Iowa City Heads Off Outfall Failure

Council Bluffs moves to head off a calamity at one of its largest sewer outfall lines, which carries about two-thirds of the city's wastewater

Council Bluffs enjoys a strategic location at the crossroads of America. The town of 59,000 is located at the intersection of Interstate 80, which runs from New York through Chicago to San Francisco, and I-29, which connects Kansas City and Omaha to Canada. Two major railroads, the Union Pacific and Burlington Northern, also intersect in Council Bluffs, and the mighty Missouri River flows nearby. Obviously, infrastructure is vital to Council Bluffs and the city's leadership knows it.

Just as important as the highways, bridges, and railroads is the city's buried infrastructure. Like any modern city, Council Bluffs needs efficient, reliable sewers to remain vibrant and growing. Although unseen, the city's sewers are just as important as any of its above-ground structures. So when Council Bluff's public works officials began examining sewer rehabilitation options, they were deliberate in their selection process.

At stake was one of the city's largest sewer outfall lines, a 48-in. and 42-in. line that carried about two-thirds of the city's wastewater. The pipe was cracked, had off-set joints, and was corroding away from the inside. In some places the six-in. wall thickness had deteriorated to only a couple of inches.

"We have some real challenges with regard to sanitary sewer flows," admitted Gregory Reeder, P.E., Council Bluffs City Engineer. "We have a high water table and very flat terrain in some areas."

To illustrate the problem, Reeder noted that the new sewers in Council Bluffs often have as little 3/4-in. fall every 100 linear ft. "Our pipes sit underwater in some places," he continued. "There are places where the sewage just sits there in the pipe from time to time. That creates hydrogen sulfide that attacks the pipes. So we have had corrosion problems as well as installation issues due to our flat terrain and high water table."

The walls of one of the city's largest sewer outfall lines had corroded from six in. thick to only a few inches. Placement of the new pipe brought city engineers much needed relief from fear of a catastrophic failure.

With hydrogen sulfide eating away at its main sewer line, the Council Bluff's public works department knew that a major sewer failure was inevitable. The line had already experienced several problems. Leaky pipes had caused soil erosion, off-set joints, sink holes, soil infiltration, and a number of other worries.

In 1998-1999, the city began exploring repair/replacement options, but finding the right solution was complicated. The pipe's size, burial depth, and high groundwater made the project difficult and potentially expensive. Engineers also had to consider the fact that the line ran under an interstate highway and a levee. The city hired a team of consultants from George Butler & Associates and HGM Associates of Council Bluffs to study the sewer and make recommendations. Terry Smith, P.E., of HGM was the lead engineer on the project.

"We conducted a study, reviewed grades and pipe capacities, and we considered several alternatives," said Smith. "We looked at sliplining, cured-in-place pipe, and a partial replacement. We even considered replacing the entire line. The city's position was to do it right; to make sure all the problems were fixed and that the capacity of the line would be there for future growth."

"Doing it right" in this case could have been incredibly expensive and disruptive, given the size of the line and the dewatering necessary for new-pipe installation. Dewatering alone would have cost approximately $35 per linear ft of pipe. But the city placed a priority on making this project fail safe in the future. They wanted a new line that would last 50 to 100 years.

Reeder explained why avoiding sewer

GRP manholes are made of centrifugally cast glass fiber reinforced unsaturated polyester resin. Joints between the individual manhole parts, such as concrete cones, pipe shafts, and base, have to be rendered watertight with bearing ring seals.

leaks and pipe problems were such a priority in Council Bluffs. "A pipe failure where a deep sewer repair is needed can cost $50,000 to $100,000. That's why water-tight joints were extremely important for this project. We knew much of the line would be under the water table and we didn't want the joints taking on groundwater. But with larger diameter pipes your options are limited. We looked at a lot of alternatives but we kept coming back to a product called HOBAS pipe (www.hobas.com) because of its corrosion resistance and water-tight joints."

After careful analysis, the city opted to conduct a series of five projects to replace the old sewer with a new 60-in. line made with HOBAS pipe. The cost of each project ranged from $780,000 to $2.6 million. In total, the city now has almost 17,000 linear ft of new sewer line ranging from 42 to 60 in. in diameter, much of it parallel to the old sewer but in a more efficient layout and designed to accommodate future growth.

The pipes, which come in sizes up to 110 in. in diameter, are centrifugally cast of glass-fiber reinforced polymer mortar. The pipe walls are constructed in strategic layers of chopped fiberglass, high performance resins, and precisely graded aggregates that contribute to the strength and corrosion resistance of the pipe. The pipes are centrifugally cast with the interior of high elongation pure resin, which provides abrasion resistance. The product has inherent corrosion resistance that is achieved without add-on linings, coatings, or cathodic protection systems. Good long-term hydraulic characteristics can be expected due to the smooth, non-corroding interior surface. Also, the pipe can be jacked under existing structures. Because the line ran under an interstate highway, a street, and a levee, finding a non-disruptive solution was important.

An early proponent of the selected pipe was Gene Lea, president of B&L Construction Company (Omaha, NE). Lea's company was the low bidder for all five Council Bluffs projects.

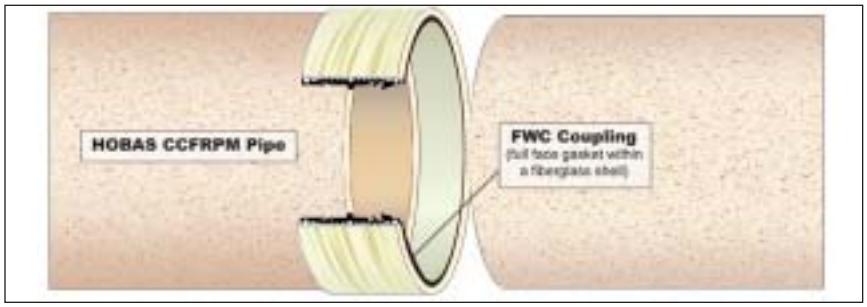
"The pipe has FWC coupling joint connections. You can cut the pipes to shorter lengths in the field and utilize the push-together FWC couplings. It's very simple," said Lea. "That gives you a lot of installation flexibility. Plus, the joints are absolutely water-tight. They will not leak, and that was an extremely important factor."

From a cost-efficiency standpoint, Lea and his installation team also benefited from the fact that the pipes come in 20-ft lengths. "Our production rates were very good," said Lea. "It takes a certain amount of time to lay a length of pipe. If you have to lay two to two-and-a-half times as many joints, the job will take a lot longer."

There were no unusual installation requirements for the pipe, which was enveloped in sand so there was no special backfill needed.

Construction of the new pipe line began in 1999 and was concluded in 2003. In retrospect, the engineers said they would do only one thing differently about the project—utilize HOBAS Tee Base systems for the all the manholes.

"If we had to do it all over again, we would use the Tee Base joints for the manholes rather than the lined concrete manholes we used in phase one," said Reeder. "We just weren't happy with those. After Phase One we used Tee Base sections with manholes from Containment Solutions, Inc. (www.containmentsolutions.com) Both of these products resist hydrogen sulfide attack. I have total confidence that these products will give us 50 to 100 years of service without any problems." GE



FWC (filament wound coupling) asymmetric is available in diameters from DN 150 up to DN 1200 for non-pressure as well as for pressure application. FWC symmetric is available in diameters from DN 300 up to DN 2400 for gravity as well as for pressure application. The couplings consist of full sleeve EPDM-rubber (ethylene-propylene-diene-polymer) to provide protection against water. The laminate, which is produced in a filament winding process, is designed to resist internal or external pressure.