By Daryn Martin, Assistant General Manager / KRWA Technical Assistant

Go Ahead and Call – KRWA is Ready to Help!

"I'm at my wit's end, and I don't know who to call for help!" The first line of the email summed it up pretty well. "I called the engineer and now the board president is upset. He insists I call KRWA this instant and "make use of our annual dues!"

I called the author of the email. It was from an operator of a small Kansas rural water district. I calmly asked why it had taken so long to call KRWA. Regardless of utility member status, KRWA is dedicated to providing assistance and training to ALL water and wastewater systems, regardless of membership status. After a problem is solved, or during the problem-solving process, utility personnel will often remark they wished they "would have called KRWA sooner".

The "Shower No-Flow Problem"

This was not going to be a simple fix. A customer had reported the water flow from his showerhead went from full flow to no flow and back over a span of 15 seconds. Of course, the water system operator was concerned. After further inquiry, the operator learned this problem occurs sporadically and has been happening for some time. The complainant lives in a cul-de-sac on a dead-end line with average residential use. There was no obvious industrial or agricultural user who would be pulling large quantities of water and affecting system pressures. I went to the system; we installed a pressure monitoring device on a nearby flush hydrant for a while to see if we noticed any patterns.

This water system is pretty simple. Water purchased from the nearby town is pumped by a 100-gpm pump that is controlled by a variable frequency drive. A large standpipe provides storage for the system. The system serves about 150 meters on 20 miles of pipeline. The static pressure was adequate; an engineer had modeled the system, and no problem areas were discovered. As is often the case, we had to wait for data.

Visualizing the pressure drops

I returned after a week to pull the pressure monitor and retrieve the data. The monitor was set to record the lowest water pressure reading every 30 seconds. From the data, we were able to graph the incident described by the customer. The pressure was steady at around 40 psi and would suddenly drop to around eight psi, increase to around 44 psi and stabilize back to about 40 psi. Based on the trend created by the data points, this appeared to be happening every time the storage tank filled and the pump shut off (See Figure 1). The RWD's pump motor is controlled by VFDs, allowing for slow starts and stops, so we did not immediately suspect water hammer. The week's-worth of data points showed that the pressure drop was remarkably consistent with the system's SCADA fill/drain cycle trend charts.

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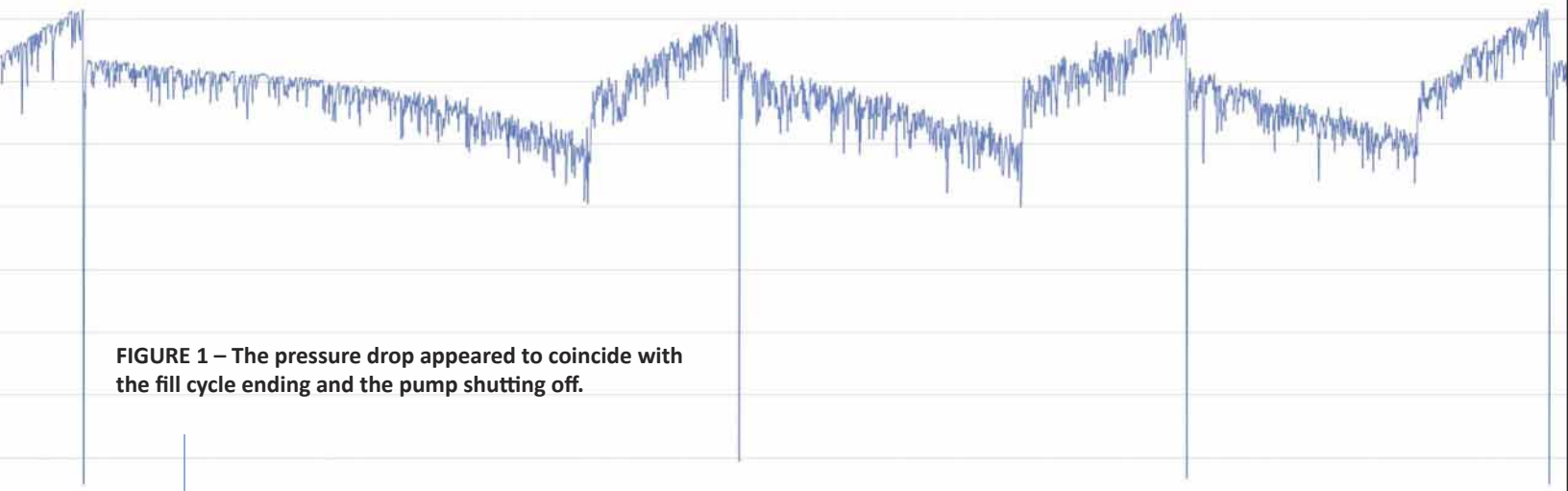

FIGURE 1 – The pressure drop appeared to coincide with the fill cycle ending and the pump shutting off.

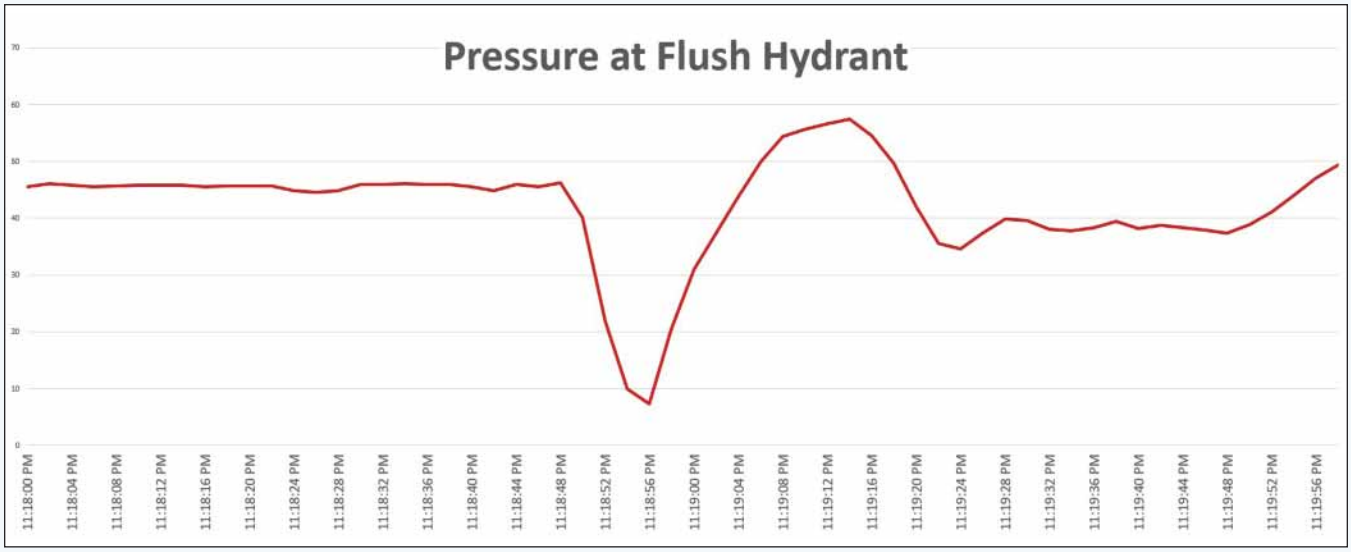

FIGURE 2 – The pressure data appeared to show a water hammer, the pressure drops suddenly, then fluctuates between high and low pressures until the water hammer shock wave passes and system pressure is resumed.

Because a lot can happen in 30 seconds, the pressure monitor was reinstalled and programmed to record the instantaneous pressure every two seconds, which is the lowest setting. That's a LOT of data points: 30 readings a minute, 60 minutes an hour, 24 hours a day which comes to 43,200 pressure readings. Although it took much longer than expected to make sense of the data, we were shown a very clear picture the next day. Figure 2 shows the pressure over a 2-minute time period (11:18 PM to 11:19 PM). There was a definite pressure fluctuation happening. It was becoming apparent that water hammer was an issue in this area. Again, the pressure drops were consistent with the fill cycle ending and the pump shutting off.

An easy solution

Convinced we were seeing water hammer, our investigation turned back to the pump station – more specifically the control valve. The system utilizes a solenoid-control diaphragm valve. When the storage tank level reaches the "full" setpoint, the solenoid receives the signal to close. We suspected that, even though the VFD was slowing the motor down gradually, the valve was closing too rapidly. Upon inspection of the control valve, the speed adjustment was set too close at the fastest setting. The operator ran the system through a few pump cycles while we observed the valve operation. The water hammer theory was supported by observing the pressure gauge needle swing wildly when the valve shut. At the fastest setting, the valve closed within a couple of seconds. We decided to set the control valve at the slowest setting, with the cycle taking about a full minute to close completely. We observed no pressure fluctuations when the valve closed, leading us to believe we were on the right track.

Mystery water savings

We were quite pleased after setting the pressure monitor out in the system to observe conditions under the new operating speed. The pressure fluctuations we observed previously were gone. The chart smoothed out (See Figure

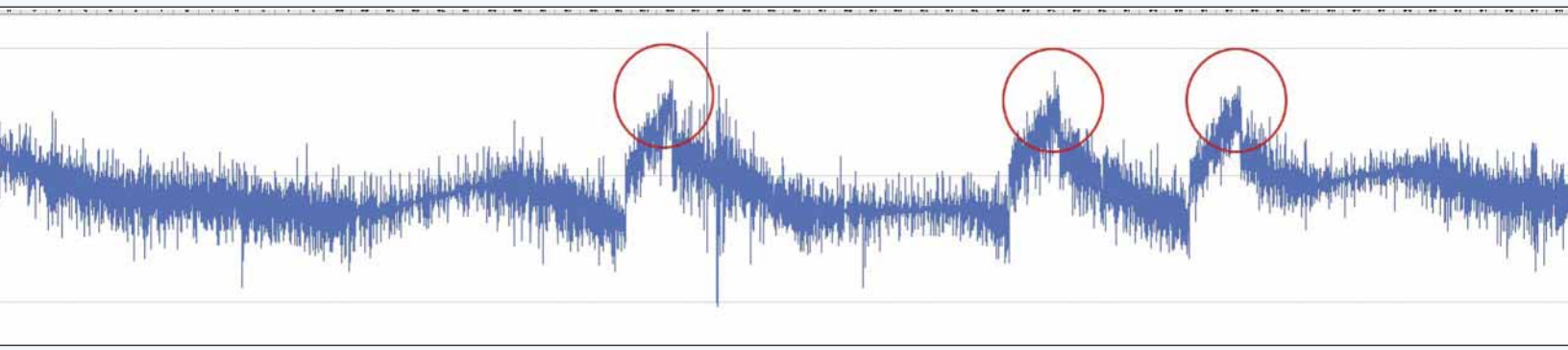

FIGURE 3: The pressure fluctuations appeared to level out after adjusting the control valve closing speed.

3). The change also resulted in significant water savings for the system. The storage tank would fill and drain three times during a normal day. After the changes to the valve operating speed, the tank fills and drains only twice. The overnight tank drain cycle is now about 16 hours instead of an average of eight hours before the changes. That's significant savings on water usage, loss and wear and tear on equipment over the years.

Reflecting on this incident, I don't exactly know how changing the closing speed of the control valve saved all that water. We suspect that the water hammer sent shock waves through the distribution system, possibly causing the system's air-release valves to open. The SCADA data and pumping numbers confirm that the system is purchasing less water from its supplier.

Go ahead and ask – KRWA is ready to help!

This problem could have been solved much earlier if the operator had thought to call KRWA for assistance. Asking for help is difficult for most of us (especially men!). Asking for help does not automatically mean the help-seeker is not knowledgeable. Not everyone can know everything, nor should they.

KRWA has a staff of exceptional employees – but we don't know everything. Figuring out the problem I've laid out here took some investigative work and technology. KRWA employees take time to help figure out those head-scratchers. In fact, this type of technical assistance in water and wastewater systems is their full-time work effort.

That is only one way KRWA can be a valuable resource. We can also provide specialized equipment that many small utilities can't afford, or most likely, it doesn't make sense for the system to purchase. Like the pressure monitor we used in the article. It doesn't make sense for a water district with 20 miles of pipeline to spend hundreds or thousands of dollars on a piece of equipment they may use only once in a great while – and know how to operate it. KRWA has that equipment.

If your utility faces a head-scratching problem, I encourage you to call KRWA for help. Sometimes, all it takes is another knowledgeable person to have a look at a problem from a different viewpoint. KRWA staff are available 24/7/365 – with nearly 600 years of experience. Someone will answer the phone and someone will be back to you promptly, day or night, any day of the year and regardless of the location of the caller.

Daryn Martin began work with KRWA in August 2019. He previously was a Water Program Inspector and Environmental Program Administrator at KDHE's Wichita office. Prior to joining KDHE, he worked as an operator in the El Dorado Water Treatment Plant. He holds a Class IV water operator certification.