divining rod

Vol. XV No. 3 New Mexico Water Resources Research Institute Fall 1992

"Lucky Lindy's" 1929 photos valuable in SCS study

Aerial view of the mesa at the junction of the Santa Fe River and Arroyo Hondo. Photo by Charles A. Lindbergh. Courtesy of the School of American Research Collections, the Museum of New Mexico. Negative number 130359.

In 1929 Charles Lindbergh and his bride, Anne Morrow, spent the summer flying an open cockpit Curtiss Falcon biplane searching the Southwest for cliff dwelling ruins. While Anne held the plane in vertical banks, Lindbergh experimented with aerial photography, earning praise as a pioneer of aerial photography.

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SPECIAL MEETING

The Role of Agriculture in State Water Planning

The WRRI has assisted a number of agricultural groups in organizing a special meeting to focus on how agriculture might best factor into the development of a New Mexico water plan.

The meeting will bring together State Engineer Office staff and other water resources professionals and members of the agriculture community to discuss issues of agricultural water conservation, instream flows, riparian habitat, phreatophyte management, and water quality. The objectives of the meeting are to inform the agricultural community, the state's largest water consumer, about current and proposed water planning activities and to examine and discuss some selected issues of importance to agriculture.

The meeting, expected to draw over 150 people, is set for **Tuesday, September 29, 1992** at the Albuquerque Hilton Hotel, beginning at 9 a.m. and ending at 3 p.m. There is no charge and the meeting is open to the public.

Mark your calendars!
37th Annual Water Conference
November 5-6, 1992
See page 12 for details

Tech hydrologists study groundwater quality underneath farmland

Story and photos by George Zamora, New Mexico Tech Information Officer

Two New Mexico Tech hydrologists are beginning a study on an afalfa field in northern Socorro County which will investigate how nutrients, pesticides, and other agricultural chemicals percolate through the soil along with irrigation water, and what, if any, effects the possible contaminants may have on groundwater quality.

Dr. Robert Bowman prepares to descend into a manhole to retrieve water samples for Las Nutrias Groundwater Project.

Las Nutrias Groundwater Project will be conducted on a 60-acre tract of private farmland which uses a unique system of underground drainage pipes to return irrigation water to the Rio Grande. Project leaders Robert Bowman and Jan Hendrickx, both Tech hydrology professors, have adapted the existing drainage system so that samples of irrigation return flows can be collected easily under actual farming conditions, providing new information for water resources management in New Mexico.

"We envision this project as generating information that is useful to a lot of people at different levels—from the farmer at the local level all the way to government agencies at the national level," Bowman says.

Corrugated metal pipes were used to construct two manholes over portions of the existing drain lines, allowing researchers easy access to the subterranean drainage flows of irrigation water. Instrumentation installed inside the manholes includes flow-monitoring equipment, automated water samplers, and water pumps, all powered by photovoltaic panels located just outside the monitoring stations.

While the study is being conducted, the landowner will operate his farm in a normal manner—applying the usual amount of fertilizer and other agricultural chemicals to his alfalfa fields. The research team will collect and analyze samples from their monitoring stations to identify the type and amount of nutrients and pesticides which may be leaching into the groundwater.

"Groundwater contamination by agricultural chemicals has been noted in a number of areas around the United States. Often it's not clear whether this contamination results from recommended chemical usage, which we call nonpoint source pollution, or whether it's due to high concentration inputs from spills or improper disposal, which is termed point source pollution," Bowman explains. "The trend is to restrict or ban totally the use of so-called 'problem' chemicals."

"Farmers would also like to know whether chemicals they're using are leaching into groundwater; this represents an economic loss to them. Besides, farmers, just like the rest of us, want to treat the environment well," Bowman observes.

Bowman says that a review of available technical materials indicates that very little hydrologic and water quality data has been obtained from actively farmed areas, and that in particular, there is very little data available on New Mexico and other southwestern states. Limited information prevents accurate calculations and predictions regarding fertilizer leaching and pesticide movement in agricultural soil profiles.

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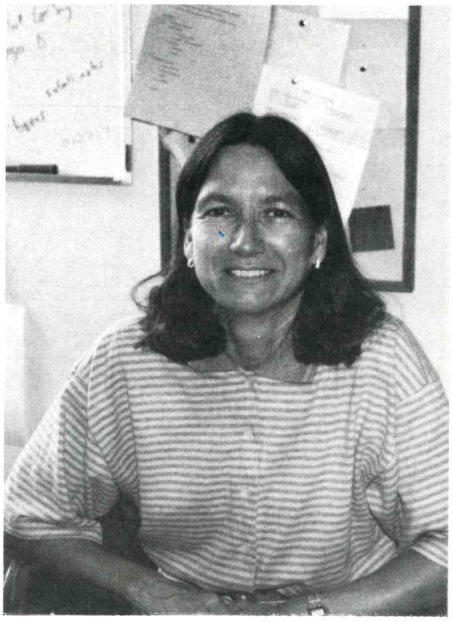
NMSU engineer wins UCOWR award

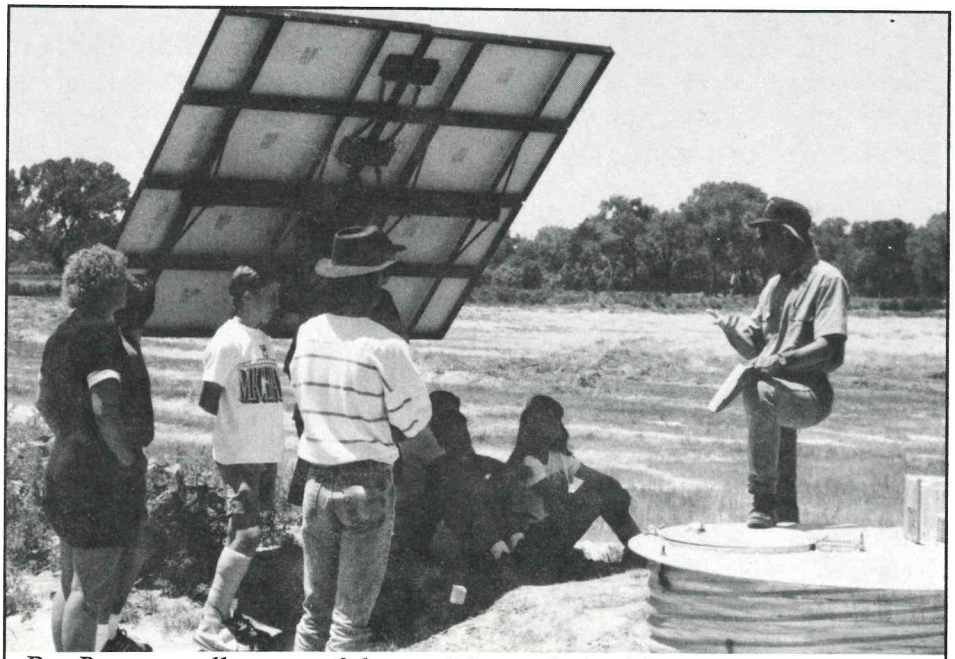
Susan M. Bolton, a New Mexico State University engineer, has received a second place in the Dissertation Thesis Award for the Outstanding Water Resources Dissertation in the field of Engineering and Physical Sciences sponsored by the Universities Council on Water Resources. Bolton's dissertation, "A Methodology for Estimating Water, Sediment, and Nutrients from New Mexico Watersheds," developed techniques for relating watershed inputs of nutrients to the more commonly modeled suspended sediment loads and comparing upland watershed nutrient/suspended sediment loads to larger streams and rivers. Bolton is the first New Mexico recipient of UCOWR's annual award.

Bolton has worked for NMSU since 1985 and completed her doctorate last summer. She has worked on a number of WRRI-funded research projects with Dr. Tim Ward, a professor in the Civil, Agricultural and Geological Engineering Department. She recently accepted a position as an assistant research professor in the Forest Products and Engineering Division of the College of Forest Resources at the University of Washingon. Susan's competence and efficiency will be greatly missed by all of us here at WRRI.



Tech hydrologists study groundwater quality, continued

"There's an increased tendency to use data from other parts of the country and apply them to New Mexico in a blanket sense. Unless state environmental agencies have some source of new information, like Las Nutrias Groundwater Project, they have no choice but to accept national guidelines and regulations handed down to them from federal agencies," says Bowman.

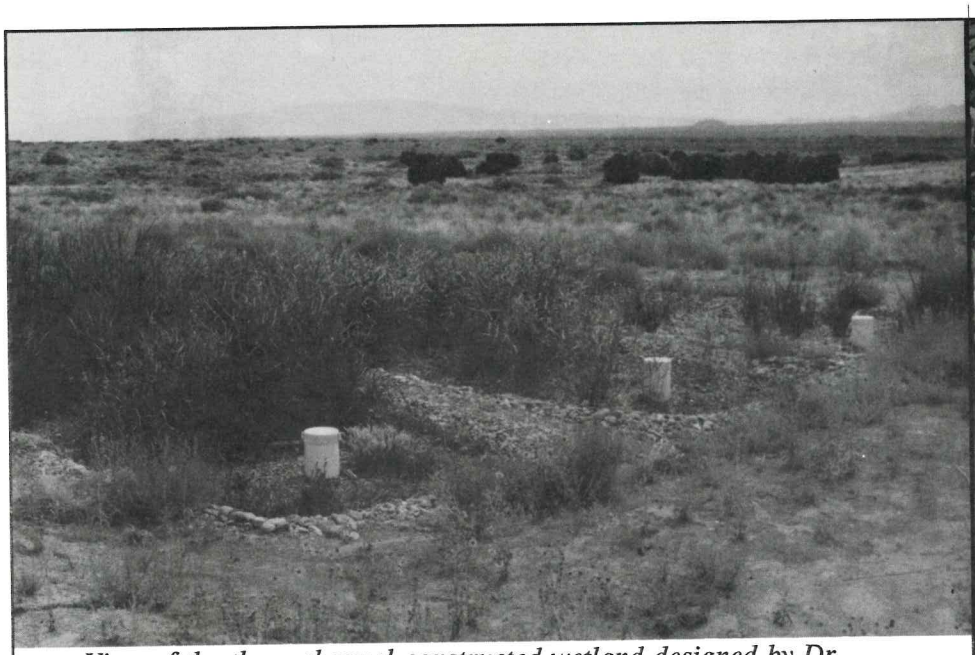


Dr. Bowman tells some of the participants in Tech's Summer Science Program about the research being conducted at a field site near Las Nutrias in northern Socorro County.

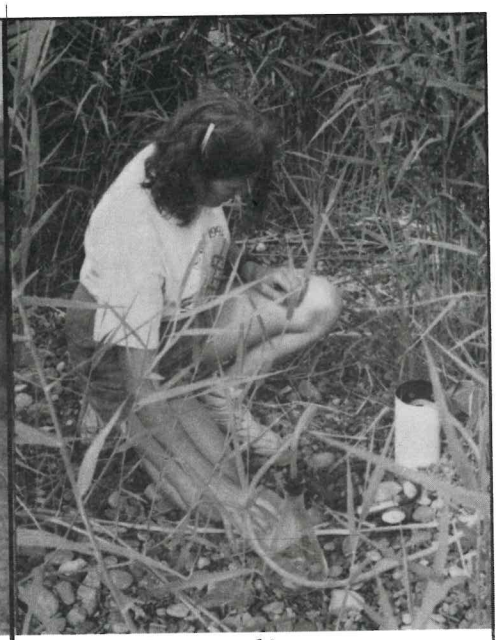
While the project's start-up funding was provided by the Bureau of Reclamation, and through a Sandia National Laboratories' solar power applications program, Bowman says that additional funding is still needed to support the project for its proposed three-to-five year duration.

Overall administration of the project and coordination of efforts to complete the project have been assigned to Jornada RC&D, Inc., a regional planning organization which includes Socorro, Sierra, and Dona Ana counties. Currently, 12 cooperating organizations have been invited to participate in the project. These include the Socorro Soil and Water Conservation District, the New Mexico Environmental Department, and the U. S. Geological Survey. The NM Water Resources Research Institute will also take part by evaluating the project's continuing efforts.

UNM biologist's comparison of constructed wetland/traditional drain field encouraging



View of the three-channel constructed wetland designed by Dr. Eleanora Trotter and Ross Coleman for the field station at Sevilleta Wildlife Refuge.



Dr. Trotter taking an effluent sample from one of the channels.

It looks like a small oasis from a distance. Reed grass, bulrush, cattails and giant sedge are tall and fairly dense, green and cool-looking compared to the surrounding desert. Mice and other small animals are seen occasionally, darting in and out of the area. Looks are deceiving, however. This isn't an oasis, but a biofilter or lined, constructed wetland to treat septic tank effluent.

University of New Mexico Biologist Dr. Eleonora Trotter and an associate, Ross Coleman, designed the system for the Long Term Ecological Research site (LTER) field station at the Sevilleta Wildlife Refuge. The area houses about 50 students and scientists working at the site every summer.

In a project sponsored by the New Mexico Water Resources Research Institute through a grant from Chino Mines, Trotter is comparing the quality of effluent treated in a traditional drain field to that of effluent treated in the constructed wetland. She and Coleman designed this three-channel wetland using native plants—one channel is bulrush only, another is reed grass only, and the third is a mixture of common marsh plants. Since the constructed wetland is lined with thick polyvinyl chloride (PVC), the water is cleaned before it is released to percolate to groundwater, possibly making the constructed wetland a good alternative to poorly sited or failing septic drain fields. So far the results she has obtained have been encouraging, especially considering that the system won't reach its optimum until after the second year.

To compare the biofilter's effectiveness to a traditional drain field, a simple valve was installed which sends equal amounts of effluent from the Sevilleta field station to the septic leach field and biofilter channels. A "splitter" box divides water equally among the three channels so that Trotter also can compare the efficiency of each of the three channels with their different kinds of plants.

Each channel is filled with river gravel ranging in length from about 4" to 3/4" with pea gravel as the top layer. According to Trotter, the pea gravel was used so the vegetation could be easily planted and to help cut down on evaporation.

The vegetation was planted last fall, with a 95% survival rate. In March, the channel containing the bulrush only was replanted because large grass mats had flourished in the nutrient-rich water, making it difficult to compare the bulrush with the other treatments. The biofilter's water level is maintained below the top of the gravel to prevent people and animals from exposure to pathogens.

This particular system is designed so the effluent remains in the

constructed wetland for 4-5 days. Trotter has been testing the biological oxygen demand (BOD_5), total coliform and fecal coliform twice monthly. During the peak system usage, she has been running Total Kjeldahl Nitrogen (TKN) and nitrate measurements too.

BOD_5 is a measure of oxygen use. If most of the oxygen in the water is used after a five-day incubation, then the water contains high levels of waste. Water coming straight from the septic tank has very little oxygen, but water that has passed through the wetland has much more.

Data from a June sampling show that water straight from the septic tank had a nitrate level of 40 parts per million (ppm). Halfway through the biofilter channels, it measured 25 ppm. By the time the effluent reached the end of the wetland, it measured 8-11 ppm. Fecal coliform were present in all three channels in samples taken from the middle of the channels, but no fecal coliform were present at the end of these channels.

Trotter says that plants and the bacteria living on their roots cooperate to clean the water. Plant root tips need oxygen as they grow. An oxygen gradient created by metabolic activity pulls oxygen down into the roots through the porous leaves and stems. Bacteria on the roots function best if they have oxygen. Although plants take up nitrogen from the sewage effluent, it is the bacteria that use most of it. These bacteria prey on pathogens as well. In water and soils that contain no oxygen (i.e. marsh soils) an oxygen-rich area is created around the plant roots because oxygen leaks into the "rhizosphere" where bacteria are most active.

During the winter this wetland won't get much use. Although there may be an occasional researcher at the LTER, there won't be any winter residents other than the caretaker. As the biofilter plants become dormant their dead stems and leaves will provide mulch to increase heat, which will help maintain the aerobic activity in the wetland. The dead stems act as straws through which some air passes to below-ground rhizomes and roots. The caretaker will monitor the system throughout the slow period, adding water to the system as needed so the plant community will survive the winter.

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Concerns about constructed wetlands

New Mexico Environment Department personnel see promise for the use of constructed wetlands but emphasize that public health is one of their primary concerns, and that is why they are apprehensive about some of the constructed wetlands.

Delbert Bell of the NMED groundwater bureau says "One of my main concerns is that in recent years wetlands have become seen as a kind of cure-all for dealing with septic waste, which in my opinion is not the case." The systems can have problems such as one in the Santa Fe area which dried out during a period when it was not receiving effluent and another time was partially washed out by rainfall. Other problems are that some systems are designed to include open ponds as opposed to subsurface systems, where humans and animals can come into contact with the effluent. Also, mosquito breeding is a problem with the open pond systems.

Bell says two areas that need research are how the wetlands deal with non-bacterial pathogens such as cysts which can cause contagious gastrointestinal illnesses (like amoebic dysentery and giardia) and how the systems work in high-elevation, colder climates. There is the potential that insufficient heat to maintain the aerobic activity could cause system failure or that the system could freeze over.

Another concern voiced by Pat Hanson with NMED's surface water bureau, is that the constructed wetlands are often proposed for use in an area where drain fields aren't acceptable either, and a safe methhod for using or disposing of the efflent must be provided. He says a recent example was in an area with a lot of granite where a drain field was not allowable. A constructed wetland was proposed. Effleunt from the wetland could have drained into a fracture, easily allowing the effluent to contaminate the groundwater. Hanson and Bell both stressed that what happens to the effluent after it has been treated by the wetland is also of great importance. A commonly expressed desire has been to discharge the treated effluent to an ornamental pond. Neither finds this acceptable due to the ease with which humans and animals could come in contact with pathogens that could still exist in the effluent and the possibility of mosquitoes breeding in the ponds.

Western regional riparian conference slated for February

"Managing Riparian Areas: Common Threads and Shared Benefits" is a western regional conference to be held at the Ramada Inn Classic in Albuquerque February 4-6, 1993 to discuss techniques for an integrated approach to management of riparian areas.

Speakers and panelists will discuss:

- riparian management programs and techniques;
- legal and regulatory matters;
- accommodating property rights issues and user group concerns;
- urban-rural interface factors
- successful organizing and conflict resolution

Working sessions will focus on regional concerns, issues and opportunities. A choice of field trips to riparian areas exemplifying various management strategies will end the conference.

Conference registration costs $100 for early registration and $135 after January 15. This includes meals and the proceedings to be published after the conference. Partial scholarship funding will be available for a limited number of participants in order to promote attendance across a broad range of interests.

For more information, or to be added to the conference mailing list, write or call: 1993 Riparian Conference, Water Resources Research Center, University of Arizona, 350 N. Campbell, Tucson, AZ 85721; (602) 792-9591.

Persons interested in participating in the poster session should send abstracts to Mary G. Wallace at the above address by October 31, 1992. Posters should be of a technical nature dealing with such matters as riparian restoration techniques or desccribe successful projects in specific western riparian areas. Poster papers will be published in the proceedings.

Cosponsors for "Managing Riparian areas" include the U.S. Forest Service, BLM, Western States Riparian Council, EPA, Soil Conservation Service, The University of Arizona, NMWRRI, American Rivers, Council of Energy Resource Tribes, National Association of Conservation Districts, and the Powell Consortium.

Wetlands, continued

Constructed wetlands are growing in popularity as a way to treat effluent inexpensively in an attractive manner. Trotter estimates this system cost $5000. Although they are simple in design, some maintenance is needed and there are concerns that system failure, such as plugging caused by soil blowing into the system or bacterial mats blocking the pipe which transfers effluent to the biofilter, can produce health hazards. Trotter says that "regulators from the state environment department are understandably cautious," and hopes that data from the Sevilleta wetland will be helpful in developing regulations and permit requirements for the systems.

Zapping: The future of water treatment?

"Zapping" waste streams with a 1.5 milion-V pulsed electron beam is the newest method for destroying hazardous organic compunds. Researchers from Los Alamos National Laboratory, Florida International University, and the University of Miami have found that they can destroy more than 99% of many hazardous chemicals and as much as 85% of difficult-to-treat materials such as phenols. In this approach an accelerator delivers a 100-nanosecond pulse of electrons that splits water molecules into free radicals which then oxidize dissolved organics to CO_2, H_2O and salts. According to the researchers, pilot studies at a municipal waste treatment plant have shown that this technology can purify drinking water. The developers also envision employing this technique to treat radioactive mixed wastes from DOE cleanup sites.

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Publication abstracts water periodicals

A new review publication, "Water Publications Digest" abstracts and summarizes information appearing in 12 leading water periodicals. This publication can be purchased for $59 a year from Water Publications Digest, Lakeview Publications, P.O Box 6866, Charlottesville, VA 22906-6866, phone (804) 973-5111.

USGS reports available on the San Andres-Glorieta aquifer, subsidence in El Paso, geohydrology near the Texas border and springs in NM

Recently the U.S. Geological Survey released five publications of interest to New Mexicans.

- *Simulations of groundwater flow in the San Andres-Glorieta aquifer in the Acoma embayment and eastern Zuni uplift, west-central New Mexico* (Water-Resources Investigation Report 91-4099) by Peter F. Frenzel. A digital flow model was conducted for the study to determine the effects of current an dprojected water development on flow in the Rio San Jose and on hydraulic heads in the San-Andres Glorieta aquifer. According to the report, the projected withdrawal of 10,000 acre-feet per year for 35 years by Acoma Pueblo did not result in substantial spring flow or streamflow depletion. However, water levels in wells may drop 20 feet in the Milan area and possibly 200 feet near the west side of Acoma Pueblo near the projected withdrawal site. Historical groundwater withdrawals and recharge were simulated for the period 1899 to 1985.
- *Listings of model imput values for the simulation of groundwater flow in the San Andres-Glorieta aquifer in the Acoma embayment and eastern Zuni uplift, west-central New Mexico* (Open-File Report 91-236) by Peter F. Frenzel. This report includes diskettes with listings of input values for the two-layer, digital, groundwater flow model of the San Andres-Glorieta aquifer in west-central New Mexico described in WRIR 91-4099.
- *Results of simulations by a preliminary numerical model of land subsidence in the El Paso, Texas area* (Water-Resources Investigation Report 92-4037) by John Michael Kernodle. This report explores the possible impact of a proposed diversion of water from an approximate 13-mile reach of the Rio Grande that would allow for more efficient delivery to agricultural users. Subsidence simulations were performed for two scenarios, with diversion and without diversion for the period 1992-2010. Simulations indicated that riverbed seepage would decline from a predicted maxium of 35,200 acre-feet per year to about 14,000 acre-feet per year, should the diversion take place. Land subsidence that would increase by more than 1 foot in some areas by 2010 would increase by slightly less than .1 should the diversion project be completed.
- *Geohydrology and potential effects of development of freshwater resources in the northern part of the Hueco Bolson, Dona Ana and Otero Counties, New Mexico, and El Paso County, Texas* (Water-Resources Investigation Report 91-4082) by Brennon R. Orr and Dennis W. Risser. WRIR 91-4082 predicts large declines in groundwater levels are projected for the Hueco Bolson. A numerical groundwater flow model constructed by the USGS estimated as much as 125 feet of water-level declines at the New Mexico-Texas state line by 2030.
- *Inventory of springs in the State of New Mexico* (Open-File Report 92-118) by W.E. White and G. E. Kues. This new open-file report has all available data reported on 1425 springs in the state as of 1978 including information on spring location, name, topography, and temperature.

All reports are available from the USGS, Federal Center, Bldg. 810, Box 25425, Denver, CO 80225. Costs are: WRIR 91-4099, $59.25; OFR 91-236, $13.25; and WRIR 92-4037, $6.00. Costs were not available for all of the publications at the time the *Divining Rod* went to press.

New Mexico AWRA meeting looks toward 21st century

Take note—the American Water Resources Association's New Mexico section will convene its fifth annual meeting on October 6-7 in Socorro at the Macey Center on the New Mexico Tech campus. The conference's general theme is *New Mexico's Water Resources: Towards the 21st Century*.

Some excellent abstracts have been received by conference chair Michael Campana, covering such topics as tritium variations in precipitation in the Los Alamos region, regional water planning, the Las Nutrias Groundwater project, risk assessment in designing remediation plans, tracer breakthrough interpretation, the Endangered Species Act and water management, and more.

The program and registration rates will be out by early September. Special student rates will once again be available. For more information contact Michael E. Campana, Department of Geology, UNM, Albuquerque, NM 87131-1116; (505) 277-3269; FAX (505) 277-8843.

Conservation as a Factor in Water Supply Planning: A Case Study of the City of Tucson

The role of conservation in water resources planning and management has become increasingly important as (Baumann, et al.; Baumann):

- New reservoir sites have become scarce;
- Groundwater resources are increasingly inadequate to meet the demands of urban areas;
- Political, economic and institutional problems of interbasin transfers have proliferated;
- Costs of water resource development have risen enormously as a result of the increases in the price of energy, the cost of money, and the rise of water quality standards; and
- Concern for environmental quality has grown resulting in more public input and unprecedented scrutiny of new supply development projects from environmental groups.

In New Mexico, water withdrawn for domestic use is only a small portion of the water used statewide. It may seem that potential savings from domestic use are insignificant, but many communities face water supply problems that could be somewhat mitigated by conservation. Conservation measures can also delay capital outlays for the development of a new water supply and provide other economic and environmental savings to the community.

The city of Tucson, Arizona provides an interesting case study for New Mexico to examine. For 15 years that city has had an active conservation program which has been a focal point in Tucson's water supply planning and management. Conservation is now a major component of Tucson's 110-year water plan enacted in 1989. What follows is a review of what that city has accomplished.

Groundwater resources are increasingly inadequate to meet the demands of urban areas.

Until about 1940, Tucson's consumption was less than recharge, but then the population was only about 40,000. By the early 1980s, Tucson's population was around 400,000 and the city was pumping from depths up to 450 feet, with pumping depth falling as much as five feet per year in some areas. Seventy-six percent of the consumptive use was obtained through overdraft (Martin, et al.). The Arizona Groundwater Management Act (GMA) of 1980 mandated a series of five management plans be implemented between 1980 and 2025 with compulsory conservation in order to eliminate groundwater mining by 2025 (Jacobs). Under the GMA, Tucson must reach a per capita use rate of 151 gpd by 1995 and 148 gpd by 1999. Currently its per capita use rate is around 165 gpd, the lowest among comparable southwestern cities (Dotson).

Prior to the GMA, however, the city began implementing conservation measures. Much of Tucson's water system needed to meet the high peak demand for water during the summer. During the fiscal year 1973-1974, per capita water use rose to a high of 205 gpd. The city hired John Corollo Engineering to conduct capital improvement and rate studies. The firm recommended substantial rate increases, averaging 30 percent, and an increasing block rate structure instead of the declining block rate structure that was in force. These recommendations were implemented in February 1974, but the per capita use was not affected right away because that year was one of the hottest and driest in Tucson's history, with an annual rainfall of only 4.76" (Dotson).

The city again hired Corollo Engineers to study the department's problems and make recommendations for water system improvement. In January 1976, the firm submitted a report calling for a six-year program of improvements to the water system and rates 42 percent higher, formulated on a cost-of-service basis. For example, customers at higher elevations were to pay pumping lift charges and new users instead of existing customers were to pay system development charges (Martin, et al.).

However, in July of 1976 there was public outrage over these increases. Some Tucson residents received bills quadruple their normal bills, largely due to the lift charges. To squelch some of the opposition, the city utility department announced in August the lift charges would be rescinded and low-income, low-water users would be helped. As a result of the protests, three city councilors were recalled and a Citizens Water Advisory Committee (CWAC) was appointed to study water department operations. The lift zones were abolished and an isolated area surcharge enacted instead. The city began an aggressive public information program that involved the CWAC and other citizens groups to help the public understand Tucson water issues and accept higher rates

(Brice and Unangst).

During the spring of 1977, Tucson was faced with spending $45 million on new wellfields and expansion of the distribution system to meet peak demand. By cooperating with local media, the CWAC and City Council established a low-cost, but highly effective "Beat the Peak" program. This encouraged residents not to water lawns and outdoor plants more frequently than every other day, not to water on Wednesdays, and never to water between 4-8 p.m. Designed and sold to the public as a way to defer capital expenditures by reducing peak demands on the water system, the program was enormously successful (Martin, et al.).

"Beat the Peak" was designed and sold to the public as a way to defer capital expenditures.

"Beat the Peak" is now incorporated into the 1988 conservation plan Tucson adopted, "Make Every Drop Count." Besides "Beat the Peak," the plan includes elementary school programs, an ultra-low-flow plumbing code, conservation by city departments, and expanded waste and tampering enforcement (Dotson). One aspect of the 1988 plan is geared for the highest water users in the commercial and multi-family classes. Conducted in cooperation with the University of Arizona, this component focuses on xeriscape conversion, irrigation efficiency and water audits. The potential savings generated by this program could be substantial since the combined total outdoor water use for targeted clients is 10,000 acre feet per year (Little and Waterfall).

Another measure which Tucson began in the 1970s is wastewater reuse. The first effluent reuse facility was built in 1975 and produces 1000 acre feet of treated effluent annually for two 18-hole golf courses. In 1976 and 1977 two more golf courses opened using treated effluent (Guild).

Effluent is the only water resource that increases with population

Tucson now operates the third largest and fastest growing nonpotable water system in the country. In 1989, 5 percent of the city's demand was met using relcaimed water. That year 5,200 acre-feet of reclaimed water was used for turf irrigation, with an additional 2,700 acre-feet of secondary effluent used to irrigate golf courses (McLean).

Tucson Water also is operating a 6,500 acre-foot per year recharge and recovery facility which provides seasonal underground storage for reclaimed water and serves as a laboratory for studying soil treatment characteristics. Guild (1990) notes that "since effluent is the only water resource that increases with population, its integration into the total water supply equation will become a necessity for many growing communities within the next century."

Conservation is not a panacea for Tucson's water problems. However, it has helped the city meet complex and rapidly changing federal, state and local laws as well as meet the needs and preferences of residents. Its effectiveness will be determined by how well it helps the city reach its goal of 148 gpd by 1999.

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WRRI preproposal deadline - October 15

October 15, 1992, 5:00 p.m. is the deadline for preproposals for New Mexico Water Resources Research Institute's 1993 Water Resources Research Allotment program. This program includes research projects to be supported with state appropriations as well as with federal funds from USGS. Generally, WRRI funding is limited to $25,000 per project per year. Preproposals with larger budgets will be considered if the project is interdisciplinary or if additional funds are to be provided by other sources.

WRRI's Program Development and Review Board will complete preproposal evaluations by early December. Researchers will then be invited to submit full proposals on which final funding decisions will be made by April 1,1993. Funds for chosen projects will be awarded July 1, 1993.

WRRI Project Coordinator Darlene Reeves says "The statewide Program Development and Review Board recently adopted a new policy that would encourage researchers to consider available funds from the WRRI as 'seed money.' That is WRRI appropriations would be used to get important new and/or creative research started, but the researchers would be expected to seek outside funding for work beyond the first year."

Due to budget constraints, it appears that there will not be federal funds appropriated for the U.S. Geological Survey's national water resources research program (section 105 matching grants) for fiscal year 1993.

For more information on WRRI's grant program, contact Reeves at 646-1194 or WRRI Assistant Director Bob Creel at 646-4337.

UST training package debuts

"Getting Out From Down Under: Underground Storage Tank (UST) Alternatives for Small Towns," is a new training module from the National Association of Towns and Townships (NATaT) designed to help local officials in ensuring UST safety and maintaining a fuel supply for public services. The complete training package, which includes an 80 page guidebook, 20 minute video and meeting planners guide, is available for $80 from NATaT, 1522 K St., NW, Washington, D.C. 20005; (202)-737-5200.

Groundwater flow sensor useful in detecting toxic waste

A low-cost groundwater flow sensor that could be useful for hazardous site cleanups has been patented by Sandia National Laboratories. The lab estimates that the production cost for each in-situ permeable flow sensor will be under $1000 and that drilling a hole to install the device will add approximately another $500.

The sensor consists of a 30-inch long, 2-inch diameter rod that contains an electric heater and an array of 30 temperature-sensing thermistors on the surface. After the sensor is buried, equipment above-ground powers the electric heater and collects data. Water flowing past is warmed and the temperature is measured. Thus downstream water measures warmer than upstream, and temperature changes correlate with flow velocity. Using several sensors, researchers can then map groundwater flows in an area contaminated by toxic wastes.

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New WRRI technical report looks at alfalfa water use efficiency

Since the last issue of the *Divining Rod*, WRRI has published one new technical report, #263, ***Increased Water-use Efficiency in Alfalfa by selection for Two Key Heritable Physiological Traits*** by Vincent P. Gutschick and Cliff G. Currier.

In previous work Gutschick and Currier developed a physiologically based model which predicted that breeding for two specific traits might confer 10% increases in water-use efficiency on alfalfa in large field growth over the whole season while modestly depressing yield. This report details tests, carried out in controlled and field environments, about this hypothesis and the researchers recommendations for future plant breeding studies.

The report is free of cost and may be ordered by calling 646-1813 or writing WRRI, Box 30001-Dept. 3167, Las Cruces, NM 88003.

SCS study, continued

Lindbergh, of course, had no idea how valuable his photographs of the Indian ruins and area vegetation would become to Pat Moore in 1992.

As a graduate student in history, Moore has a very interesting role in a USDA Soil Conservation Service project, "Vegetative History of the Pecos Basin." This project is a five-year historical study in conjunction with New Mexico State University, the Carrizozo, Chaves, Hagerman-Dexter, and Upper Hondo Soil and Water Conservation districts, and NMWRRI.

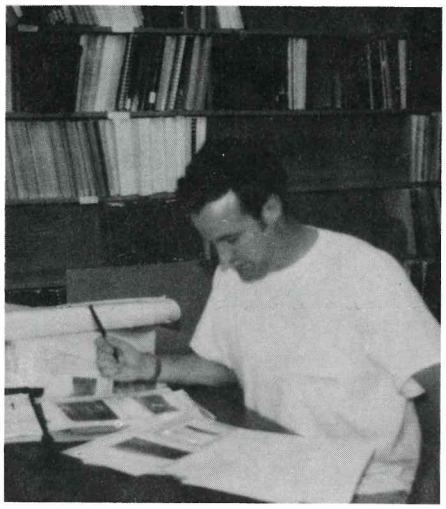
The study will reveal how New Mexico's soil, vegetation and water resources have changed since the 1850s. The investigators will determine if vegetative change in the Pecos River Basin has influenced water yield and if improvement of the basin's watershed condition can increase the water quantity and/or improve water quality.

Moore is interpreting information from several sources for geographers to use in another phase of the study. One source is information from a literature search of documents from government agencies, libraries and historical societies. Another source is personal and taped interviews of people who owned land in the area or worked for government agencies. The third source is vegetation information from old photographs, including 150 of Lindbergh's photographs on file at the Museum of New Mexico. Moore examined the photographs for type and amount of vegetation including trees, shrubs and grasses.

This is where the NMSU Animal and Range Sciences and Earth Sciences departments step in. Rex Pieper, Animal and Range Sciences professor and Albert Peters, Earth Sciences assistant professor and historical consultant, are examining the vegetative change within the basin by looking at six types of vegetation: grassland, grassland with scattered shrub, desert shrub, pinion and juniper, pinion and juniper with grassland, and forest.

This information will be given to geographers who will take these bits and pieces of writtten and visual information and make maps, charting environmental changes and trends in vegetation, soil and water resources. The maps will be digitized to a geographic information system (GIS). Estimates of the historical trends of precipitation, stream flow, vegetation and groundwater yield and quality will then be developed to determine the environmental changes since 1850. Questions such as "Is there a pattern to these changes?" and "What are the effects of these changes on water yield and quality in the future?" will be answered.

While this study should be completed by December 1994, it will also be a part of a larger, similar study conducted by the USDA for the entire country.



NMSU graduate student Pat Moore works on his part of the SCS Pecos Basin study. Moore's work was partially funded by WRRI.

Albuquerque conducts groundwater model development program

The City of Albuquerque and the U.S. Geological Survey have initiated a cooperative effort to develop a refined understanding of groundwater in the Albuquerque Basin. This modelling effort differs from all previous and current efforts nationwide in that a spatial database and data extraction system will be developed that can be dynamically updated and used for enhancements to the model or other special application management tools.

The investigation and development of a three-dimensional regional flow model will extend over two years at a cost of $680,000. The model will be used to evaluate the impacts on the groundwater/surface water system that might result from implementation of water resource management options.

Some observations that require better understanding include:

- northeast Albuquerque production well pumping level declines of more than 100 ft. in recent years;
- pumping level declines east of the Rio Grande at a maximum rate of 7 ft. per year and non-pumping level declines at a maximum rate of 5 ft. per year;
- non-pumping water level declines reaching 11 ft. per year west of the river in the Volcano Cliffs field; and
- wells in the southern part of Albuquerque with groundwater level declines of 70 to 90 ft. since the 1950s.

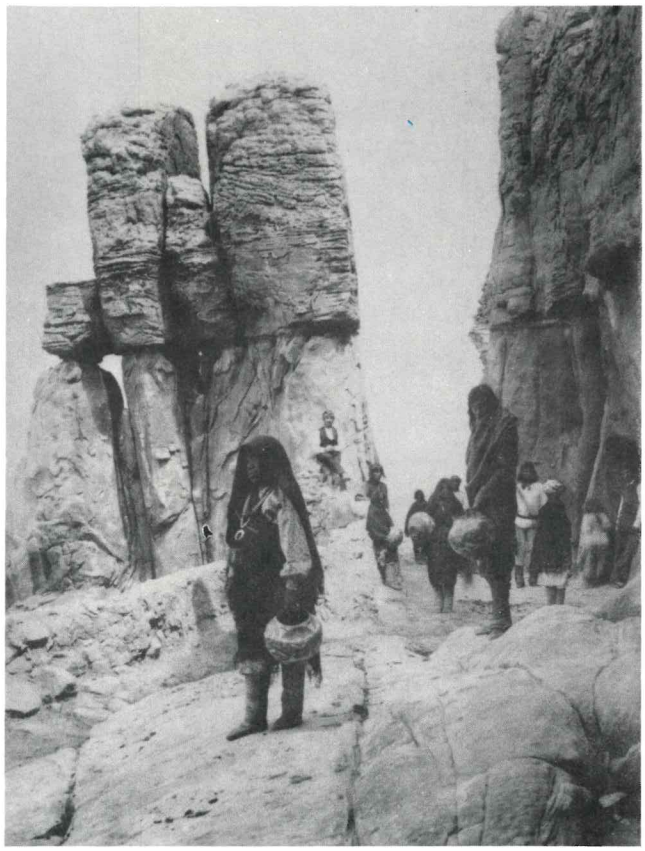
Groundwater modelling in the basin has gone from laborious compilation of response functions on a three-mile spacing to a finite difference analysis with a maximum resolution of one-half mile.

37th Annual New Mexico Water Conference
Multiculture, Multiuse: Planning New Mexico's Water Resources Future

Water planning continues to be a hot topic in New Mexico. The necessity for good water planning is obvious when you compound our limited water supply with meeting the requirements of eight interstate compacts, meeting the needs of a diverse population with strong cultural ties to water use, and increasing demands for improving water quality.

This year the 37th Annual New Mexico Water Conference will focus on planning, with a session devoted to conservation as a component of planning. We're going to look at water plans from other states and hear from Jo Clark, Director of Programs for the Western Governors' Association, on trends in western water resources management and planning. We'll also hear about some of the regional planning done in New Mexico and break into concurrent workshop sessions to discuss instream flow, water banking, and agricultural conservation. Other topics we'll broach are industrial and urban conservation, with a closer look at the conservation plans of El Paso, Tucson, Denver, and Phoenix.

We would like to encourage exhibits on conservation and water planning at this year's conference. It will be held at the Taos Civic Plaza November 5-6, 1992. The Holiday Inn de Don Fernando de Taos (1-800-759-2736) has given us a special room rate of $49 a night, with a cutoff date of October 20, 1990. All those on the *Divining Rod* mailing should receive a conference flyer with registration information in late September.



Acoma water carriers, c. 1900. Photograph courtesy of the Rio Grande Historical Collection, NMSU.

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