Monitoring Hydraulic Flow

By Matt Maxfield

Large-scale flow monitoring yields cost savings in San Antonio

In an effort to better plan and prioritize its capital improvement program (CIP), San Antonio Water System (SAWS) is using flow monitoring to create an all-encompassing and accurate model of hydraulic flow across its entire system. Launched in July 2013 and expected to run through mid-2016, the project has delivered positive results, including substantial cost savings.

The metropolitan region of San Antonio is spread over 7,387 sq miles, posing significant challenges to wastewater collection. With approximately 1,700 employees, SAWS serves more than 1.6 million people in three different counties, including more than 411,000 wastewater customers. To serve these customers, SAWS manages more than 9,000 miles of pipe (sewer and water) in four watersheds spanning more than 560 sq miles, and requiring three wastewater treatment plants.

SAWS' Wastewater Master Planning (WWMP) group, comprising eight employees, outlined specific goals for the program, which included:

- Optimize system capacity to eliminate sanitary sewer overflows at the lowest possible cost;
- Create a more accurate comprehensive hydraulic flow model—putting the tools in place for ongoing, long-term positive results; and
- Utilize the improved flow model to more accurately define its CIP to better determine which projects were needed, the accurate scope of those projects and how to prioritize them.

To successfully deliver on these goals, WWMP knew it would need to remove overly conservative flow assumptions that existed in its current model. With inherent low-flow conditions, particularly in times of drought, the SAWS collection system faces unique challenges and its model needs to reflect them.

In addition, SAWS knew its model needed to better address the impact its water conservation efforts have on flow levels. SAWS has almost doubled its number of customers in the past 20 years without increasing its water usage. While this is an achievement, it also increases the collection team's low flow challenges.

Crews installed more than 155 meters in 45 days to get the program up and running.

San Antonio Water System corporate headquarters

Minimizing Site Visits

With these goals and challenges in mind, the team launched the project in the summer of 2013. Partnering with Hach Co. and utilizing its Data Delivery Services (DDS) flow monitoring program, SAWS initially installed 176 flowmeters and 32 rain gauges throughout its entire sanitary sewer system. Currently it has approximately 300 meters in the system, as well as 42 rain gauges and more than 50 flow level alarming systems.

In order to successfully execute a flow monitoring program of this scale in a cost-effective manner, the ability to reduce the number of required monitoring site visits, either for maintenance, recalibration of equipment or data downloading, was critical. The less SAWS has to visit each site while still receiving

accurate data was key to keeping expenses in check. With these specifications in mind, the meters chosen incorporate three elements designed to limit the number of required visits and guarantee data accuracy:

1. Non-contact flow sensors: FLO-DAR AV sensors are mounted over the flow, not in it, and use Doppler radar and ultrasonic technologies to capture flow data. By staying above the flow, these sensors reduce the risk of fouling and the resulting required maintenance.
2. Wireless data transmission: The flow loggers selected—FL900 Series flow loggers—are all equipped with wireless transmission capabilities, programmed to collect and transmit data every five minutes, providing the team with immediate flow information. This eliminates the need for manual retrieval of flow data, which is a huge time and expense savings when the sheer size of SAWS' collection system is considered.
3. Uptime guarantee: Because the program utilizes wireless data collection, Hach is able to monitor the accuracy and consistency of the collected data on a daily basis. If anything looks amiss, the team knows immediately and can dispatch crews for service.

Hach also provided Installation and maintenance under the DDS flow monitoring program, so SAWS has not had to hire any additional staff for those purposes. This has resulted in significant cost and time savings for the organization. It also was helpful in getting the program up and running quickly: 155 meters were installed and collecting data within the first 45 days as Hach led two separate crews to perform all site reconnaissance and installations.

Tracking Results

Once installed, data collection began immediately. With data coming from a variety of sources, another key component of the monitoring program came into play—Web service-based data integration. Through a partnership with FlowWorks Inc., Hach developed a Web service that pulls together SAWS' flow data from a variety of sources and delivers it through a secure, Web-based portal. This service also provides a variety of tools for the SAWS team to use in its analysis.

With meters installed, SAWS began to see the benefits of having system-wide data, with numerous departments capitalizing on the real-time information. Specifically, the engineering team is utilizing the flow data to validate projects. For example, with one year of data collected, it is clear that at least one currently scheduled project probably is not necessary. New flow data dropped the projected flow by 50%, meaning that the existing pipe should have capacity to manage the flow effectively and not require planned capacity expansion as the design criteria states. If this project could be postponed or cancelled, the expected savings would be in the range of $10 million. On another project, the engineering specifications called for the installation of 20,000 ln ft of pipe. After reviewing current flow data, however, it was determined that the actual flow responses to rain events were much lower than previously believed. As a result, it was determined that some of the flow could be rerouted to another line and the amount of required and new pipe was reduced by approximately 8,000 ln ft, leading to significant cost savings.

For the Emergency Operations Center (EOC), the wireless level alarming feature on all installed meters allows it to dramatically increase its speed in identifying and responding to system issues within the system. If a flow monitoring location measures a "no-flow" or "high-level" condition, the EOC immediately receives a text message alerting it to the situation. As a result, many alarms have led to automatic field verifications by on-call staff, which is contributing greatly to the avoidance of potential overflows.

One benefit to these alarming services is protection around SAWS' primary clean water source, the Edwards Aquifer. The San Antonio region has always relied on the Edwards Aquifer for its water needs and it is one of the most abundant artesian aquifers in the world. Twenty alarming meters—upstream and downstream of 10 different sewer locations in areas where the collection system passes nearby these sensitive aquifer features—play a vital role in safeguarding it from potential wastewater contamination. Lastly, the Operations and Maintenance (O&M) team is intelligently utilizing the flow monitors to better understand silt levels and blockages by grease and/or debris. As the team cleans the collection system, it can immediately record changes in flow conditions and validate the positive results of its efforts from segment to segment within the system. It also can quickly identify if these new flow conditions might create other unintended consequences.

The benefits of the SAWS system-wide flow monitoring project are far reaching, with both expected and unexpected positive advantages. While the program has not been without its challenges, the results are proving themselves to be well worth it. The SAWS monitoring program validates in many ways how smart data, efficiently collected and intelligently used, can improve work efficiency and reduce expenses. From an accurate hydraulic model for the engineering team to use to valid data to guide the daily efforts of the EOC and the O&M team, this project will benefit the organization for years to come. w&wd

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