

divining rod

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Summer 1995



A Double-Crested Cormorant perches atop its nest at Caballo Reservoir. Dr. Colleen Caldwell will be evaluating mercury accumulation in the birds as part of her comprehensive mercury research program. Photo by Colleen Caldwell.

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WRRI Allotment Program Funds Six Projects

Out of 19 preproposals received, the Water Resources Research Institute will fund five new projects and one continuation project. One additional project is pending. The six projects will provide training opportunities for 13 undergraduate and graduate students. The projects are summarized below.

Environmental Factors Influencing Mercury Concentrations in Water and Sediments in Caballo Reservoir

- Colleen Caldwell, Department of Fishery and Wildlife Sciences, New Mexico State University.

Mercury is a toxic metal with no known essential function in living organisms. Consumption of contaminated fish represents the primary route of mercury exposure in humans. Fish monitoring programs in New Mexico waters have detected total mercury concentrations in edible fish tissues that have resulted in

statewide Fish Consumption Advisories since the early 1970s.

Dr. Caldwell and her research team will measure and correlate the spatial distribution of methylmercury concentrations with physical and chemical environmental factors through time. Characterizing methylmercury in New Mexico waters will help determine the contamination sources as well as risk to human health and ecological systems.

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The project's objectives are to characterize the combined effects that water acidity, hardness, temperature, organic carbon, and wet deposition have on the presence and availability of methylmercury in Caballo Reservoir.

Information from this study will complement other similar studies to determine mercury's transport, fate, and biomagnification in New Mexico's reservoirs. This study is part of a comprehensive mercury research program at NMSU.

Determination of Agricultural Pesticide Impacts on Shallow Groundwater in the Rio Grande Valley - Robert Bowman, Department of Earth and Environmental Science, New Mexico Tech.

Very limited data exist on the impacts of typical agricultural practices on the quality of shallow groundwater. Currently, there is almost no available information on groundwater quality impacts of agriculture in New Mexico.

Dr. Bowman's research will provide producers, the New Mexico

Environment Department, and other agencies, with adverse impacts, if any, due to typical agricultural practices in the Rio Grande Valley. Results of this research may lead to better management practices regarding the use of specific agricultural chemicals in the state; conversely, the results may show that chemicals which present groundwater pollution hazards in other parts of the country may be safely used under New Mexico agricultural conditions.

The project's objectives are to:

- utilize an existing highly instrumented, tile-drained agricultural field to determine pesticide inputs at the soil surface and outputs to shallow groundwater under conditions representative of the Rio Grande Valley of New Mexico;
- collect this information over three complete growing seasons to provide a data base which includes behavior of several different pesticides and crops; and
- utilize the collected field data to test a new mechanistic model of

pesticide transport in soils and shallow groundwater.

This WRRI-funded project is part of a larger project entitled the *Las Nutrias Groundwater Project*. For the past two years, the project was supported by a U.S. Department of Agriculture Cooperative State Research Service Special Water Quality Grant and joint efforts of New Mexico Tech, U.S. Bureau of Reclamation, Natural Resources Conservation Service, New Mexico State Cooperative Extension Service and Sandia National Laboratories.

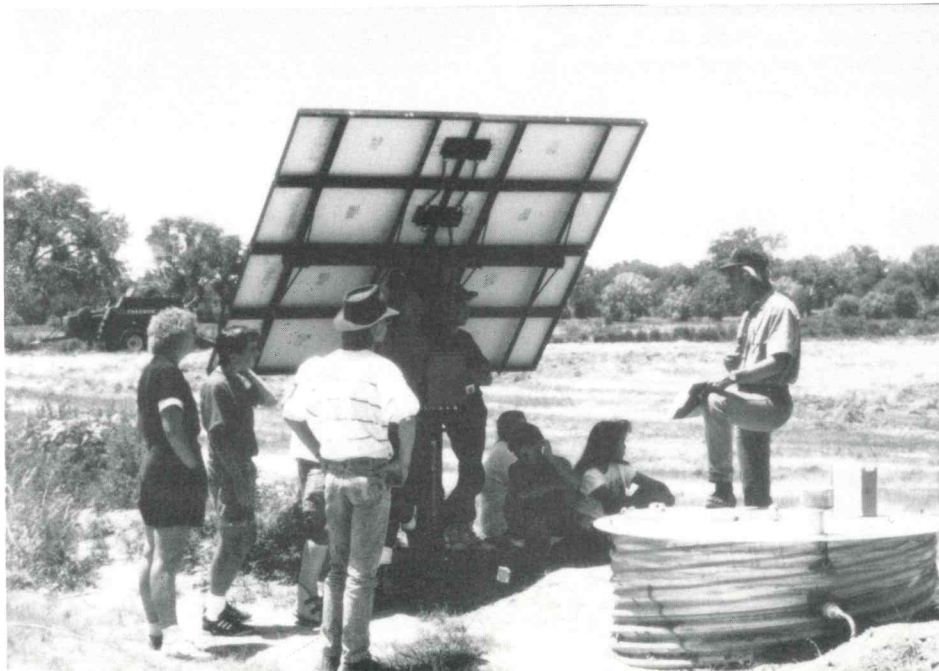
A ten-minute video on the project has been produced by the New Mexico Cooperative Extension Service. Copies of the video are available from the Jornada Resource Conservation and Development office at (505) 527-6993.

Arsenic Removal from Groundwater Using Ferrate - Michael Johnson, Department of Chemistry and Biochemistry, NMSU.

Water supplies having arsenic problems are common in the Southwest and cities like Albuquerque, which have insidious problems with arsenic-contaminated water supplies, could benefit greatly by new treatment technology.

Dr. Johnson has initiated a series of studies into new methods for arsenic removal. These methods differ from the established practices of direct treatment with ferric salts, which are relatively insoluble and require large doses for effective arsenic removal.

The new techniques utilize forms of iron reagents in the +2 oxidation state. Through oxidation of the iron, the +3 oxidation is obtained which forms insoluble precipitates of ferric arsenate and hydrated ferric oxides. This method will reduce the treatment chemical costs and the need for disposal of large amounts of sludge, itself a costly process.



Dr. Robert Bowman describes the Las Nutrias Groundwater Project to a group of visiting high school science students. New Mexico Tech photo.

The two major objectives of this study are to:

- determine the optimal conditions for removal of arsenic from water; and
- explore the redox reactions of ferrate with several forms of arsenic-containing compounds, such as herbicides.

Geologic Membrane Controls on Saturated Zone Heavy Metal Transport - Mike Whitworth, New Mexico Bureau of Mines and Mineral Resources, New Mexico Tech.

To learn more about the behavior of heavy metal contaminants in the subsurface, this study will demonstrate experimentally that membrane-induced precipitation of heavy metal occurs. Dr. Whitworth also will develop a mathematical model which describes the process.

The experiments will filtrate lead carbonate and copper carbonate solutions through laboratory-produced clay membranes. Using facilities at the New Mexico Bureau of Mines and Mineral Resources Chemistry Laboratory, six filtration experiments will be performed.

Results of this study could lead to more efficacious aquifer remediation, and more importantly, this research may suggest that aquifers with bounding shales may ultimately be self-cleaning of heavy metal contamination.

*Reaching the Limits,
Stretching the Resources of
the Lower Rio Grande*

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40th Annual New Mexico
Water Conference
October 26-27, 1995
Las Cruces Hilton

Selective Removal of Toxic Heavy Metals from Contaminated Water Supplies Using Immobilized Humic Substances - Gary Rayson, Department of Chemistry and Biochemistry, NMSU.

All wastewater containing heavy metal ions must be treated. Energy intensive methods, such as distillation, evaporation or reverse osmosis, are not economical for treating these waters. Commercial ion exchange resins may be effective in removing and recovering heavy metals but costs associated with manufacturing these resins can be prohibitive. This study looks at an inexpensive material which has been identified as showing great promise toward treating heavy metal polluted water.

Dr. Rayson and a couple of his students will continue their research in its second year of funding by the WRRRI. They will attempt to characterize a humic-substrate based material for the removal of toxic heavy metals from contaminated water.

An Assay for Toxic Chemicals Using Microorganisms - James Botsford, Department of Biology, NMSU.

Dr. Botsford has developed a simple, inexpensive test for toxic chemicals using bacteria as the test organism. He will test this assay in a "real world" situation by determining the toxicity of agricultural chemicals used in New Mexico and then following their breakdown by the soil microflora. The assay also will be used to test mine wastes for toxic minerals and chemical residues.

This one-year project has three objectives:

- to gain experience with the assay in a situation similar to what would be encountered if the assay method were sold and used in actual situations;

- to determine if chemicals commonly used in New Mexico agriculture pose a health risk; and
- to test representative samples from industry and mining in New Mexico to gain experience with the test and to determine if there are some unsuspected sources of toxicity.

**39th Annual Water
Conference Proceedings**

***The Water Future of
Albuquerque and Middle
Rio Grande Basin***

Last year's conference, co-sponsored by the American Water Resources Association, New Mexico Section, attracted over 400 participants interested in learning more about the water problems and possible solutions facing those living in the Middle Rio Grande Valley.

Seventy speakers discussed a wide range of relevant topics and their comments are contained in a 450-page proceedings. Conference proceedings are now available by sending \$15 to:

New Mexico WRRRI
Box 30001 - Dept. 3167
Las Cruces, New Mexico 88003

Participants of last year's conference will be receiving their copy of the proceedings in July.

Nine new USGS reports available

The U.S. Geological Survey has published the following New Mexico related publications since the last issue of the *Divining Rod*. Copies are available for inspection at the USGS District Office in Albuquerque (4501 Indian School Road NE, Suite 200). The Water Resources Research Institute library also has the reports on file. They may be ordered from the USGS, Federal Center, Box 25286, MS 517, Denver, CO 80225. You may call (303) 236-7476 for price information.

◆ **Simulation of ground-water flow in the Albuquerque Basin, central New Mexico 1901-1994, with projections to 2020** by J.M. Kernodle, D.P. McAda, and C.R. Thorn (WRIR 94-4251) - The most complex computer model of its kind is described in this report. The model is helping City of Albuquerque water managers plan and predict the limits of Albuquerque's future water supplies. The model confirms City

projections of water-level declines based on an earlier USGS report, which indicated that Albuquerque's water supply is much more limited than originally thought.

Model simulations indicate that if current trends in pumping continue, by the year 2020 average groundwater levels will drop an additional 65 feet throughout the metropolitan area, with

maximum additional declines of 160 feet east of the Rio Grande and 250 feet west of the river.

◆ **Analytical results from an environmental investigation of six sites on Kirtland Air Force Base, New Mexico, 1993-94** by R. Wilcox (OFR 94-547) - Six sites on Kirtland Air Force Base—silver recovery units, a buried caustic drain line, a neutralization pit, an evaporation/infiltration pond, the Manzano fire training area, and a waste oil underground storage tank—were studied because past or

ciation with the environmental samples.

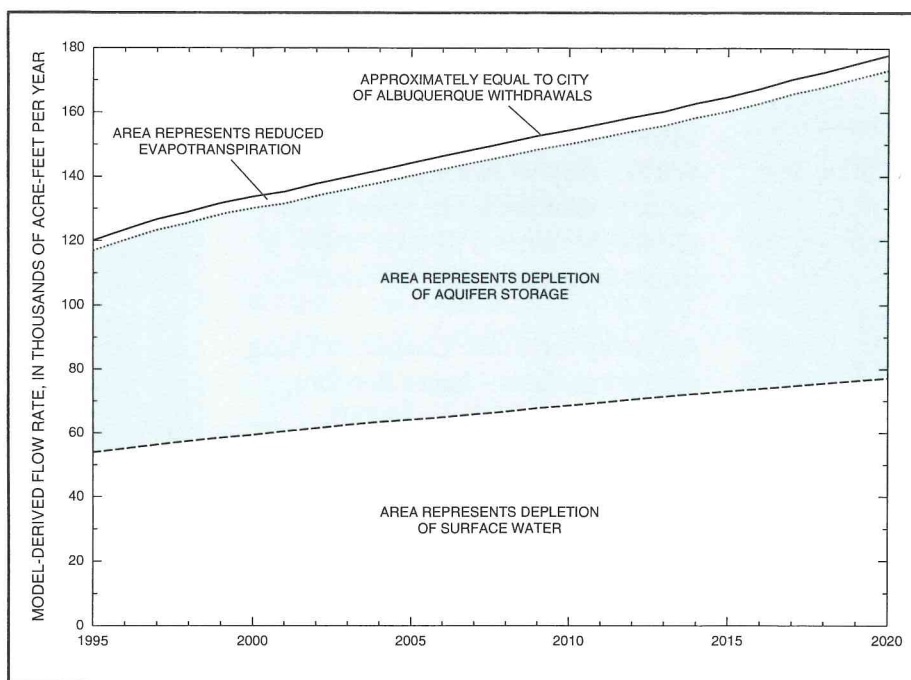
◆ **Radioactivity in the environment—A case study of the Puerco and Little Colorado River basins** by L. Wirt (WRIR 94-4192) - Although elevated concentrations of dissolved uranium were found in shallow saturated sediments underlying the Puerco River, USGS hydrologists found no residual effects of past uranium mining activities in streamflow in the Puerco and Little Colorado rivers, according to this report. The report, which is written in nontechnical language, discusses the questions—what is radioactivity, why is it a concern, where do radioactive elements occur,

and what is the potential risk to humans and animals.

◆ **Selected hydrologic data for the Mesilla ground-water basin, 1987 through 1992 water years, Doña Ana County, New Mexico and El Paso County, Texas** by E.L. Nickerson (OFR 95-111) - Recent population growth in the Mesilla groundwater basin and adjacent areas has resulted in a significant increase in groundwater with-

drawals to meet increasing water demand. A monitoring program was established in 1987 to document hydrologic conditions and to establish a long-term, continuous data base to assist future quantitative evaluation of the groundwater flow system and stream/aquifer relations.

Report data include well records and water levels for 181 wells; mean daily river stage and groundwater



Sources of City of Albuquerque withdrawals assuming the current growth trend, 1995-2020 (from USGS report WRIR 94-4251).

current site activities could have resulted in contamination of soil, pond sediment, and water and sediment in drains. This report includes information about the collection and analysis of samples of soil, pond sediment, soil gas, and water and sediment in drains. Field quality-control samples were collected and analyzed in asso-

levels at 37 sites; seepage investigations of the Rio Grande from Radium Springs to El Paso; and chemical analyses of 29 water samples from the Rio Grande.

◆ **Water-quality assessment of the Rio Grande Valley study unit, Colorado, New Mexico, and Texas—Analysis of selected nutrient, suspended-sediment, and pesticide data** by S.K. Anderholm, M.J. Radell, and S.F. Richey (WRIR 94-4061) - Surface and groundwater quality data for nitrates, phosphorus, suspended sediment, and pesticides have been summarized for a 47,500 square mile study area in Colorado, New Mexico and Texas. Concentrations of nitrogen, ammonia, nitrate, phosphorus, and orthophosphate in the Rio Grande were approximately 3 to more than 10 times higher at stations below Albuquerque than at stations upstream from the city. This finding probably results from urban and agricultural effects on water quality in the Rio Grande.

◆ **Subsurface recharge to the Tesuque aquifer system from selected drainage basins along the western side of the Sangre de Cristo Mountains near Santa Fe, New Mexico** by M. Wasiolek (WRIR 94-4072) - According to this report, water budgets developed for basins of five streams draining the western side of the Sangre de Cristo Mountains in northern New Mexico indicate that subsurface inflow along the mountain front is recharging the Tesuque aquifer system in the Española Basin. Water budget calculations indicate that the Rio Nambé drainage basin potentially may contribute a maximum volume of about 5,520 acre-feet of water per year, or about 12% of the average annual precipitation over the drainage basin as subsurface recharge to the Tesuque aquifer system; the Rio en Medio drainage basin, 1,710 acre-feet,

or about 15% of precipitation; the Tesuque Creek drainage basin, 1,530 acre-feet, or about 10% of precipitation; the Little Tesuque Creek drainage basin, 1,790 acre-feet, or about 19% of precipitation; and the Santa Fe River drainage basin, 4,170 acre-feet, or about 11% of precipitation.

◆ **Erosion assessment at the Petroglyph National Monument area, Albuquerque, New Mexico** by A.C. Gellis (WRIR 94-4205) - Areas of the Petroglyph National Monument, specifically those located along the West Mesa escarpment, are being affected by erosion and gullying, according to this report. The author indicates that “the gullies may not be a direct threat to petroglyphs but may have a greater effect on the aesthetics of the monument and the residences located down gradient from a gully.”

◆ **Bridge-scour analysis on Cuchillo Negro Creek at the Interstate 25 crossing near Truth or Consequences, New Mexico** by S.D. Waltemeyer (WRIR 95-4050) - A sediment transport model was used to simulate anticipated channel scour or deposition, pier and local bridge scour for a 1-mile reach at the Cuchillo Negro Creek I-25 crossing. Scour is defined as a lowering of the streambed below a natural level or assumed datum and can contribute to bridge failure. This report presents results of peak discharges and flood volumes used to design synthetic hydrographs to simulate extreme events. The 100-year, 500-year, and regional maximum-peak discharge flood hydrographs were used in the bridge scour analysis.

◆ **Spatial data in geographic information system format on agricultural chemical use, land use, and cropping practices in the United States** - W.A. Battaglin and D. Goolsby (WRIR 94-4176) - A sum-

mary of agricultural practices and herbicide, fertilizer and land use of the U.S. by county can be obtained over the Internet at <http://h2o.usgs.gov/public/pubs/bat/bat000.html>. The data base consists of 18 geographic information system layers that cover such areas as the estimated use of 96 herbicides, annual sales of nitrogen fertilizer, livestock holdings, and cropping practices. Paper and microfiche copies of the report are available from the USGS Federal Center address provided above.

◆ **Hydrogeology of Cibola County, New Mexico** by J.A. Baldwin and D.R. Rankin (WRIR 94-4178) - Groundwater resources of Cibola County were evaluated to determine the availability and quality of water. Aquifers within the county commonly yield 5 to 30 gallons per minute; however, yields from the San Andres-Glorieta aquifer may exceed 2,800 gallons per minute. Calcium, sodium, magnesium, bicarbonate, sulfate, and chloride are the predominant ions in the water.

WRRI's Universal Resource Locator

The New Mexico Water Resources Research Institute (WRRI) is now accessible through the Internet via the software packages, Mosaic and Netscape. These allow Internet users to access the WRRI "home page" which provides a general description of the institute and its mission, its newsletter, the *Divining Rod*, institute-supported research projects, funding opportunities, WRRI publications, and other data developed and maintained by the WRRI. Institute publications can now be ordered online. The Universal Resource Locator (URL) for the WRRI is:

<http://wrri.nmsu.edu>.

Bob Creel, WRRI Assistant Director, with assistance from New Mexico State University computer science graduate student, Kedar Bangalore and Terry Duttle of NMSU's Computing and Networking Technology Organization, has implemented this new technology. Dr. Creel says, "I was surprised at how easy it was to initiate the system and at the extent of usage being made."

Dr. Creel and Kedar currently are developing an online catalog of the institute's library holdings containing over 8,500 environmental and water-related books and periodicals. Also in development is the New Mexico Water Resource Data System which will contain maps and Geographical Information System coverages.

The WRRI "home page" also contains links to other resources of interest including the National Institutes for Water Resources (NIWR). It contains information about the NIWR including a summary of current research projects and a data base of all NIWR publications. Also available is a description of each of the 54 Water Resources Research Institutes located at land grant universities in each state and in the District of Columbia, the

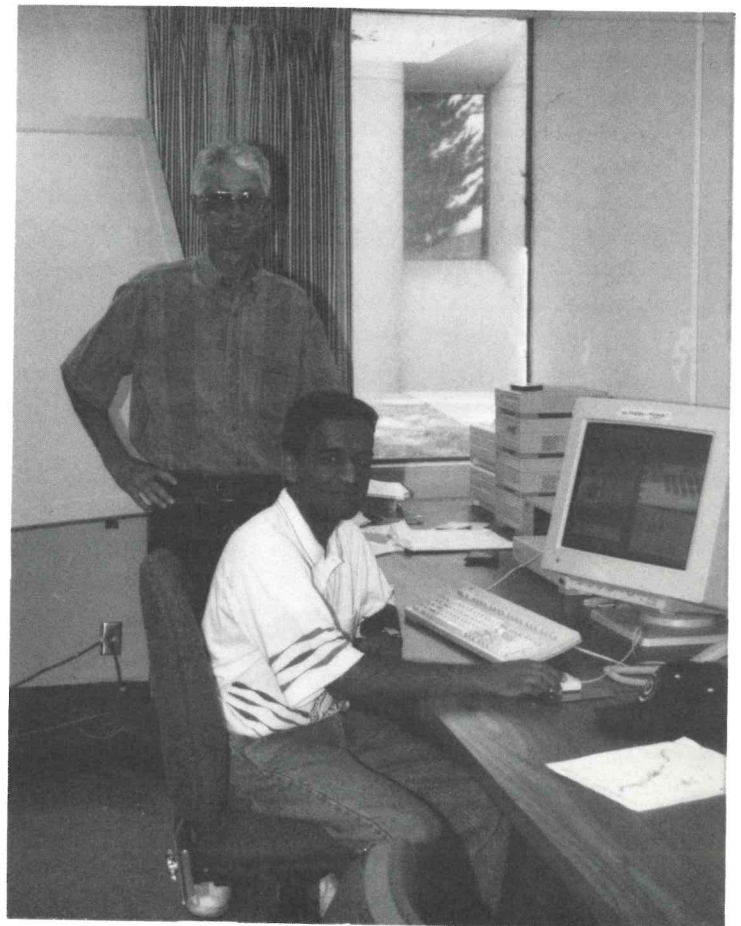
Virgin Islands, Puerto Rico, and Guam.

The NIWR "home page" includes access to the Department of Energy Environmental Restoration (DEER) gopher, the National Oceanic and Atmospheric Administration, the U.S. Department of Energy, and the National Science Foundation. Other information accessible from the NIWR server includes the National Wetlands Inventory, the latest United States weather map, the latest satellite image of the continental United States, the National Water (Streamflow) Conditions published by the U.S. Geological Survey, the Planet Earth Home Page, and the U.S. Congress Home Page.

The WRRI provides direct links to the following sites:

- Powell Consortium, containing information on the alliance of seven western Water Resources Centers and Institutes that cooperate on water issues related to the Colorado River and Great Basin
- U.S. Geological Survey
- U.S. Environmental Protection Agency
- Universities Water Information Network

- U.S. Army Corps of Engineers, Albuquerque District Water Control Data
- International Arid Lands Consortium, an independent, nonprofit research organization supporting ecological sustainability in arid and semiarid lands worldwide
- New Mexico Geographic Information Systems Advisory Council



WRRI Assistant Director Bob Creel and graduate student Kedar Bangalore are working this summer to make WRRI information available through the Internet.

1995 Upcoming Conferences

August 9-12, 1995 Skamania Lodge in the Columbia River Gorge	National Water Resources Association 1995 Western Water Seminar
September 14-15 Tucson	Arizona Hydrological Society Symposium 1995 - <i>Water Use in Arizona: Cooperation or Conflict?</i>
September 27-30 Santa Fe	New Mexico Geological Society - <i>Geology of the Santa Fe Region</i>
October 4-6 Jackson Hole	1995 Rocky Mountain Groundwater Conference - <i>Science or Policy: Who's driving groundwater cleanup?</i>
Rescheduled to October 12-13 Santa Fe	American Water Resources Association, New Mexico Section - <i>Santa Fe Area Water Resources Issues, Bringing the Regulators and the Private Sector Together</i>
October 26-27 Las Cruces	New Mexico Water Resources Research Institute's 40th Annual New Mexico Water Conference - <i>Reaching the Limits, Stretching the Resources of the Lower Rio Grande</i>
October 30 - November 2 Honolulu	National Water Resources Association 1995 Annual Conference
November 5-9 Houston final symposium: November 10-12 Cancun	American Water Resources Association 31st Annual Conference - <i>Symposium on Water Management in Urban Areas; Symposium on the Advances in Development and Use of Models in Water Resources; Symposium on North American Water Resources</i> (will reconvene in Cancun)
November 12-16 New Orleans	American Water Works Association Water Quality Technology Conference

KUDOS

The Water Resources Research Institute made four awards at the 43rd Annual New Mexico Science and Engineering Fair for outstanding water resources related projects by New Mexico high-school students.

First place in the junior division went to Taos Junior High School student Christy R. Keenan for her project entitled *The Rio Hondo: A River Under Question*. El Dorado High School student Laura P. Levine received first place in the senior division for her project, *A Bio-Remediation Solution to Gas Mercaptan Ad/Absorption in An Underground Gas Storage Water Aquifer*.

Junior division honorable mention went to Christine McLemore of San Miguel School for her project, *Metal Contamination in Plants and Soils* and senior division honorable mention was awarded to Mary Alice Olmstead

of Los Lunas High School for her project, *Algae: The Wave for the Future*.

Congratulations to these students and we wish them well in their future research endeavors.

Water Planning Handbook Available

The New Mexico Interstate Stream Commission has published the *Regional Water Planning Handbook*, which according to Tracy Seidman-Hephner, Commission Member, "sets a template for water planning in New Mexico and delineates the tasks necessary to develop a comprehensive water plan." The tasks are addressed in full in a companion document called the *Checklist for Water Planning*. Both are available from the ISC office. Call (505) 827-6160 for copies.

Join us in celebrating our 40th annual water conference

The site of the 1st Annual New Mexico Water Conference, Las Cruces, will again host the 40th. Mark your calendars for October 26 - 27, 1995. This year's theme is *Reaching the Limits, Stretching the Resources of the Lower Rio Grande*.

A field trip from Elephant Butte Dam along the Rio Grande to Las Cruces is planned for Wednesday, October 25th. Gary Esslinger, Manager of the Elephant Butte Irrigation District and Tom Bahr, Director of the WRRI will host the tour.

The conference will be held at the Las Cruces Hilton from Thursday morning, October 26 through noon on Friday, October 27. A block of rooms has been reserved at the Hilton as well as at other nearby hotels.

The cost of the conference is \$90 before October 10, \$115 after. Student registration before October 10 is \$30, \$40 after. The registration fee includes a banquet dinner Thursday evening and a copy of the proceedings.

A conference agenda and additional details will be mailed to *Divining Rod* readers later this summer. We will be experimenting with an online Internet registration system for the conference this year. Instructions for registering via the Internet will be provided with the conference agenda.

Urban wetlands tested in Juarez

From Erin Ross, Southwest Center for Environmental Research and Policy, NMSU

NMSU and the Universidad Autonoma de Ciudad Juarez have opened an experimental wastewater facility in Juarez that uses natural methods to filter pollutants from the highly contaminated aguas negras canal.

The facility, a pilot project of the Southwest Center for Environmental Research and Policy at NMSU, was designed to test the feasibility of using "urban wetlands" technology as an alternative to expensive wastewater treatment plants.

The technology uses naturally occurring plants such as bull rushes that are rooted into a shallow pool of water. The plants serve as a natural filter that cleans impurities from water.

The concept of urban wetlands as a waste filtering system is not new, said Walter Zachritz of NMSU's College of Engineering and the project's manager. "What is unique about this facility is that we took a technology that is applied regularly in industrialized nations and brought it to Mexico."

The wetlands facility filters about 1,000 gallons of water a day and operates on energy supplied by a small electrical pump. Normally, no pump is required for wetlands projects, but the location of the park was found to be uphill from the canal. The canal is a large open sewer that flows alongside the Rio Grande.

Tom Bahr, Director, New Mexico Water Resources Research Institute
Catherine T. Ortega Klett, Editor

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