By Jon Steele, KRWA Technical Assistant

Determining and Managing Water Loss Requires Attention to Detail

High water loss is often assumed to be leaking pipes. In this case, the author located a failing check valve in a pumping station that was allowing 10 gpm backflow to the neighboring water system.

Much can be said about controlling excessive unaccounted for water loss, especially for public water suppliers that purchase water from another supplier. The cost of purchased water added to the operational costs of the purchasing entity can result in some pretty high priced water. I know of many rates as high as $7 and even up to $14 per thousand gallons. The problem of high unaccounted for water loss can have an additional dramatic impact on those systems.

There are many possible contributors to unaccounted for water loss. Some of the older solvent weld pipe materials seem to have inherent problems. Compared to the more recent rubber-gasketed PVC used since about 1974, the solvent weld PVC has no capacity for expansion or contraction that will occur with changes in water temperature or soil movement. It is typical to experience breaks in the pipe just behind the bell. Poor workmanship and assembly techniques are also more prevalent with solvent weld PVC.

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In my discussions with water system operators, I strive to encourage managers and operators to learn their system so well that it becomes instinctive as to the expected range for daily pumpage. Sudden increases in the amount of water pumped or purchased should be an alert that something may be wrong. I suggest close monitoring for a few days to see if the usage returns to normal. If it doesn't, then it's time to aggressively search for reasons why usage increased.

Accountability is more than sending out bills

Many municipal and rural water districts wait until the end of the month or billing period to document water purchased or produced. Pumping records should be logged and monitored daily. Frequently, the usage reported by customers, especially in self-read systems, is suspect. I recall a recent situation when reviewing the accounting for a RWD, indicating the system had a 70 percent unaccounted for water loss. The district purchases water from another system; this unaccounted for loss cost $1,500 per month. I contacted the operator immediately to offer help with a leak detection survey. He agreed; we soon learned that the problem was customers not reporting meter readings accurately.

The situation I mentioned in the previous paragraph is not uncommon in many smaller cities too. Frequently there is no single person paying attention to the amount of water purchased or produced, water sold, or lost until the end of

the year when the system completes the annual Water Use Report, which all water right holders are required to submit to the Division of Water Resources by March 1 of the following year. Purchasing systems are also encouraged to do so. The record keeping is in their interest as it helps identify high unaccounted for water loss. But when system staff or board/council members make little effort to account for water loss until the end of the year, the challenge to determine what happened the prior June or July can be frustrating.

A problem I find in larger water systems is that while they generally have more staff members, each person often has their own limited area of responsibility. There is no one person who reviews the entire operation. The city clerk may have the sales figures, the water treatment or well field manager may have the production records, the distribution crew installs meters and flushes hydrants and repairs leaks, still others read the meters, and another clerk may be completing the annual Use Report – and that person sometimes has no understanding of what the figures even mean.

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Water systems don't "make" water

Another problem I find on self-read systems or those where the meter readings are not verified is that there sometimes is a negative loss one month and a positive loss the next. First, it is impossible to sell more water than a system purchases or produces. Unfortunately on self-read systems the bookkeeper or manager has no choice but to enter the amount of water that was reported. I have actually had water system staff and board/council members argue this point with me as they try to convince me that the system sold more than it actually purchased or produced. It can also be due to a meter reading timing issue. Here's a typical alibi. "Oh the city reads the master meter at a different time than we read our customer meters." My reply is then why doesn't the purchasing system read or verify that master meter reading and compare the use to the same time period as the customer meter readings? Master meters and customer meters should be read at the same time or the system will be making incorrect comparisons. This sort of management issue may be overcome to some extent by automated meter reading systems, but it is going to be many years before a majority of systems attain that technology.

Training, education is necessary

I have come to the conclusion that training on water loss and accounting should be included and thereby emphasized in the original funding of new water systems or on improvement projects. Such training is especially important for water utilities that purchase water, as the cost of lost water is only recoverable through additional rate increases. KRWA has experience with some water system staff and board/council members who place too little emphasis on reducing unaccounted for water loss as they are of the opinion that it is less expensive to allow a leak to continue versus repairing it.

I have recently been assisting numerous small RWDs to reduce water loss. One such district is being assisted as a "Special Focus" project identified by the Kansas Water Office; those projects have unaccounted for loss of 30 percent or more. Two of the systems purchase water from neighboring small towns at moderate costs of approximately $2.50 per thousand gallons. One of the systems was experiencing unaccounted for loss of 50 percent or more. The cost of the water being lost was $3,000 per month.

Having used up most of the district's cash reserves, and being frustrated in not being able to locate the problem, the operator even suggested shutting the system down and allowing people to return to use their own wells. I was able to convince them that would not be necessary and we would be able to find the problem. There was no alternative, given their dire financial condition. I recommended that the board

Harper County RWD 4 Operator Jim Coady surveys the location where a 30-gpm leak was located on this crossing. Replacement will involve a directional bore of approximately 250 feet.

A major break on an 8-inch line in Reno RWD 3 required operator Richard Jensen to set up this "Road Closed" barricade. The pipe that broke was cast iron. Reno RWD 3's service area includes the old naval air station area, now industrial complex, south of Hutchinson. The district's user base is approximately 35 industrial customers and 40 residential, including the Kansas Law Enforcement Training Center and Hutchinson JuCo. This 8-inch line was installed in the 1940s by the U.S. Navy under what was a gravel road. The present road is asphalt. The cost of the recent repair was nearly $18,000 as the county required the RWD to also pay for the road repairs. The RWD is evaluating installing a new PVC pipeline on private right-of-way.

temporarily increase rates to compensate for the negative cash flow due to water loss. The district's rates were already high at $7 per thousand. I recommended they add a surcharge to the minimum to ensure payment. The increase was $30, in addition to their existing $20 minimum. It was a huge increase; users complained but they had no choice. I also recommended they leave the extra charge in place for a while after the problem was corrected in order to build a reserve emergency cash fund. In the meantime I asked the manager to meet with the city from which the water was being purchased and explain the situation and what we were doing to correct the problem. The selling city was very gracious and reduced the cost of the water.

With much effort the problem was eventually solved. We tested the master meters; high usage customer meters were replaced. We performed a series of leak detection surveys during nighttime hours, generally from midnight to 4 a.m. We located loss along a pipeline but were not able to isolate it because of somewhat inoperable valves. A valve that turns only part way down is only a restriction – it's worthless for conducting a water loss survey. Water systems with valves that are inoperable should repair or replace them.

In the case of this small district, the district did have some parts on hand but not what we needed to make the particular repair. Over the course of the next few weeks, I assisted the operator in replacing several valves so that we could complete the water loss survey. We then located the leak that turned out to be in a creek crossing.

Another district I recently assisted was experiencing similar high unaccounted for water loss. After several nights of leak detection, and installing several new valves, we were able to locate the leakage. We located one small leak in a sand hill area but the largest contributor to the water loss turned out to be a leaking check valve. This district purchased water and water was flowing back to the seller. The master meter did not subtract that reverse flow. Much to my amazement, the backflow was in excess of 10 gallons per minute (gpm). I had not detected that during our prior surveys. Most of the time you can hear a check valve or washed out lube line valve leaking back.

Years ago a manager in a small town called me about a water loss issue. When I arrived onsite we reviewed the production and sales records. After we determined the extent of the problem I suggested we check the well meters. I will never forget the sound of water

screaming through what was a washed out half-inch valve on a pre-lube line on the turbine lineshaft pump. That small gate valve was putting nearly 12 gpm back into the well.

I recently worked in one larger city in Kansas that had a high loss problem. I first reviewed data and discussed operations with several of the city's staff. It is a complicated system with multiple sources of raw water. I learned that there was a control problem with the data collection system. The SCADA system was showing 400 to 500 gpm and at times, even more water, coming from a source where the valve was closed and was not being used. The person recording the water use had no working knowledge of the system and what the figures even meant; that staff member was just recording numbers. Certainly having that much water reported in use was a dramatic contributor to their perceived water loss.

In this article, I have touched on several contributors to high unaccounted for water loss. Others include unmetered well lube lines, unmetered services, overflowing storage tanks, theft, bookkeeping errors, other control or data reading problems. When conducting a search for water loss, always begin with recordkeeping. There is nothing worse than spending time out chasing problems that don't exist.

Good water loss accountability begins by verifying the accuracy of master meters. Here the author records results of one such test.

Water loss is not a complicated issue if a systematic approach is taken to try to resolve it. Every water system is unique. System operators and managers need to learn how the system functions and have a mental log of what level of usage is average. Good recordkeeping, verification of master meter accuracy and diligent attention to details are important to maintaining low water loss. There are many contributors to water loss. Good management and sound operations are essential to keeping it in check. Call KRWA if you need assistance. Do that before the problem turns into a crisis.

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