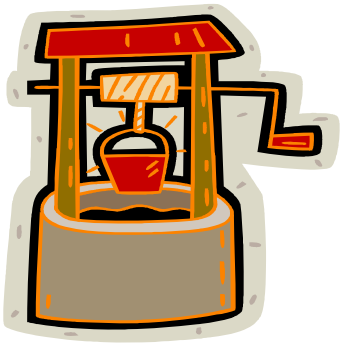
Aquifer Storage and Recovery

"And the future is here!"…This is a line we have all heard from advertising agencies, but how about from your water district? Centennial Water and Sanitation has embraced the future by implementing a new process to automate their Aquifer Storage and Recovery (ASR) program. This program helps Centennial to meet their summer water demand while increasing awareness of aquifer levels.

Centennial serves the communities of Highlands Ranch, Colorado, located south of Denver in the rolling hills between C470 and Castle Rock. Their vast well field offered ideal storage for water that became available during high run-off events. Paul Grundeman, and his knowledgeable staff at Centennial started the process of ASR in 1992. The basic concept is simple: Obtain surface water during high run-off periods, process the water, and then pump finished water to the well fields to be stored in aquifers. Once the water is stored, it is then available to be pumped back out during summer peak-demand. As simple as this process may seem, there were a surprising number of hurdles, both legal and logistical, that had to be overcome for the process to work.

Centennial's wells have been adjudicated a certain number of acre-feet of water that can be utilized by the District. The State Engineer oversees these limits. When the total numbers of acre-feet have been pumped from a specific well, the pump must be turned off for the rest of the year. Centennial determined that through ASR they could store enough water to extend their number of pumping days during the summer. As an example, the A-10 well has an adjudication of 171 acre-feet, equivalent to only 26 days of pumping on this high-producing well. With ASR, the district hopes to double the number of summer days it can utilize this well.



With their water-rights plan in place, Centennial then had to make the ASR system work. They first had to build a pump station to send the water to the well field. Then they manually adjusted the flow into the wells using a unique technology called a "Baski Valve". This valve uses a nitrogen filled bladder to reduce the velocity of the water flowing back into the wells. This velocity-control is necessary when water is being delivered down a 2000' shaft. (Does 32 ft/second ring a bell?). By manually observing and adjusting this ASR process, the district learned enough about the fluid dynamics to move to the next step of automation. Tom Anderson, Special Projects Coordinator for Centennial notes, "We wanted to automate the process because weather conditions often prevent us from accessing the well field during runoff season and we wanted to be able to stop the process remotely if we had a problem with the Baski Valve."

By using their existing network of Motorola Moscad radio telemetry sites, the district can monitor the water flow rate back into the aquifer, the pressure of the Baski valve, and the level of the nitrogen tank that feed the Baski Valve. From these parameters, the Moscad PLC logic runs a basic proportional loop that regulates bladder pressure and flow. If at any time the nitrogen tank levels drop below operator controlled set points, or if an alarm condition occurs at the well, the computerized system can immediately shut the valve at the top of the well head. Brandon Buss, from Timber Line Electric and Control, Centennial's automation integrators, observed, " After automating the first well, we discovered that each well had unique characteristics and that the operators needed to be able to set pressure and flow points from the central computer."

As this new technology becomes more familiar to the District operators they will be able to fine-tune the ASR process with just the click of a mouse! Additionally, the district will be able to generate ASR flow reports for the State's review using their G.E. Historian software. Each of these steps helps to assure a plentiful supply of water for Centennial's customers, and a long-term commitment to keeping aquifers healthy!