of cowboys and outlaws for many people, behind that Old West facade, you'll find a thriving, innovative city. It's a city whose forward-thinking leadership has given careful consideration to securing its infrastructure and its natural resources for future generations.

Ray Slattery, P.E., is director of engineering services for the city of Dodge City, where he began his career in 1994. Ray and his wife Brandi have three children, and still work on the family farm that has been in his family for more than 110 years. Ray is a 1993 graduate of Kansas State University.



Sarah Unruh, P.E., is a project engineer in the water/wastewater division of Professional Engineering Consultants, Wichita, KS. Her expertise includes treatment plant design, system hydraulics and site design. She is married and the mother of a son. Sarah is a 1999 graduate of Kansas State University.



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