Ag Pumping Causing Surface Sinking

The land surface in Central California dropped 30 feet in elevation from 1925 to 1977 and is still falling, reported the *Fresno Bee*. Worldwide, subsidence such as this resulting from extensive groundwater pumping, is "the largest human alteration of the Earth's surface," the USGS said, according to the *Bee*. As a result, in Central California, millions of dollars will be needed to repair damage to infrastructure such as irrigation canals and highways, and eventually the Mendota Dam on the San Joaquin River.

USGS scientist Kerry Arroues described for the *Bee* two kinds of subsidence affecting the California landscape. One is regional, in which deep groundwater pumping causes an overall lowering of the landscape; this is happening in the area near Mendota. Further south, the weight of irrigation water added to the surface has caused local, nonuniform subsidence, resulting in the transformation of once-smooth topography to rolling hills.

According to scientists, regional subsidence occurs in conjunction with droughts, the newspaper said. When snowpack is low and streamflow is reduced, farmers fall back on groundwater for irrigation, and subsidence increases. When river water is used, subsidence slows. Arroues estimated that an additional 10 feet of subsidence may have occurred in Fresno County's west side since 1977.

Visit www.fresnobee.com.

Methane-Related Groundwater Pumping Raising Interest

The amount of groundwater pumped for the production of coalbed methane in Wyoming's Powder River Basin is drawing attention. According to the *Casper Star-Tribune*, some groundwater wells have been pumping for two years or more while no gas is produced. The newspaper stated that according to the Wyoming Oil and Gas Conservation Commission (WOGCC), "more than 14 percent of active coal-bed methane wells in the Powder River Basin in December were producing only water," and "more than 39,000 acre-feet of water have been produced from wells that have not produced any gas."

The pumped water is generally released to drainages or low-lying areas. Its quality is generally too poor, or the location too remote, for beneficial uses. Small amounts are used to supply stock wells or for irrigation.

In the interest of production efficiency and environmental concerns, some companies have begun to inventory the wells to determine where water savings might occur, said the *Star-Tribune*. Welldog Inc., a company in Laramie, Wyoming that specializes in "direct technical evaluation of coalbed natural gas reservoirs," used data from WOGCC to analyze water production figures relative to gas production.

The analysis is not straightforward because some water pumping is necessary to reduce the regional hydrostatic pressure to allow gas production, even if a specific well is not producing gas. However, at a minimum, the newspaper reported, Welldog found that 8.6 percent of water-producing wells that have been in production for at least two years do not economically contribute to overall gas production; collectively they pumped about 29,000 acre-feet of water. The high end of the estimate is 39.3 percent.

According to the *Star-Tribune*, Welldog and other companies have begun to work with gas producers to improve production efficiencies and reduce the amount of water produced, a move supported by agricultural interests who only want as much water as they can use. Reducing the amount of water pumped would likewise reduce the energy demand for pumping, providing additional savings.

Visit www.casperstartribune.net and www.welldog.com.

Earth Fissure Maps Available for Arizona

In June, the Arizona Geological Survey (AZGS) released individual, 1:250,000 scale, earth-fissure planning maps of Cochise, Maricopa, Pima, and Pinal counties with an accompanying Open-File Report. The maps show all currently known earth fissures. This is the first step in preparing highly detailed fissure maps to be completed area by area over the next few years.

Earth fissures are associated with basin subsidence that accompanies extensive groundwater mining. In Arizona, fissures were first noted near Eloy in 1929. Their physical appearance varies greatly, but they can be more than a mile in length, up to 15 feet wide, and hundreds of feet deep.

During torrential rains they erode rapidly, presenting a substantial hazard to people and infrastructure. Moreover, fissures provide a ready conduit to deliver runoff and contaminated waters to basin aquifers. Rapid population growth in southern Arizona is increasingly juxtaposing population centers and fissures.

In response to the sudden reactivation in August 2005 of a 1.5-mile long fissure near Queen Creek, Arizona, the Arizona Legislature passed legislation to map earth fissures in Arizona. Effective Sept. 21, 2006, House Bill 2639 charged AZGS with 1) comprehensive mapping of earth fissures throughout Arizona, and 2) delivering detailed earth-fissure map data to the State Land Department for public access online. A complementary bill, A.R.S. 33-422, requires disclosure of earth fissures in nonincorporated areas.

The maps are available at www.azgs.az.gov/earth fissure planning maps.html or for $4 each at the AZGS bookstore in Tucson and the Department of Mines and Mineral Resources in Phoenix. The accompanying 25-page report, Earth Fissure Mapping Program: 2006 Progress Report; Open-file Report 07-01, will be available at the same locations and online.

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TAES gets TEEA from TCEQ

Scientists at the Texas Agricultural Experiment Station (TAES) El Paso Research Center earned the state's highest environmental achievement: the Texas Environmental Excellence Award, presented by the Texas Commission on Environmental Quality. TAES earned the award for its achievements in water quality improvement for bacterial source tracking research.

TAES El Paso scientists carried out two large-scale projects to track pollution sources for two state agencies. Using state-of-the-art DNA fingerprinting and antibiotic resistance typing methods for *E. coli*, they identified specific animal and human sources of fecal pollution in seven different watersheds.

In addition, the researchers created a genetic library of *E. coli* bacteria isolated from known sources. The library could save millions of dollars on future fecal pollution source tracking projects. By pinpointing the sources of pollution, resource managers can develop effective pollution control strategies to ensure water is drinkable and safe for all users.

Visit elpaso.tamu.edu/Research/award.htm.

Report on Status of New Mexico Water Quality

A report issued last spring by the New Mexico Department of the Environment (NMED) summarizes the condition of the state's water bodies and recommends federal measures to improve water quality management. The report was prepared to comply with U.S. EPA Clean Water Act requirements and was based on data collected from January 2002 through February 2004.

Surface water: Nearly 40 percent of New Mexico's 6,500 miles of perennial streams do not meet standards for their designated use and 65 percent of lakes, reservoirs, and playas do not fully support

designated uses. The major causes of surface water impairment are heavy metal contamination, sedimentation, temperature, and turbidity. Nonpoint source pollution is responsible for more than 95 percent of the impaired water quality of streams.

Groundwater: About 22 percent of facilities with groundwater discharge permits in New Mexico had confirmed groundwater contamination or presented a threat to groundwater as of early 2004. Groundwater contamination stems from both nonpoint sources (such as septic tanks, residual minerals from evapotranspiration, mining activities, and urban and agricultural runoff) and point sources (such as surface impoundments, landfills, accidental spills and leaks, and injection wells). Naturally occurring radon and arsenic also affect water quality.

Recommendations: NMED's recommendations to Congress and EPA reflect water quality issues common to many states in the Southwest. Among them:

- Allow sufficient time for determining the efficacy of nonpoint source pollution control programs before federal mandates are enacted, and make deadlines for compliance with mandates flexible to meet the conditions of the specific area.
- Rethink the required 40 percent nonfederal match for federal funding for water quality improvements. This is a challenge for states with large land areas and small populations with low tax bases, as well as for tribes.
- Provide additional federal funding for water quality research, data collection (especially for the USGS), and wastewater treatment facilities.
- Make federal facilities operating within a state responsible for water quality protection, compliance, and remediation related to their activities.
- Develop federal programs and legislation to protect against groundwater contamination to support state programs and initiatives, rather than to supercede them.

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- Use species appropriate for the ecosystem to evaluate impairment of a water body, and make standards flexible to take into account existing background conditions.
- Better integrate federal mandates to reflect close ties between water quality and water quantity issues.

The report is available at www.nmenv.state.nm.us/wqcc/303d-305b/2004/.

Portable Test Kits for Pathogen Detection

University of Arizona scientists are developing technology to rapidly detect and quantify specific pathogens in food and water in the field. Innovis Technologies, a business created by students in the McGuire Center for Entrepreneurship at the school's Eller College of Management, has developed a portable test kit for use on solids (tissue) or liquids that can identify microbes at the genetic level in less than 10 minutes.

The test kit combines two key technologies. First, it uses biomolecules known as zinc fingers, which can be customized to recognize and bind to specific DNA sequences, such as from *E.coli*. Highly specific zinc fingers now can be developed within weeks, thanks to new computer modeling software. Second, Innovis' proprietary detection system was developed to produce an easily observed color change if DNA from the microbe of interest is detected. No color change means no target pathogen.

Innovis is promoting the test kits for use with irrigation water, well water, fresh produce, and meat products. According to the company, the technology "can potentially be adapted to any DNA sequence, generating nearly unlimited adaptability both for microbial identification as well as human, plant, and animal genetic characterization."

According to an April 19 article in the *Tucson Citizen*, the test kits will have to comply with U.S. EPA testing requirements before they can be marketed. The students are meeting with potential investors, and plan to sell the kits for $35.

Visit www.innovistechnologies.com and www.tucsoncitizen.com.

Grant Will Advance One-Stop Water Data Website

David Maidment, director of the University of Texas at Austin's Center for Research in Water Resources, recently received a five-year, $4.6 million grant from the National Science Foundation (NSF) to create a one-stop website where water-related data from hundreds of federal, state, and local agencies will be available. Early aspects of this Hydrologic Information System were described by Maidment and his colleagues in *Southwest Hydrology* (May/June 2006). Maidment received the grant as part of the Consortium of Universities for the Advancement of Hydrologic Science Inc. He is cooperating with researchers from Drexel University, Ohio State University, and the San Diego Supercomputer Center.

Ready access to comprehensive water information will help municipalities make more informed responses to water challenges, such as the droughts occurring in much of the Southwest. Currently, water managers obtain streamflow measurements, soil data, and satellite and meteorological data from dozens of organizations, each of which gathers data for different purposes and often stores them using different software.

Besides providing nationwide water data at one site, Maidment and colleagues plan to provide user-friendly programs on the website for modeling how a given water resource could change over time. Eventually, they hope to make the system easy enough for the general public to use.

Visit www.engr.utexas.edu/news/articles/200703061176/ and www.cuahsi.org/his.html.