Compiled by Kate Cline

The Effects of Overuse

Steven E. Rice

The water supplies beneath our feet are crucial to many areas across the country, but as water needs increase, cities must take care to ensure their groundwater aquifers last. *Water Quality Products* Managing Editor Kate Cline recently spoke with U.S. Geological Survey (USGS) Hydrologist Steven E. Rice on the dangers of overusing aquifers and USGS' latest study on New Mexico's groundwater.

Kate Cline: How have groundwater levels and flow changed in the Santa Fe Group aquifer system?

Steven E. Rice: The prominent direction of groundwater flow in the Albuquerque Basin used to follow the Rio Grande, roughly north to south. After several decades of substantial groundwater withdrawal, flow directions in many locations now are moving away from the Rio Grande toward pumping centers. Declines in groundwater levels, primarily in the "production zone" (the depth interval where most pumping occurs) expanded over the past 50 years due in large part to rapid population growth and associated water demand. Groundwater level declines in some areas exceeded 120 ft from predevelopment conditions. Water conservation efforts steadily decreased annual groundwater withdrawal from its peak in 1989, but withdrawal was still in excess of recharge, and water level declines continued.

These findings came from a long-running project in cooperation with the Albuquerque Bernalillo County Water Utility Authority, where USGS has been monitoring water levels in the Albuquerque Basin for 18 years. Analyses of these data have included water level contour maps for specific points in time, as well as groundwater modeling of groundwater development scenarios.

Cline: How has the addition of surface water sources to Albuquerque's water supply affected groundwater?

Rice: Introduction of surface water through the San Juan-Chama Drinking Water Project has allowed Albuquerque to reduce its volume of groundwater withdrawal for municipal purposes. Rising water levels in many groundwater observation wells in the city can be attributed to reduced pumping from city well fields, while continued groundwater level declines are observed in areas of the Albuquerque Basin where groundwater remains the sole source of supply. The groundwater resource was impacted by many years of focused pumping, and although monitoring locations in some areas show groundwater level increases after the addition of surface water, the increases are small in comparison with total declines over the past several decades.

Continued use of surface water resources may allow the groundwater basin to be used as a reserve during times of greater need rather than a primary source, and may even allow for artificial recharge projects to supplement the resource during times of water excess.

Cline: What are potential consequences of the Albuquerque metropolitan area's heavy reliance on groundwater over the next few decades?

Rice: The Albuquerque Basin, like most western U.S. basins, has a finite amount of groundwater available to wells, and a variable amount of recharge entering the basin. Where there is an imbalance in the amount of water leaving the system versus what is added, groundwater declines are likely. Rather than homogeneous rates of water level decline, water level declines tend to be focused near major pumping centers and areas where transmission to wells is reduced by the physical properties of the aquifer or other factors.

Groundwater level declines may result in land subsidence and other costly situations, such as the need to deepen wells, install larger pumps and treat lower-quality water. Quantification of sustainable levels of groundwater withdrawal in conjunction with conservation efforts, identification of potential additional sources, and treatment and reuse technologies all are important to prevent overuse of the groundwater resource.

Cline: In general, how does overuse of groundwater affect underground aquifers? Are other areas in the western U.S. experiencing similar issues?

Rice: A number of impacts to aquifers are associated with overuse of groundwater. Aquifer compaction from pumping can result in land subsidence and damage to surface and subsurface infrastructure, and also may permanently reduce the storage capacity of the aquifer. Heavy groundwater pumping also may disrupt groundwater-surface water interactions. Groundwater base flow input to surface water bodies may be reduced or eliminated, and may ultimately lead to pirating of surface water to the aquifer. Heavy pumping also may draw in poorer-quality groundwater over time.

Many areas across the western U.S. are seeing aquifer systems being taxed in their abilities to provide reliable sources of quality groundwater. Over-allocation and overuse of groundwater is a common problem, and demands (municipal, agricultural, industrial) on a finite resource often require modifications to current water use and water supply models. *wqp*

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For more information on this subject write in 1009 on this issue's reader service card.

Compiled by Williette Nyanue

California Legislature Approves $7.5 Billion Water Bond

The California Legislature approved a $7.5-billion water bond to provide drinking water for disadvantaged communities, as well as $1.5 billion for water recycling, storm water capture, water efficiency and other local water supply projects. The bond provides funding to restore watersheds across the state. It also provides as much as $3.6 billion in funding for groundwater storage and cleanup projects.

NSF Standard Addresses Contaminants in Drinking Water

NSF Intl. developed the first American National Standard that validates the effectiveness of water treatment devices designed to reduce trace levels of emerging contaminants in drinking water. The standard addresses the ability of a water treatment device to remove up to 15 contaminants, including some pharmaceuticals, over-the-counter medications, herbicides, pesticides and chemicals used in manufacturing, such as bisphenol A.

USGS Begins Drilling 'Sentinel' Wells in New Mexico

Scientists from the U.S. Geological Survey began drilling "sentinel" wells at the first of three locations in the Trumbull Village neighborhood of Albuquerque, N.M., to provide early alerts for groundwater contamination. The wells will provide early warning if there is a northeastward movement of the Kirtland Air Force Base Bulk Fuels Facility plume, and would provide Albuquerque Bernalillo County Water Utility Authority and Air Force officials with lead time to implement plans to protect nearby groundwater drinking water supply wells.

EPA Awards Funds for Water Quality Management in Arkansas

The U.S. Environmental Protection Agency awarded $100,000 to the Arkansas Department of Environmental Quality for water quality management planning. The funds will be used to conduct analysis of chemical samples of rivers, streams and lakes in Arkansas.

Africa's First 'Waterbank' Designed to End Water Wars

The Waterbank Campus, conceived and designed by PITCHAfrica, opened at the Endana Secondary School in Laikipia, Kenya. The campus comprises four low-cost rainwater harvesting building types, termed Waterbanks because of their capacity to harvest and store high volumes of water at low cost, providing a year-round supply. The annual harvesting capability of the campus is in excess of 2 million liters of water in a semi-arid region. The buildings provide clean drinking water to the students and irrigation to the conservation agriculture plots across the campus. *wqp*

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