

Is the monsoon season over yet?



This young Las Cruces is ready to brave yet another storm. Several WRRRI staffers have experienced flooding in their homes during recent rains and have had to resort to creative flood control techniques.

Sludge could be just the thing for NM rangeland

The City of Albuquerque produces 20-30 dry tons of treated sewage sludge daily. A city the size of Las Cruces produces about two to three dry tons a day. Currently all this sludge is being trucked to land application sites. In the case of Albuquerque, some of it will eventually go to the city's new composting facility. However, there may be a more beneficial use for sludge—improving the thousands of acres of New Mexico's rangeland. It appears the sludge can help control erosion, increase vegetation, and perhaps help get rid of the villainous range plant, broom snakeweed.

Soil Scientist Richard Aguilar from the USDA Forest Service's Rocky Mountain Forest and Range Experiment Station, Biology Professor Jim Gosz, from the University of New Mexico, and Sam Loftin, a
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***Make plans to attend
the 36th Annual New
Mexico Water
Conference
November 7-8, 1991
Las Cruces, NM***

Rio Grande Basin hydrology to be discussed

There is still time to register for the American Water Resources Association, New Mexico Section, annual conference. **Rio Grande Basin Hydrology** will be held September 18-19, 1991 at the Macey Center at New Mexico Institute of Mining and Technology in Socorro. Conference sessions will address surface water management, water quality, hydrology and water supply, and water management. Topics and speakers include:

- *Pueblo Water Quality Standards on the Rio Grande* - Pete Balleu, Legette, Brashears and Graham, Inc.
- *Policy and Operation of the Elephant Butte Irrigation District* - Gary Esslinger, EBID
- *Responsive Groundwater Modeling for LUST Activities* - F. Harvey Dove, International Technology Corp.
- *Determining Groundwater Contamination Risks for a Municipal Water Supply System* - Timothy Graves and Michael Bitner, CH₂Hill
- *Relationship of Ground and Surface Water in the Rio Grande Basin* - Patricia Turner, Interstate Stream Commission
- *Politics in Water Resource Management-Santa Fe Style* - Tony Mayne, Santa Fe Metropolitan Water Board

The registration fee is \$30 (\$40 at the door); \$15 for students (\$20 at the door). For more information, contact Jean Witherspoon at (505) 768-3647 or Doug Earp (505) 768-2000.

NAWQA underway in the Rio Grande Valley

In 1991 the U.S. Geological Survey began to implement its full-scale National Water-Quality Assessment (NAWQA) program which will describe the water-quality of a large part of the nation's surface and groundwater resources. The sixty study-unit investigations comprising the program encompass hydrologic systems that include parts of most major river basins and aquifer systems. Because the USGS sees communication and coordination between its personnel and other interested scientists and water management organizations as critical to the NAWQA program, each of the study units will have a local liaison committee consisting of representatives from federal, state, and local agencies, universities, and the private sector.

The Rio Grande Valley was one of the first twenty NAWQA study units selected for study under the full-scale implementation plan. It covers about 45,476 square miles and includes about 2,940 square miles in the San Luis Valley in Colorado to the International Boundary and Water Commission stream-gaging station on the Rio Grande at El Paso, TX.

Major water-quality issues to be addressed during the study include:

- Nitrate and pesticide contamination of groundwater from agricultural practices in the San Luis Valley and the Rio Grande Valley downstream from Elephant Butte Reservoir
- Pesticide contamination in the Rio Grande upstream from Elephant Butte Reservoir
- Trace element contamination of several reaches of the Rio Grande and its tributaries as a result of source extraction
- Nitrate contamination and/or low-oxygen concentrations in groundwater near several populated areas in the Rio Grande Valley in New Mexico
- Large concentrations of suspended sediment in streams and high rates of sedimentation in several reservoirs

A twenty-person liaison committee has been established for the RGV project, but according to Sherman Ellis who is overseeing the program for the Albuquerque District USGS office, data collection probably won't start until later next year.

Guide for public involvement available

Public Involvement for Better Decisions: A Guidance Manual is available from America's Clean Water Foundation, 444 North Capitol St., N.W., Suite 330, Washington, D.C. 20001 for \$9.50. The 43-page manual was prepared to assist government organizations in designing and conducting public

involvement programs for environmental and natural resource management projects. The manual covers planning steps as well as public involvement techniques including audio/visual presentations, meetings, responsiveness summaries and contact lists.

Bowman studies new tracers

By Denise Monette, New Mexico Tech Public Information Office

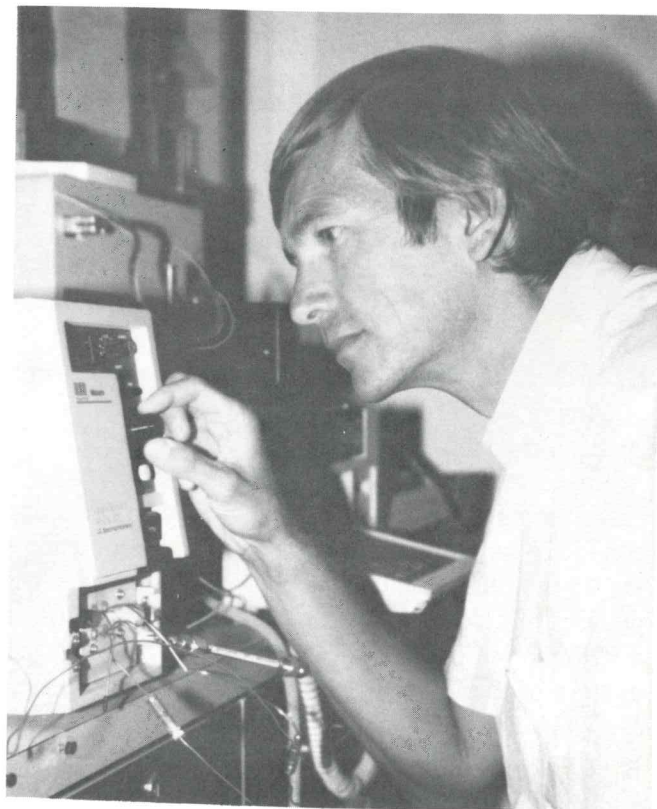
Robert Bowman, associate professor in the Department of Geosciences at New Mexico Tech, is conducting a research project which will increase the number of tracers which are chemicals that can be added safely to groundwater to follow its movement through soils and aquifers. Scientists use tracers to determine the rate of groundwater flow in a specific area and to determine whether water from a certain source will contaminate water at a particular site.

An example of the latter is a study at Yucca Mountain, Nevada to evaluate its suitability for radioactive waste disposal. Bowman stresses that a key criterion in selecting such a site is a minimal amount of water movement in the area. By adding tracers to the potential water sources, scientists are able to tell how fast water from surrounding areas get to the site. If tracers are detected too soon, they know that the water movement in the area is too swift to allow the location of the disposal site in that area. It has been estimated that thirty unique tracers will be needed for the Yucca Mountain study.

In his project sponsored by the New Mexico Water Resources Research Institute, Bowman will examine certain

chemical compounds that will yield as many as seventeen unique tracers. The tracers must be non-toxic, non-degrading and easy to analyze.

By increasing the number of tracers available to scientists, Bowman says it would be possible to trace groundwater at a particular site back to multiple sources using a single analysis. Different tracers could be added to water at several sources, then water at the test site could be analyzed to determine whether the tracers arrived and how long it took them to get there. Currently, sources are analyzed independently because of the few tracers available to safely test water movement.



Robert Bowman in his lab at New Mexico Tech. Photo by Mike Vittilow, New Mexico Tech Public Information Office.

Kudos to Cole, Ward and Ward

It has been said "Fishing is a delusion entirely surrounded by liars in old clothes." If this is true, New Mexico State University Professors Richard A. Cole, Frank A. Ward, and Timothy J. Ward have spent the past decade working to optimize those liars' experience—and now they've won an award for it.

Through a project sponsored by New Mexico Department of Game & Fish and New Mexico Water Resources Research Institute, Drs. Cole, Ward and Ward have developed a model called RIOFISH to analyze effects of resource management decisions on New Mexico fishery production, yield, sportfishing effort, and economic benefit to anglers. It can generate information regarding estimated angler days of activity at reservoirs and annual statewide monetary benefits to anglers from use of reservoirs as well as hydrologic outputs such as measured evaporation and biologic outputs such as mean annual sportfish production per habitat.

Along with Robert M. Wilson from the NMDG&F, the trio has won the Boggess Award from the American Water Resources Association for a paper they wrote on the interdisciplinary model for *Water Resources Bulletin*. The Boggess Award honors the author(s) of the best paper published in the *WRB* during the previous year. Cole, Ward, Ward and Wilson will receive their award in September at the annual AWRA meeting to be held in New Orleans in September.

Six new WRRI publications available

Summaries of New Mexico Water Resources Research Institute reports published since December 1990 appear below. These may be ordered from WRRI, Box 30001-Dept. 3167, Las Cruces, NM 88005; (505) 646-1813.

Report No. 255 - *Expediting Changes in Water Use Hydrologic Criteria and Market Transactions* by Susan Christopher Nunn and Shaul Ben-David with Julie Urban and John Shomaker **and *Use of Hydrologic Criteria to Expedite Changes in Water Use in the Mimbres Basin, New Mexico*** by A.W. Blair and Kenny Stevens.

Concern that institutional restrictions on water transfers are inhibiting the ability of New Mexico water markets to allocate water to its highest and best use is expressed often. This project attempted to evaluate New Mexico's administrative criteria for determining the hydrological impacts of proposed changes in place and purpose of water use. It set out to identify the most important sources of delay and transactions cost in applications for change in place and/or purpose of water use, to develop a relatively less costly hydrologic criteria that can be used to evaluate the effects of proposed changes in water use, and to evaluate the magnitude and distribution of the economic and social benefits and costs of implementation of these criteria.

Nunn, Ben-David and Urban conducted a census of applications to change the place and/or purpose of water use during a thirteen-year period. The census determined most applications were processed efficiently, only a small fraction experiencing any significant delay until approved, and that the protests,

hearings and appeals that create large costs were infrequent. The researchers then conducted an institutional study using State Engineer Office memoranda, decisions in SEO hearings, the hydrologic reports on applications to change place and/or purpose of water use, and interviews with SEO staff to determine whether a particular application would result in impairment.

For the project, Blair and Stevens provide a computer program to analyze whether an application in the Mimbres basin conforms to the SEO criteria. They combined a Geographic Information System database of the Mimbres basin with a simplified version of the U.S. Geological Survey model used by the SEO to produce a computer simulation of the hydrologic evaluation process.

Report No. 256 - *Alluvial Aquifer Heterogeneities in the Rio Grande Valley: Implications for Ground Water Contamination* by J. Matthew Davis, Susan J. Colarullo, Ruth C. Lohman and Fred M. Phillips.

The purpose of this project by researchers at New Mexico Institute of Mining and Technology was to evaluate the methods and delineate major issues involved in the aquifer characterization process. They conducted an empirical study focusing on the relationship between patterns of sedimentology and the distribution of permeability at an outcrop of the Pliocene/Pleistocene Sierra Ladronas Formation located in central New Mexico. To study aquifer heterogeneity, they used geostatistical methods and sedimentary basin analysis. Results of the study suggest there is a direct connection

between observable geologic structures and permeability statistics.

Report No. 257 - *Proceedings of the 35th Annual New Mexico Water Conference - Toward a Common Goal: Forging Water Quality Partnerships* edited by Catherine Ortega Klett. Cost: \$5.25.

The 1990 water conference was planned to bring together regulators and those being regulated to discuss perspectives from both sides. Presenters discussed tribal water quality regulations, an overview of federal water quality laws and regulations, surface water regulations, issues and conflicts in New Mexico, drinking water protection strategies, risk assessment, and wildlife issues.

Report No. 258 - *Lipid Production from Algae Grown in Saline Water Using Low Intensity Culture Techniques* by R. Peter Herman.

New Mexico State University biologist Peter Herman studied the feasibility of growing algae inexpensively in outdoor tanks for possible use in synthetic fuel production. Herman determined dry matter production, lipid content, lipid production and lipid characteristics for *Chaetoceros gracilis*, *Monoraphidium sp.*, *Tetraselmis suecica* and *Navicula Sp.* to select promising species for pilot scale outdoor trials. *Chaetoceros* and *Tetraselmis* exhibited superior performance at these trials. Herman found that low-intensity culture procedures can produce only a fraction of the algae that intensively managed laboratory production facilities can.

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Sludge may be beneficial to rangeland (continued)

UNM graduate student in plant biology, are studying the effects of sludge on semiarid rangeland at the Sevilleta National Wildlife Refuge. The project is sponsored by the Water Resources Research Institute and Chino Mines Company.

Aguilar, Loftin and a team of technicians have set up 10 meter x 3 meter plots where sludge is applied (treated plots) and plots of the same size and slope where no sludge is applied (control plots). They are measuring and studying runoff collected from the treated and control plots to look at the differences in runoff sediment loads and differences in the amounts of heavy metals (cadmium, lead, zinc, and copper) and nitrate carried by the runoff. They have a second set of treated and control plots where they will sample the soil to determine the amounts of metals and nitrate absorbed from the sludge.

The sewage applied to the plots in early April was provided by the City of Albuquerque. It is very "clean" sludge according to Steve Glass, Resource Recovery Manager for Albuquerque's Public Works Department. Glass says that the sludge is low in heavy metals and virtually devoid of toxic organic compounds, thanks to the City's aggressive industrial pretreatment program. Already, Aguilar has noticed a slight difference in the growth of vegetation on the treated and control plots. Although the study site only recently began to receive rainfall, the treated plots seem somewhat greener. Recent evaluation of the runoff collected from summer rains indicate that the plots with sludge had much less runoff than those control plots without sludge, suggesting that the sludge could help control erosion.

Analysis of the runoff from a storm of .40 inches July 25 showed that on plots with a 7% slope, runoff on sludge-amended plots was reduced 5.7 times as compared to the control plots, while sediment was reduced by 30%. Plots with a 12-13% slope showed runoff from control plots more than 2.5 times greater than observed on treated plots, with sediment loads approximately three times greater.

An earlier study found rangeland plants were not adversely affected by metals or nitrate from the sludge.

After a year, Loftin and Aguilar will quantify differences in the vegetation through aerial photographs which will be digitized and compared to photographs taken at the onset of the project. The vegetation growing on the plots will be analyzed for crude protein content to see if sludge can also improve the quality of livestock forage.

An earlier study of sludge applied to a semiarid grassland, conducted by Phil Fresquez and other researchers at the Rocky Mountain Experiment Station, found that the rangeland plants were not adversely affected by metals or nitrate from the sludge. The study also indicated that perhaps the sludge helped get rid of broom snakeweed. The snakeweed at that study's research site was reduced significantly. But, more studies are needed regarding the snakeweed. Aguilar said the earlier study did not determine how the sludge affected the snakeweed;

whether it encouraged growth of the blue grama which in turn choked out the broom snakeweed, whether it was something microbial which affected the snakeweed, or whether the snakeweed involved in the study had naturally died out.

Glass says he is very interested in Aguilar and Loftin's work because the City must constantly look at innovative ways to deal with its growing sludge production. There haven't been any cost/benefit analyses done, but it could be that applying sludge to rangeland is practical due to Albuquerque's location. The major cost would be in transporting the sludge which is 85 percent water.

Although this type of sludge application has the Environmental Protection Agency's approval, public acceptance is a major factor which will determine whether sludge can be widely used for rangeland restoration. Many are worried the sludge could contaminate water. Since water table depths are generally very deep in the areas of New Mexico where sludge would be applied to rangeland, any water contamination problems would most likely occur in the form of runoff. If Loftin and Aguilar's results continue as they have thus far, surface runoff should not be a problem.

Aguilar notes there are other factors to consider. When the sludge dries, it has the appearance and texture of "clinkery lava" rocks. After some time, however, it will become more powdery and some have expressed concern over potential wind-borne transport off-site. Aguilar says a much larger project must be undertaken to see if this could be a potential problem.

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Environmental investments: Spending will shift to land and groundwater

In a new report, *Environmental Investments: The Cost of a Clean Environment*, the Environmental Protection Agency analyzes the costs of environmental pollution control since 1972. The table below indicates costs for pollution control activities have increased during the past twenty years and will continue to do so for the next decade.

The report concludes that over the next decade a shift is expected in the share of costs directed toward land pollution control (including a significant groundwater protection component) and a corresponding decrease in the share devoted to surface water quality control. The shift will be due to the hazardous waste legislation passed in the 1980s and reflects the costs associated with Superfund, various Resource Conservation and Recovery Act and underground storage tank programs. Other EPA forecasts include:

- The non-EPA federal share of total annualized pollution costs should increase by more than 140 percent between 1987 and

2000 due to the cost of military nuclear waste clean-up.

- Pollution control burdens on local governments will increase dramatically and result in large increases in rates and/or fees charged to consumers for locally provided environmental services. Smaller municipalities may face severe difficulties in securing the capital necessary to comply with environmental requirements.
- Although national environmental pollution control expenditures continue to rise, the nation spends three times as much on defense, and collectively Americans spend twice as much on clothing and shoes.

The report is available from the National Technical Information Service (703) 487-4600, order number PB91-153783. A summary, (EPA-230-12-90-084) is available from the EPA, (202) 382-5606.

Annualized Costs for Pollution Control Activities in the United States

Total Annualized Costs	1972	1987	1990	2000*
In billions of 1987 dollars	26	85	100	148
In billions of estimated 1990 dollars	30	98	115	171
As percent of GNP	0.9	1.9	2.1	2.6

* Assuming that present levels of implementation of existing programs remain the same as in 1987.

New reports (continued)

Report No. 259 - *Hydrologic Parameters for Selected Soils in Arizona and New Mexico as Determined by Rainfall Simulation* by Timothy J. Ward and Susan M. Bolton.

In this study Ward and Bolton sought to determine infiltration and soil erosion parameters for a variety of soil-vegetation complexes in the pinyon-juniper vegetation zone of western New Mexico and Eastern Arizona. A total of 104 plot runs were conducted at five sites on plots which had natural cover, were scraped bare, were covered by pinyon or juniper litter or were burned. Water quality samples were also collected during the simulations to determine the magnitude of phosphorus, nitrogen, and volatile suspended solids.

Report No. 260 - *Field Analysis on the Role of Three-Dimensional Moisture Flow in Ground-Water Recharge and Evaporation* by Daniel B. Stephens, Eric Hicks, and Todd Stein.

Stephens, Hicks and Stein looked at recharge and soil-water flow directions through sandy soil at the Sevilleta National Refuge near Socorro, New Mexico. The researchers' objectives were to: quantify (to the extent practical) ground-water recharge from in situ soil-moisture data; investigate directions of soil-moisture flow in the root zone of desert shrubs; examine the significance of the horizontal flow components on soil-water movement; and evaluate the seasonal variability of soil-water movement in a desert plant community.

Measurements taken over a one-year period showed the soil-water uptake by saltbush and desert

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Conferences, symposia, etc.

- **Wellhead Protection Area Delineation in the Western United States** - September 11-13, 1991, Las Vegas, NV. Contact: National Water Well Association, P.O. Box 182039, Dept. 017, Columbus, OH 43218, (614) 761-1711.
- **Rio Grande Basin Hydrology** - September 18-19, 1991, Socorro, NM. Sponsored by the New Mexico Section of the American Water Resources Association. Contact: Jean Witherspoon, (505) 768-3647.
- **Symposium on Settlement of Indian Reserved Water Right Claims** - September 19-21, 1991, Hyatt Regency Hotel, Albuquerque, NM. Sponsored by Western States Water Council and Native American Rights Fund. Contact: WSWC, Creekview Plaza, Suite A-201, 942 E. 7145 S., Midvale, UT 84047, (801) 561-5300.
- **International Seminar on Efficient Water Use** - October 21-25, 1991, Mexico City. Contact: International Water Resources Association, 205 N. Mathews, Urbana, IL 61801.
- **Symposium - Recharge in Arid and Semi-arid Regions: Estimations Techniques** - October 27-November 1, 1991, Denver, CO. Sponsored by the Soil Science of America, American Society of Agronomy, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, and U.S. Geological Survey. Contact: Glendon Gee, Pacific Northwest Laboratory, Box 999, Richland, WA, 99352, (509) 376-8424.
- **Climate and Water Resources Management** - November 5-7, 1991, Albuquerque, NM. Sponsored by the Bureau of Reclamation, Army Corps of Engineers, Environmental Protection Agency, National Oceanic and Atmospheric Administration, and the U.S. Geological Survey. The conference will characterize regional water resource sensitivities to climate change and shifts in climate variability, discuss techniques to deal with climate uncertainties, and consider resource management strategies and policy changes that could minimize resource sensitivity to climate change. Contact: Lucia Buie (301) 652-8444. \$200 registration fee.
- **36th Annual New Mexico Water Conference: Science and Agencies Working for the Future** - November 7-8, 1991, Las Cruces, NM. Sponsored by the New Mexico Water Resources Research Institute. Information will be mailed to all on the **Divining Rod** mailing list. Contact: Leslie Blair, (505) 646-5367.

New reports (continued)

plant community.

Measurements taken over a one-year period showed the soil-water uptake by saltbush and desert shrubs did not induce significant horizontal flow components. The researchers concluded for this and similar sites, one-dimensional analysis of soil-water movement was adequate. They determined recharge was about 0.4 cm/year and comprised about 2.3% of the 17.4 cm/yr rainfall.

Report M24 - The Rio Grande Basin Global Climate Change Scenarios: Proceedings Workshops/Conference June 1-2, 1990 compiled by William Stone, Michele Minnis and Eleanora Trotter. Cost \$5.25.

Topics discussed at the workshop and conference include "Climate Change Expressed in Human Terms" (William Kellogg); "Energy Use and Climate Change—The Real Challenge" (Sen. Pete Dominici); "Impacts of Climate Change and Variability on Ecological Systems" (Paul Risser); and "Research Opportunities Regarding the Human Dimension" (Tom Baerwald) among others. Also included in the proceedings is a background paper on the Rio Grande Basin written by Stone, Minnis, Stephen Thompson, and Susan Christopher Nunn.

Sludge (continued)

Currently the Forest Service is trying to organize a joint project with the USDI Bureau of Land Management that would encompass approximately 200-400 acres of rangeland.

WRRI preproposal deadline - October 25

October 25, 1991, 5:00 p.m., is the deadline for preproposals for New Mexico Water Resources Research Institute's 1992 Water Resources Research Allotment program and for proposals to be submitted through WRRI for the U.S. Geological Survey Section 105 matching grants program.

WRRI's allotment program includes research projects to be supported with state appropriations as well as with federal funds from the USGS. Generally, WRRI funding is limited to \$25,000 per project per year.

WRRI Project Coordinator Darlene Reeves says "preproposals with larger budgets will be considered if the project is interdisciplinary or if additional funds are to be provided by other sources." She stresses that WRRI funds projects for only one year at a time. Continued funding for projects with a two- or three-year time frame will be awarded on a year-by-year basis.

WRRI's Program Development and Review Board will complete the

preproposal evaluations by early December. Researchers will then be invited to submit full proposals on which final funding decisions will be made by April 1, 1992.

Those needing information regarding project eligibility or a copy of the preproposal guidelines may contact Reeves at 646-1194.

The USGS Request for Proposals for the nationally competitive Section 105 program also may be obtained from WRRI. Researchers interested in receiving guidelines for this program may also contact Reeves.

The 105 program requires at least one dollar of non-federal support for each federal dollar provided. The federal share of the grant may range from \$25,000 to \$175,000, with total project budget not exceeding \$350,000.

To inquire about possible non-federal matching funds from WRRI, researchers may contact Reeves or Assistant Director Bob Creel, 646-4337.

Aquifers could meet Zuni needs

The Bidahochi and San Andres-Glorieta aquifers could provide sufficient water of suitable quality to meet future water needs on the Zuni Reservation according to test results included in a recently published U.S. Geological Survey report. The report includes results of test drilling, aquifer tests, and water-quality analyses conducted during 1984-1986. Copies of *Evaluation of the Bidahochi and San Andres-Glorieta aquifers on parts of the Zuni Indian Reservation, McKinley and Cibola Counties, New Mexico,* by Thomas M. Crouch (Water-Resources Investigations Report 89-4192) are available for inspection at the USGS district office in Albuquerque. It can be purchased from Books and Open-File Reports, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225.

Tom Bahr, Director, New Mexico Water Resources Research Institute
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the divining rod

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