

When Sewers

Runneth Over

Ordered to control SSOs, an Arkansas city implements a comprehensive sewer rehab program

By Hugh M. Kelso

The city of Fayetteville, Ark., is home to the University of Arkansas and located in one of the fastest-growing regions of the country. Infrastructure growth, coupled with infiltration/inflow (I/I) issues, has placed a burden on local wastewater collection and treatment facilities.

Fayetteville is divided by two distinct watersheds. The north and west half of the city is located in the Illinois River Watershed, which flows into Oklahoma, and the south and east portions are located in the White River Watershed, which flows into Beaver Lake. Each watershed has specific issues that affect Fayetteville. The Illinois River, classified as a “scenic river” by the state of Oklahoma, has stringent

discharge requirements. Situated downstream of Fayetteville, Beaver Lake is the region’s water source.

The wastewater collection system in Fayetteville comprises approximately 487 miles of gravity sewer, 33 miles of force main, 45 lift stations and 13,200 manholes. The original system was constructed in 1906. Until 2008, the city had one wastewater treatment plant (WWTP) located in the White River Watershed; it required all flow generated in the Illinois River Watershed to be pumped.

The city of Fayetteville also provides wastewater treatment for flows from the University of Arkansas and the cities of Farmington, Greenland, Elkins and part of Johnson. Much of this flow

also required pumping to the White River WWTP.

The White River WWTP was constructed in 1967 and underwent a major upgrade in 1988. Improvements were based on a wastewater facility plan that took into account future population growth, but the plan did not establish a design storm event or fully account for peak I/I in sizing. Flows were based primarily on water usage and measured flows that historically had reached the WWTP.

As a result, the flows from the first major rain event after construction completion overloaded the WWTP and collection system, causing WWTP damage and sanitary sewer overflows (SSOs) in the collection system.

Administrative Order

Because of continued SSOs, in 1989 the city was placed under an administrative order (AO) by the U.S. Environmental Protection Agency. At this time, more than 545 SSOs were identified and reported. The city later estimated that another 800 to 900 SSOs were not discovered and thus not reported. The AO required Fayetteville to reduce I/I and eliminate overflows, leading the city to develop and implement a comprehensive sewer rehabilitation program.

Although the sewer rehabilitation program was successful and the AO lifted, rapid regional population growth required the city to begin planning for a treatment facility upgrade. In 1995,



The new Westside WWTP features 46 acres of constructed wetlands.

Fayetteville authorized a wastewater master plan study. To avoid a repeat of past problems, this study included both treatment and the collection system.

The Master Plan

In 1997, the city retained a team of engineering firms—including RJN Group, continuing a six-plus-years relationship—to develop a wastewater facilities master plan for the collection system and treatment plant facilities. Utilizing a hydraulic model and various treatment options, the master plan evaluated several different alternatives.

The option that was recommended and selected involved Fayetteville constructing a second WWTP in the Illinois River Watershed and essentially separating the flows in the distinct watersheds. This would allow several lift stations to be abandoned and free up capacity within the existing gravity system.

The master plan evaluation resulted in the \$186-million Wastewater System Improvement Project, incorporating the treatment facilities, pumping stations and collection system. RJN's Dallas and St. Louis offices provided design services for the \$40-million Westside interceptor system, including:

- A new 40-million-gal-per-day (mgd) lift station;
- Upgrade of an existing lift station from 6 to 18 mgd; and
- 80,000 ln ft of 24- to 48-in.-diameter interceptor sewers.

Other consultants provided the design service for the new 10-mgd WWTP in the Illinois River Watershed and upgrades to the existing White River WWTP and collection system.

Along with the engineering challenges, special consideration had to be given to community impacts and sensitive environmental issues, including wetlands and endangered species. Construction would affect many existing wetlands requiring 404 Permit approval and development of a best management plan to be incorporated into the contract documents and followed closely by all project contractors. One of the larger interceptor sewers was constructed through a wetland and creek area

that is home to the Arkansas darter, a candidate endangered species at the time of project planning and permitting.

Most improvements in the Illinois River Watershed and the new Westside WWTP were completed and brought online by May 29, 2008. The average daily dry-weather flow measured at the new WWTP was within 10% of that projected in 2001. The city needed to wait until the area received a design storm to

evaluate wet-weather projections and facility performance.

Seeing Results

In September 2008, Fayetteville was hit by Hurricane Gustav, followed 12 days later by Hurricane Ike. During the passage of Ike—by then downgraded to a tropical storm—more than 5 in. of rain fell during a 24-hour period. Measured peak intensities exceeded 2 in. per hour, and there were reports of

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heavier rainfall intensities in areas of the city.

Prior to project completion, a storm this large would have caused numerous overflows, ranging from one-hour to three-day events. During the actual storm, six small SSOs occurred in the upper sections of the collection system; they lasted a few hours, thus verifying that peak design flows were projected accurately in the study. Five of the six overflows were later eliminated by projects that had not been completed before the storm.

Not only did the sewer rehabilitation program reduce overflows, it also minimized flows at the WWTP and allowed capacity for growth. From 1989 to 2008, the service area population increased from approximately 45,000 to slightly more than 80,000. Although this was population growth of more than 75%, the average annual daily flow at the WWTP increased by less than 15% due to reduced peak flows.

What's Next?

Future city plans include implementation of a totally proactive maintenance program to identify potential problem areas before a dry-weather, maintenance-related overflow occurs. With the help of RJN and other experts, the city also will continue to do sanitary sewer evaluations and rehabilitation to further reduce I/I and prevent wet-weather overflows.

Fayetteville has established a goal of zero SSOs, and the program it has put in place will achieve that goal. **[SWS]**

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