City of Cottonwood Acquires Private Water Systems

Robert B. Hardy *– City of Cottonwood, Arizona*

Utilizing both uncontested condemnation and asset purchase agreements, the City of Cottonwood, Arizona acquired four privately owned water systems to form an integrated municipal system. The process took more than six years to complete; the city now operates and maintains a system serving approximately 10,000 customers, including Cottonwood's 12,000 residents and an additonal 13,000 residents in unincorporated areas.

A number of political and practical reasons led the city to embark on this complex project. The community had been served by four different water companies, each with separate rate structures and policies. With few exceptions, the systems lacked fire flow capability and emergency storage, and were generally undercapitalized. Additionally, the private suppliers were not actively integrating water resource development, planning for growth, or taking active roles in regional water issues such as the surface water adjudication that could impact groundwater withdrawals.

City managers saw many benefits to acquiring the water companies, interconnecting the systems, and expanding its utility department, which had for many years successfully operated a wastewater collection system and treatment facilities. An integrated and municipally owned system would allow better growth planning and a massive capital improvement program. A single municipal system also would provide more local control and responsiveness to residents, with the city council—not the Arizona Corporation Commission (ACC)—setting rates and hearing complaints. Further, being a water provider would increase the city's ability to influence legislation and participate in regional and state water programs. The acquisition would also allow the city to develop and regulate strong drought management and water conservation programs.

The Acquisition Process

The four private water companies ranged in customer meter base from about 600 to nearly 4,500; two were family-owned, one was part of a larger private water company, and one was owned by a development corporation. The acquisition process began in 1999 after the owners expressed interest in selling. Three companies were acquired through uncontested condemnation in 2004 and the fourth was acquired through an asset purchase agreement in 2006. As negotiations neared completion, the city obtained revenue-bond financing and bond ratings, adopted a rate structure, and expanded its utility staff in preparation for performing maintenance, operation, and billing services as of the day of closing.

Uncontested condemnation provided tax advantages for the sellers, avoided sale approval hearings by the ACC, and allowed faster resolution with fewer regulatory complications. However, this process has high legal costs and the system is obtained in an "as is, where is" condition, without warranty or representation. The asset purchase process is more public and utilizes less specialized counsel, but the process takes longer and is subject to considerable last-minute maneuvering.

System appraisals were obtained, a capital improvement program developed, and long-term financial projections were calculated for the initial three acquisitions and then modified when the fourth system was acquired. The city included the purchase price, a three-year capital improvement program, issuance costs, and arsenic remediation costs in each of the two bond issuances. The first issue was valued at $14 million and the second at $20 million. The bonds are 20-year term and rated AAA with insurance.

The New System

Generally, monthly water system rate structures include a base fee that covers administrative costs and a tiered usage fee that covers the cost of delivering the water and maintaining the water system. But Cottonwood's rate structure is unique in that it includes four restricted accounts in addition to the base and usage fees. These accounts incorporate customer charges independent of usage for water resource development, adjudication expenses, the water conservation program, and participation costs in regional associations. The highest fee is $4 per meter per month for the water resource development fund, while the lowest is 25 cents for the water conservation program. By restricting these funds, the revenue is applied only to the relevant program and not mixed with other projects.

Among the many challenges of creating the new integrated system, some of the biggest were "surprises" encountered upon purchasing the water companies "as is, where is." Although city managers were allowed cursory inspection of the systems and had general knowledge of the problems they might encounter, the widespread lack of maintenance of wells, pumps, and water mains exceeded even their estimates. As a result, the city had to greatly accelerate the capital improvement program to upgrade the infrastructure.

In spite of these challenges, the results to date are impressive. The utility department now has a staff of 16 employees with an annual budget of $2.1 million for operations and $4.4 million in capital.

The city is continuing to interconnect the systems and upgrade pumps, mains, and other facilities. These improvements have allowed Cottonwood to avoid the emergency summer water shortages that had become an annual occurrence prior to the acquisitions. Other successes include adoption of a drought management plan, water conservation plan, meter replacement program, reuse program, aquifer testing, and creation of a WaterCad system model.

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Dowsing for Water and Answers

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Water witching. Dowsing. Divining. Can a stick lead a man to water? Most scientists say "no way," yet there continues to be just enough anecdotal evidence of the phenomenon that the door to the subject has never quite closed.

Dowsing is the practice of using a forked stick, bent wire, crossed metal rods, or other devices to find groundwater. The tool is held in a two-handed position by the dowser, who then walks along with it extended in front of him. When water is detected, the tool—either of its own accord or perhaps in tune with the body or mind of the dowser—points downward, in effect saying "drill here." The practice is believed to be thousands of years old. Some drillers in the Tucson area today regularly dowse before drilling; others estimate that 15 to 20 percent of their customers, particularly in rural areas, employ dowsers before drilling.

In 1968, the U.S. Geological Survey concluded that dowsing had no scientific merit and attributed much of dowsers' alleged successes to the fact that in many areas, groundwater is hard to miss if the driller goes deep enough. Others attribute dowsing successes to "ideomotor reaction," or subconscious movement that

Photo: Howard Grahn

Experienced dowser Tom Hunt shares the power with publisher Woodhouse.

accompanies an expectation in the mind (Raloff, 1995). In other words, the dowser consciously or unconsciously expects to find water in a certain location and causes the dowsing tool to react accordingly.

Tests Generally Fail

Numerous tests to prove the validity of dowsing have been reported in the literature, and the majority indicate failure. One of the most cited was performed in the late 1980s involving scientists from multiple disciplines at the University of Munich (Betz, 1995). The experiment was carefully designed to stand up to scientific scrutiny, yet the outcome remains debated. Some say a few of the 43 dowsers who participated showed an extraordinary rate of success that could not be explained statistically. Others dispute that, saying the success of those particular dowsers was not duplicated in other tests they took, and the "extraordinary" results were merely consistent with statistical fluctuations (Enright, 1995).

The James Randi Educational Foundation *(www.randi.org)* offers a $1 million prize to "anyone who can show, under proper observing conditions, evidence of any paranormal, supernatural, or occult power or event." Two scientists from York University in Ontario designed and evaluated a test for a candidate who claimed to have dowsing abilities (EEGS, 2002). The candidate failed and others have tried as well. The prize has never been awarded.

And Yet…

Apart from the researchers who actively seek to prove or disprove dowsing, a number of reputable physical scientists have stumbled upon dowsing through a relative or friend, and, while they can't explain it, they freely admit something happens. Among them are an astronomer from the University of Edinburgh, an electrical engineer from the University of Virginia (Raloff, 1995), and an exploration geophysicist from Stanford University. None claim to understand what happens, but all believe what they experienced is real.

Doug Bates is a self-proclaimed geologist and water diviner who uses his combined abilities in an apparently successful consulting company, GeoDivining

International *(www.geodivining.com)* in Scotland. According to Bates, divining is a phenomenon "that can not be adequately explained within our present framework of scientific understanding," yet his website offers a discourse on what is understood and how divining may work.

OK, Let's Try It

Southwest Hydrology set out to do its own investigation of dowsing. We met with Tom Hunt, a dowser in demand in the Tucson area. Now retired, he spent his career in real estate, but about 35 years ago, a family friend visited, demonstrated his own dowsing ability, and Hunt tried it and felt the tug of water. Now there are drillers in southern Arizona who won't site a well without first calling him. Hunt claims to have found water in many locations where no one else was able to. And while he doesn't make a living at it, he sometimes accepts payment for his work.

Hunt freely calls the process "snake oil" magic. He doesn't know how it works—he just knows it does. We had him demonstrate in an area he was quite familiar with: his yard. He used both a forked stick (green mesquite) and a bent wire. They both readily bobbed down. Could a skeptical hydrologist-publisher get the same result? Apparently she doesn't have the touch. However, when Hunt held one end of the rod and the publisher held the other, and the two held their free hands together, the pull was too strong for the publisher to resist. What's up with that?

Articles published in nearly every decade of the past century can be found purporting to clarify the status of dowsing—and yet they do not. Add this one to the pile. From a hard science perspective, dowsing is without merit. But enough scientists and skeptics have either experienced or witnessed the phenomenon that it seems dowsers will continue to be in demand.

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When Water Meters Grow Old

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Two Arizona water utilities recently reported on studies of aging residential water meters that were conducted to 1) predict which meters are most likely to be inaccurate, and 2) develop cost-effective, proactive water-meter replacement programs. Metropolitan Domestic Water Improvement District of Tucson (Metro Water) and the City of Phoenix Water Department (Phoenix Water) focused primarily on 3/4-inch residential water meters, the predominant meter size in their service areas.

As they age, most water meters eventually begin to underrecord flows, particularly at low flow rates. Often, the meters' rotors fail to turn at all until a minimum flow rate is reached; over time, that minimum rate increases. As a result, low flows may go unmetered, while moderate and high flows continue to be metered with fair accuracy.

This authorized but unbilled consumption has several negative effects, including lost utility revenues, erroneously high estimates of system losses, inequitable cost sharing among customers, and misleadingly low per-capita water consumption rates. Additionally, if inaccurate meters are geographically clustered, studies of water use trends and conservation program effectiveness can be impacted.

Research by the American Water Works Association indicates meter accuracy drops significantly after 1,000 Ccf passes through the meter (one Ccf equals 100 cubic feet or 748 gallons). For many utilities, the majority of their meters have exceeded this milestone, including 58 percent of the 3/4-inch meters in Phoenix Water's service area.

Metro Water: Age Matters

Metro Water's study began in 1999. The district serves 17,000 customers, and averaged 8.3 percent system losses between 1993 and 1999. A sample of 10 meters revealed a good correlation between total water metered and decreased accuracy at low flow rates. Based on these findings, Metro Water established a goal of having no meters older than 10 years, as estimated by cumulative flow. A replacement program began in 2000 and ran for 2.5 years, during which time 9,300 3/4-inch and 1-inch meters were replaced, 63 percent of the meters in that size range.

Meter accuracy tests were performed on 381 of the replaced meters, or 4 percent of the total. The tests were made at three flow rates, as defined by AWWA Standard C700: low (0.25 gallons per minute), medium (2 gpm), and high (15 gpm). The results (see chart below) revealed accuracy declining by 2.7 percent per million gallons cumulative flow at low flow rates, 0.5 percent per million gallons at medium flow rates, and 0.7 percent per million gallons at high flow rates.

Financial impacts of inaccurate meters, and therefore the optimal meter replacement schedule, depend on the costs of meter replacement, the price of water, and the relative amounts of water delivered to customers at various flow rates. Replacing Metro Water's meters cost $28 for each new meter plus $17 in labor and travel, or $45 per meter.

In a separate test, Metro Water logged 171 customer meters for a minimum of one week to determine water usage by flow rate. Low flows accounted for 11 percent of usage, while medium flows (0.25 to 2.0 gpm) accounted for 22.5 percent. Flow rates above 2 gpm accounted for 66.5 percent of usage. Based on these findings,

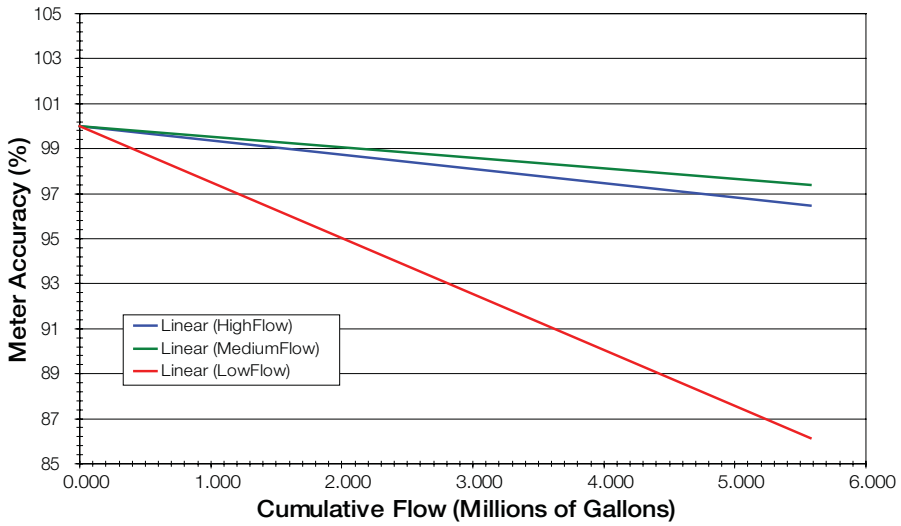
Metro Water estimates its meter recovery program cost $378,000 but increased revenues by $1.7 million, for a net savings of $1.3 million. In addition, apparent system losses declined from around 10 percent to around 5 percent. Metro Water estimates the ideal replacement age for its 3/4-inch meters to be 10.9 years.

Phoenix Water: Manufacturer Matters

In 2006, Phoenix Water randomly replaced 2,012 3/4-inch residential meters installed before 2001. The pulled meters were tested for accuracy at the three AWWA-defined flow rates, plus a very low flow rate of 0.125 gpm. The initial findings were:

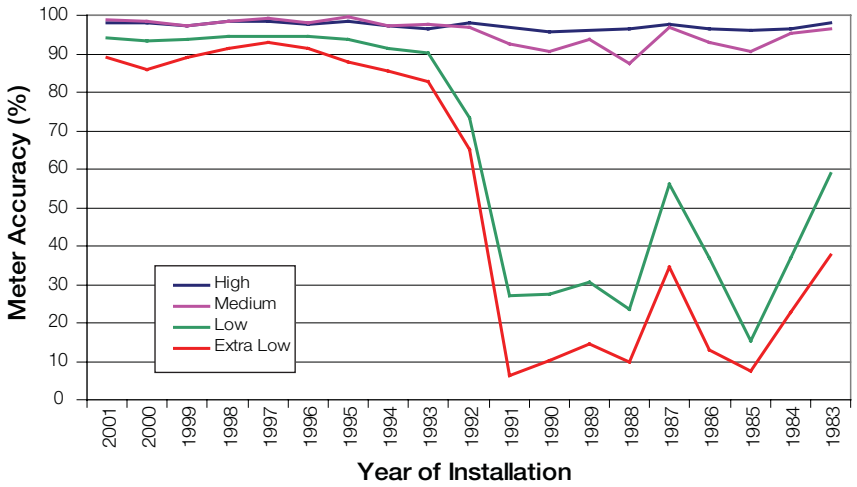
- for high-volume flows, only 10 were less than 80 percent accurate, of which six registered no flow at all;
- for medium flows, 36 meters were less than 80 percent accurate, including 18 showing no flow;
- for low volumes, 306 meters were less than 80 percent accurate, including 196 with no flow;
- for extra-low volume, 455 meters were less than 80 percent accurate, including 315 with no flow.

Early attempts to correlate meter accuracy with age and cumulative flow were



Accuracy of Metro Water's 3/4-inch meters as a function of flow rate and cumulative volume metered.

unsuccessful; some older meters actually performed more accurately than some newer ones (see chart, next page). Only when meter manufacturers were taken into account did the data make sense; nearly all the meters were from one of four manufacturers. Overall, Badger and ABS meters were 98 percent accurate, while Kent meters (no longer manufactured) were only 82 percent accurate. There were not enough Rockwell meters to draw any firm conclusions on their accuracy.



Accuracy of Phoenix Water's 3/4-inch meters as a function of flow rate and year installed.

After accounting for manufacturer, Phoenix Water found the correlation between meter age or total volume metered and accuracy to be relatively weak, averaging 0.45 percent per 1,000 Ccf cumulative flow and 0.10 percent per year.

Phoenix Water assumes residential water usage to be 16 percent low flows, 67 percent intermediate flows, and 17 percent high flows. Based on this assumption, annual revenue losses per meter due to underrecording were about $12 for the typical Badger or ABS meter, but a startling $94.07 for Kent meters. Phoenix Water estimates replacement costs to be $45 for a new meter plus $45 to $50 for labor, for a total of $90 to $95. The payback period for replacing Kent meters is only one year.

Phoenix Water has developed a meter replacement plan that uses its accuracy model to prioritize meter replacement. The three-year plan calls for spending $1.2 million per year to remove the backlog of underperforming meters, initially concentrating on replacing approximately 30,000 Kent meters in the system. The utility expects a payback period of less than two years.

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