Divining Rod
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Tracking Antibiotic-Resistant Microbes

By Will Keener, WRRI

To address growing concerns about antibiotic-resistant microbes in the natural environment, a method is needed to understand the pathways of these organisms from their sources. New Mexico State University researchers have reported a successful first step, developing a way to link sources of antibiotics and antibiotic resistance in the community to antibiotic-resistant microorganisms found in wastewater treatment plants and their effluent.

Jesus Sigala prepares culture plates for use with wastewater samples. He is now continuing his research as a graduate student.

"Our long-term goal is to identify and quantify the sources that are contributing most to the problem," says Jesus Sigala, a graduate student in NMSU's Plant and Environmental Sciences Department. "If a single source proves to be the dominant contributor, some type of direct pre-treatment might be a required and recommended option. If diverse sources are found to contribute to the antibiotic resistance in the effluent, then improved treatment options at the wastewater treatment plant will be needed. We still have a lot to learn, but options are available."

Divining Rod

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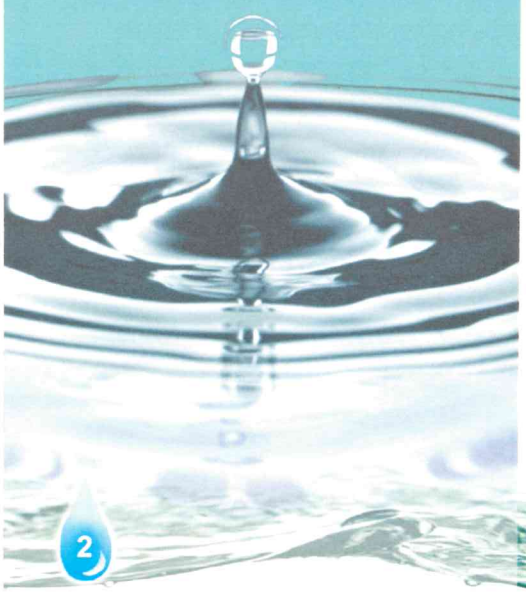


Working with Adrian Unc, Assistant Professor in the Plant and Environmental Sciences Department, Sigala submitted a first report on the research last year. The project, funded in part by the New Mexico Water Resources Research Institute, showed several promising results:

- The method used in the tests was able to discriminate between some community wastewater sources.
- The method discriminated resistant bacteria from a spectrum of other bacteria found in a wastewater treatment plant.
- Two antibiotic types were found to be especially helpful in identifying hospital wastewater sources.

To conduct the study, Sigala and Unc sampled four wastewater source streams, each serving a distinct area, in the Las Cruces, New Mexico, wastewater system in 2008. They compared those to other samples taken during the same period at the city's water treatment plant after different treatment stages. Generally, wastewater may originate in residential or industrial areas or it may include agricultural runoff, and medical sources. Beginning in 2008, the researchers took samples at four "lift stations," where city wastewater is pumped to higher elevation so that it can then drain to the treatment plant. Three samples taken over two days were mixed to get a composite – more representative – sample. The project made use of wastewater treatment plant samples that are taken routinely for lab testing. "We took the same samples at the different treatment stages and from the effluent," Sigala says.

With the composite samples, the process of growing the bacteria on agar plates began. The plates used two types of agar, one simulating a nutrient-rich environment, the other a nutrient-poor one. The plates were then treated with four distinct antibiotic types to identify the resistant strains. Other "control plates," without antibiotic amendment showed the diversity of organisms found in the samples.

In a laboratory providing special protection to researchers and samples, DNA from the resistant microbes was extracted using a commercially available kit. Next, the amount of DNA was measured using an ultraviolet light measuring system. "You need to know how much you have before the next step," says Sigala. In that step a special enzyme is used to replicate the DNA. "Without this reaction there would not be enough DNA. You need to amplify it for later steps," Sigala explains.

A process called DGGE, for denaturing gradient gel electrophoresis, separates the amplified DNA according to organism type. DNA strands are connected by bases that vary in the strength of their hydrogen bonds. Under electrical current and in the presence of certain chemicals, the DNA strands migrate and settle at distinct locations in the gel, depending on the order and type of their bases. The gels are then stained and scanned, to better see different bands or patterns, called "fingerprints." A software program interprets the fingerprints, including the number and location of the bands, and

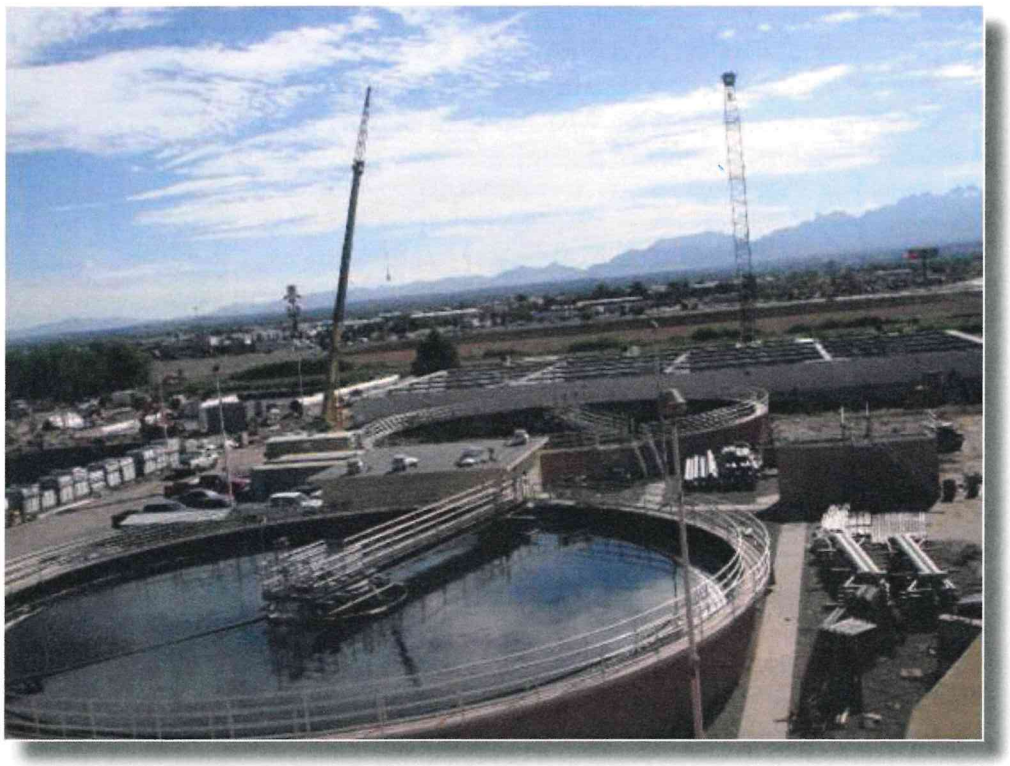
provides a data matrix for researchers to analyze.

Statistical analysis of the many factors and variables is conducted on the data to help sort out the bewildering array of possibilities. "We selected four distinct types of antibiotics, including some older types and a new antibiotic. We saw that resistance was detected all across the sources," Sigala says. "With older antibiotics you see increases in resistance."

To improve the approach, the researchers hope to develop a fingerprint comparison protocol for each potential source and be able to evaluate it against data from the water treatment plant. In the initial project, the research showed that erythromycin-resistant and cefaclor-resistant microbes are most similar to hospital sources. "If we were able to develop a source-tracking protocol, we would possibly recommend those two antibiotics as source discriminators," says Sigala.

Other data showed that some effluent fingerprints don't coincide with any source. The next step is to extend sampling periods throughout the year and cover all eleven lift stations in the city. Work started on that with sampling in February. Sigala, who earned his bachelor's degree in 2009, is continuing the project for his master's degree project.

Last November, Sigala and Professor Unc traveled to Leeds, England, where the graduating senior presented his research results at the 14th European Biosolids and Organic Resources Conference. "I got some questions and some suggestions that helped me," Sigala says of the experience.



The primary clarifier (foreground) at the Las Cruces Wastewater Treatment Plant was one of several places were wastewater samples were taken for the study.

"Our proposed protocol will be further verified using more complex molecular methodologies such as gene microchips and pyrosequencing," says Unc. Sigala will collaborate with another graduate student and the team will take advantage of expertise developed at other universities. "Successful completion of this project will result in a significant increase in our understanding of the health risks associated with wastewater collection and treatment, and will offer a novel and rapid method for evaluating the significance of individual sources of antibiotic resistance to the system," says Unc. "Eventually we hope to verify our approach in other wastewater treatment systems within and outside New Mexico."

Bobby J. Creel
1943-2010

On February 15, 2010, the New Mexico Water Resources Research Institute lost a dear colleague, Bobby J. Creel. Dr. Creel began working for the WRRI in 1986 and served as Associate Director, Interim, and Acting Director.

Prior to working full time at the institute, he had worked on many institute projects starting in 1972. Throughout his career at WRRI, Bobby received nearly 60 grants and oversaw several projects, including the development of one of his favorite projects, the Geographical Information Systems Lab, which employed many students over the past decade. Having authored dozens of reports and complex maps, Bobby was involved in numerous water-related projects in the state and region.

In the days following his unexpected death, the staff received many calls and emails with condolences on the terrible loss of a gentle person and friend who had invaluable knowledge and insight into water resources management and planning in New Mexico. It was repeated many times that he was someone who could be counted on professionally in that he was very bright, hard working, and willing to contribute substantially to the success of others. All of that, plus his soft spoken personality helped to resolve many difficult project related issues that would inevitably surface from time to time. In this sense, he was regarded as an indispensable mediator as well.

On a personal note, in 1987, Bobby, then WRRI Acting Director, hired me at the institute and through the years, I came to very much value his friendship and advice. I could

count on Bobby for everything from explaining to me technical terms used by faculty researchers, to fielding phone calls on drilling wells in any part of the state, to setting up projectors and sound systems at the water conference. He simply did what needed to be done and always in good humor. Not seeing him just after 7:00 a.m. every morning heating his breakfast makes me terribly sad. And our staff luncheons will not be the same without Bobby and his homemade carne adovada. He will be missed in many ways.

To honor Bobby J. Creel's memory and his devotion to students over a career of 40 years, the WRRI has established the Bobby J. Creel Student Water Research Scholarship. Those interested in contributing to the scholarship can call the WRRI at 575-646-4337 or visit our webpage at http://wrri.nmsu.edu/forstudents/forstudents.html and click on the Bobby J. Creel Student Scholarship link.

Catherine Ortega Klett, Editor

Some Memories of Bobby J. Creel, Ph.D.

by John W. Hawley, given at Dr. Creel's memorial service, February 19, 2010

Everyone's life is multifaceted. Some facets refract inward to private places best left unvisited. Here, I choose to recall those that reflect the sunlight of a very special life and sparkle with the vigor of great accomplishments. In the case of my long-time friend and professional associate, Bobby J. Creel, his all-too-short lifetime is a wonderful but still heart-wrenching place to visit. Bobby's physical absence today is such an unexpected event and devastating blow that the best my wife Diane and I can do under the circumstances is offer our heartfelt condolences to his immediate family and loved ones.

The following comments are limited to a few observations of Bobby's seminal contributions to water-resources research based on about thirty years of personal acquaintance, and are obviously just a subset of the many other memories that will be recalled on this occasion.

During most of the 1980s, I was one of several New Mexico Tech representatives on the multi-institutional panel that evaluated proposals for water-research projects administered by the New Mexico Water Resources Research Institute. In those days quite a lot of public funds and matching support was still available, mostly in the form of "seed" grants for water-related graduate research programs throughout the state-university system. In his position as Assistant (and Acting) Director of the Institute (and an astute natural-resource economist), Bobby Creel was always there to ensure that public funds were appropriately distributed and utilized in the most cost-effective manner. As the "cash cow" got leaner in subsequent years, Bobby was still able to turn challenges into opportunities and never stopped growing in intellect and professional stature.

I'm just one example of the many lives that Bobby Creel has enriched. Fortunately, most were his students and peers, and not old folks like me. In 1997, he reignited the spark in my professional life by inviting me to work at least part-time at the WRRI after my retirement from the New Mexico Bureau of Mines at New Mexico Tech. At the time, I was a semi-burned-out 65-year-old with no particular plans other than doing some consulting in environmental geology. Bobby actually believed that I could recover some useful information from earlier (1960s) work with the USDA-SCS and apply it to building more robust hydrogeologic models of transboundary aquifers of the southwestern New Mexico region. Thanks to him I'm still a viable geologist with passable computer skills, and even reasonably effective in terms of communication with GIS specialists and groundwater-flow modelers.

I still haven't figured out why such an eminent natural-resource economist, scientist, and research administrator would attempt to resurrect an eccentric old geologist with an obsessive compulsion to treat earth science as some sort of religious experience. This is even more mystifying because GIS, automotive mechanics, animal husbandry, and farm/ranch operations were also part of Bobby's skill set. However, our common bonds definitely included love of the binational American West, its natural resources and culture (including Dick's Café); as well as a stubborn desire to get things "right." Family, co-workers, and friends would probably like to forget our "infamous" work binges (e.g., all-nighters and weekenders) when project-completion reports had to meet research-contract deadlines.

In closing, I choose to remember and honor Bobby Creel as one who left a very positive and healing mark on this part of our wounded planet. He could and did "think outside the box," but Bobby was most of all an effective consensus builder, who instinctively knew the location of and how to respect all boundaries dictated by scientific rationale and "common sense" (the ability not to repeat a mistake more than twice). He was the epitome of an effective public servant who lived by a motto attributed to James Cash Penney: "There's no limit to the good a man can do if he doesn't care who gets the credit."

Bobby J. Creel, third from right, participated in many water-related projects including the U.S.-Mexico Transboundary Aquifer Assessment Program. This photo was taken at the International Boundary and Water Commission (IBWC) headquarters in El Paso on August 20, 2009. It was taken to recognize and celebrate the signing by IBWC and CILA (Mexican counterpart) of an agreement on U.S.-Mexico data exchange and scientific research to develop a better understanding of the shared aquifers along the U.S.-Mexico border. Bobby Creel actively and diplomatically represented the New Mexico WRRI and New Mexico through 18 months of negotiations to reach this agreement.

Project Aims at Slowing Urban Runoff in Arid Southwest

By Will Keener, WRRI

KT LaBadie is someone who speaks for the river.

LaBadie, who recently completed her master's degree at the University of New Mexico, is advocating a new path for her adopted hometown of Albuquerque and for other cities and municipalities along state waterways. By applying a group of methods referred to collectively as low impact development (LID) or green infrastructure (GI) techniques, she is trying to slow down some of the stormwater that passes through the city for the benefit of residents and for the Rio Grande.

KT LaBadie stands in one of Albuquerque's concrete-lined arroyos. She is looking at ways to slow runoff and improve water quality on its way back to the river.

Techniques that use stormwater in urban design features, such as increased tree cover, rain barrels, curb cuts, or porous pavement, can reduce both runoff to the river and the amount of pollutants. LaBadie read about this approach during study for her dual master's degree in water resources and community and regional planning. She decided to pursue the topic for her professional project.

With support from New Mexico's Water Resources Research Institute, she visited Portland, OR and Seattle, WA to study programs developed there. "I was able to see a lot of case study sites and pilot projects. I also met with people who could answer a lot of my questions," she says. "I came home with an eye for finding LID design features and I found a lot of them."

LaBadie saw LID as a more sustainable approach to development, but there was not a lot of discussion about the techniques locally and they were not being widely used in the region. Other cities offered incentives for developers to use LID, or had stormwater ordinances requiring their use, she notes.

When she met with city professionals she learned the U.S. Environmental Protection Agency was encouraging the city to use LID techniques. The problem was that much of the information EPA provided was suitable to wet climates, not the arid Southwest.

"Rain gardens where you direct rain to low places are lush and green back East or in the Pacific Northwest," LaBadie says. "Here they look and function differently and you need to use native plants that can take a lot of water at one time and then no water at all. Some people feel that porous pavement doesn't work as well in dry dusty environments because the pores clog. You need to choose places to use it carefully."

LaBadie organized a focus group to bring key players together from the Albuquerque area to discuss possibilities and barriers to the success of LID concepts. "We were able to host a focus group for over 3.5 hours and because we could offer food, our participants were able to meet over lunch to minimize their own time commitments. The [WRRI] funding really helped," she says.

The focus group was diverse and bringing them together was a first. "I learned a lot about the challenges they face in terms of knowledge, staff, budget, and other considerations. The focus group approach allowed me to document and analyze these challenges and concerns." Not all LID techniques will be equally useful, she concludes in her project report. But there are enough options to make the concept work in our arid climate.

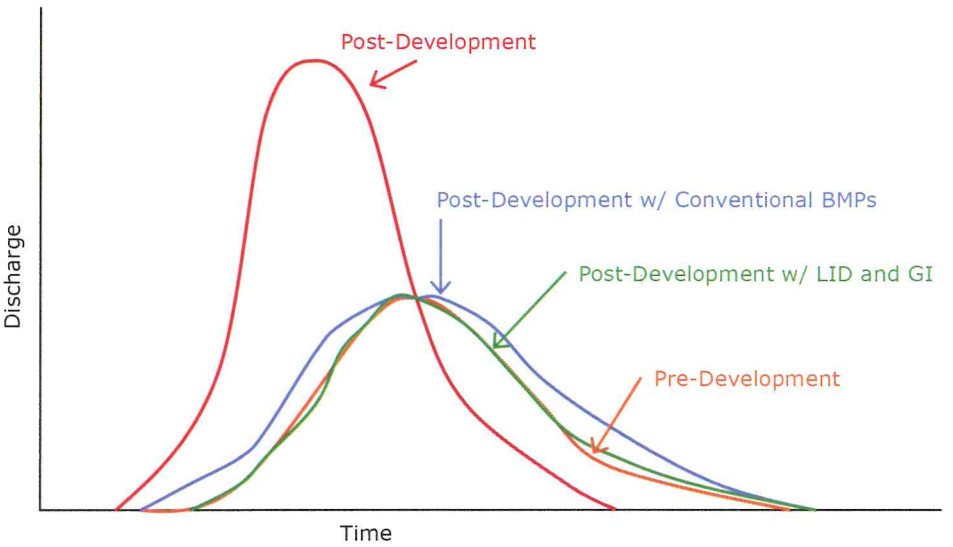
"With LID you need the involvement of landscape architects, arborists and native plant experts, architects, developers, engineers, and builders to fit techniques into building and landscape design. You need policy people involved to change current regulations and practices. You need staff involved to address issues of long-term maintenance. There is also a huge education and communications component to reach the general public and tell them why it's important. You must coordinate and collaborate with these diverse groups. It's extremely difficult," she says.

One obstacle facing the LID/GI concept is the legal framework established from the perspective of keeping flows in the river to meet treaty obligations. LaBadie describes the current policy as "brief," but believes the issue can be resolved with a more specific statement from the office of New Mexico's State Engineer John D'Antonio. He plans to discuss the issues with participants at an upcoming LID/GI workshop in March.

"You can look at water in the river and water keeping the urban environment more green as part of the same system. If you don't allow the harvesting of stormwater for use in the urban landscape, people are going to use groundwater or water from the river. All these things are connected," she says.

"KT's work has shown that information specific to the Southwest needs to be disseminated to planners, landscape architects, architects, engineers, policy professionals, and the general public on the benefits of keeping stormwater on the landscape," says William Fleming, Associate Professor for UNM's School of Architecture and Planning and LaBadie's advisor. "The need for the Office of the State Engineer to change its policy on stormwater use is particularly important."

Following publication of her professional paper, LaBadie has moved on to her next project, maintaining a website for the upcoming LID/GI March 24 workshop. She is also a planning committee member for the workshop and will present her research at the event. (To learn more, go to: aridlid.org) The website will be used to keep resource lists, information on case studies, and information on regulations and requirements. "We hope to keep it going to keep people informed even after the workshop," she says.



Roofs, roads, parking lots, and other impervious city surfaces mean water peaks more quickly (red line) and runoff terminates more rapidly than runoff prior to development (orange). The blue line shows how runoff can be affected by current best management practices and how those practices compare to low impact development and green infrastructure measures (green). (Modified from: LIDC 2007)

Model Uses Radar to Reveal Transport through Aquifers

By Steve Carr, UNM

It doesn't take Nicholas Engdahl long to grasp an idea and run with it. When his former advisor Gary Weissman, an associate professor in the Earth and Planetary Sciences Department at the University of New Mexico, suggested Engdahl look at ground penetrating radar (GPR) and geostatistical modeling to determine how contaminants move through an aquifer, Engdahl quickly took hold of the idea.

Although it sounds relatively easy, Engdahl had some challenges to overcome with the research, starting with the need to build a model that had features below the scale of many of the standard methods for modeling an aquifer's structure.

"The question became how we resolve an unresolveable feature of an aquifer like cross beds," said Engdahl. "The method we came up with used two of the common tools for subsurface description: ground penetrating radar and geostatistics."

Geostatistics are often used to recreate an entire aquifer, but they are usually based on sparse data and cannot reproduce sedimentary structures at the centimeter scale. On the other hand, GPR is really useful for picking contacts in the subsurface, but isn't as reliable for describing the flow properties of the subsurface.

Using ground penetrating radar images to obtain the three orientations relative to flow (parallel, perpendicular, and oblique), Engdahl generated five models from four survey methods in each orientation. The methods used in each direction were identical. The process began with the creation of a subsurface model, since there is uncertainty in the configuration; they used more than one "realization" of the aquifer to look at the possible range of results.

"When evaluating flow and transport numerically, we have to choose boundary conditions for the model that control the internal behavior of the model. The boundary conditions had to be changed for each orientation to drive flow in the correct direction," explained Engdahl.

The transport model also required Engdahl to "release" a numerical tracer into the model. The transport problem also needs boundary conditions that control where the tracer is released and how it exits the model. For simple transport analysis, a one-dimensional breakthrough curve is used to describe the behavior of the model.

Nick is shown hauling equipment used for GPR surveys. He is an Albuquerque native and completed a master's degree from UNM in May 2009. He is now pursuing a Ph.D. at the University of California - Davis. Nick worked at the USGS office in Albuquerque for the past four years.

"This is equivalent to letting your tracer go at one end of the model and watching the concentration at the other end," said Engdahl. "The shape of the resulting curve is the data we need to understand transport along that path."

The groundwater at the site flowed through a sandy or silty aquifer, which makes a pretty good aquifer because it can store a relatively high amount of water. However, it tends to flow slowly compared to a gravel aquifer.

"In terms of the actual path the water takes, we quantify that with something called the tortuousity, which is the ratio of the length of the actual path the tracer takes to the straight

line distance traveled," he said. "A bigger number means the tracer had to go over, under or around more portions of the model, and a smaller number means a straighter path was taken."

"The idea was to use the strengths of each survey method to compliment the uncertainties of the other method," explained Engdahl. "In the end, we used the GPR to find the contacts between individual periods of deposition and then used geo-statistics to "fill-in" the space between the bounding surfaces. The method was able to represent explicitly realistic sedimentary features, like channel scours and cross-bed sets, that we see in outcrop analogs for deposits similar to the Rio Grande."

The new models provide a way of understanding what's happening at a small scale, which helps to properly account for transport on a larger scale.

"If we were going to build a larger scale model of transport along the Rio Grande, we now know that transport in certain directions should be faster than others and we can enforce that kind of knowledge in future transport modeling codes," said Engdahl. "That's not to say that our model is perfect. We can always improve it but it provides a useful framework for evaluating directional effects in fluvial aquifers."

Fickian and non-Fickian describe the transport modality in the research. Fickian transport predicts that the shape of the breakthrough curve should be a Gaussian curve (the bell curve). "But this is often found not to be true in the lab or field, even for homogeneous aquifers," said Engdahl. Non-Fickian or anomalous transport is a term that describes transport that doesn't exhibit the Gaussian shape.

"The relation to our study was that the breakthrough curves for our models all exhibited shapes that weren't Gaussian," said Engdahl. "We found that as we rotated the flow field, the transport changed to become more or less Gaussian depending on which way we rotated."

These kinds of models won't change the way hydrologists look at regional water management or usage, but they can be used to refine larger scale models, which do a better job of predicting transport paths, Such models are of great importance to the challenge of contaminant transport and remediation.

"What we've shown is that by doing a better job of describing the small-scale features of an aquifer and by determining the correct form and parameters of the transport equations to use Fickian or non-Fickian, we can build better transport models," said Engdahl.

Editor's Note: Nicholas Engdahl was one of twelve students who received funding through the WRRI 2009 Student Water Research Awards program. Unfortunately, the New Mexico state legislative appropriation for this program was eliminated in 2010. The New Mexico WRRI is working to reinstate funding for this program in the near future.

Mark Your Calendars

55th Annual New Mexico Water Conference
How Will Institutions Evolve to Meet Our Water Needs in the Next Decade?
December 1-3, 2010, Corbett Center, NMSU
conference information to be posted soon at
http://wrri.nmsu.edu

April 8, 2010 – NM Riparian Council meeting and fieldtrip to Las Huertas Creek, Placitas, NM
www.riparian council.org

May 17-21, 2010 – Rio Grande Basin Initiative Annual Meeting, Sul Ross, TX
http://aces.nmsu.edu/rgbi/

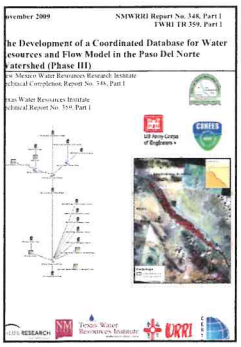
July 13-15, 2010 – UCOWR/NIWR 2010 Annual Conference: HydroFutures: Water Science, Technology, and Communities, Seattle, WA
www.ucowr.org

August 3, 2010 – New Mexico Water Research Symposium: Resource Interdependence, Macey Center, NM Tech, Socorro, NM
http://wrri.nmsu.edu/conf/tc10/symposium.html

September 1-4, 2010 – Arizona Hydrological Society Symposium, Dryland Hydrology: Global Challenges/Local Solutions, Tucson, AZ
http://www.azhydrosoc.org/2010_symposium.html

WRRI Recent Publications

The WRRI has published several technical reports recently. These publications are peer-reviewed completion reports resulting from WRRI funded projects. All reports are available online at: http://wrri.nmsu.edu/publish/publications.html.



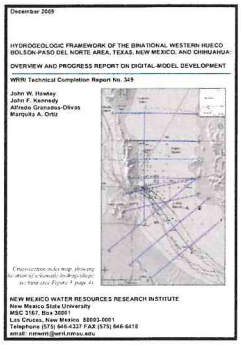
The Development of a Coordinated Database for Water Resources and Flow Model in the Paso del Norte Watershed (Phase III)

November 2009 - This is a three-part report co-published by the New Mexico WRRI (Report No. 348) and the Texas Water Resources Institute (TR 359)

Part I: Lower Rio Grande Flood Control Model [LRGFCM] RiverWare Model Development by S. Tillery, Z. Sheng, J.P. King, B. Creel, C. Brown, A. Michelsen, R. Srinivasan, and A. Granados Olivas

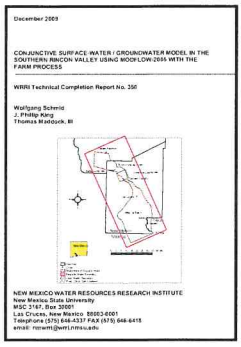
Part II: Availability of Flow and Water Quality Data for the Rio Grande Project Area by S. Tillery, Z. Sheng, J.P. King, B. Creel, C. Brown, A. Michelsen, R. Srinivasan, and A. Granados Olivas

Part III: GIS Coverage for the Valle de Juárez Irrigation District 009 Chihuahua, México by A. Granados Olivas, Z. Sheng, B. Creel, C. Brown, A. Michelsen, and R. Srinivasan



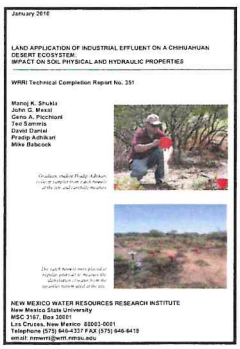
Hydrogeologic Framework of the Binational Western Hueco Bolson-Paso del Norte Area, Texas, New Mexico, and Chihuahua: Overview and Progress Report on Digital-Model Development

December 2009 - Report No. 349 by J.W. Hawley, J.F. Kennedy, A. Granados-Olivas, and M.A. Ortiz



Conjunctive Surface-Water/Groundwater Model in the Southern Rincon Valley Using Modflow-2005 with the Farm Process

December 2009 - Report No. 350 by W. Schmid, J.P. King, and T. Maddock, III



Land Application of Industrial Effluent on a Chihuahuan Desert Ecosystem: Impact on Soil Physical and Hydraulic Properties

December 2009 - Report No. 351, M.K. Shukla, J.G. Mexal, G.A. Picchioni, T. Sammis, D. Daniel, P. Adhikari, and M. Babcock

Funding Opportunities

USGS FY 2010 National Competitive Grants Program
Proposals due April 7, 2010

Matching grants support research on the topics of water supply and water availability. If interested, contact Karl Wood at WRRI (575-646-4337). The RFP is available at https://niwr.net/competitive_grants/RFP

Bureau of Reclamation 2010 WaterSMART Program
Proposals due May 4, 2010

Proposals for projects that seek to conserve and use water more efficiently, increase the use of renewable energy in water management, protect endangered and threatened species, facilitate water markets, and carry out other activities to address climate-related impacts on water or prevent any water-related crisis or conflict. The funding opportunity is available online at www.grants.gov

NIWR and IWR, U.S. Army Corps of Engineers Water Resources Research Competitive Grants Program, FY 2010 Request for Proposals
Proposals due June 1, 2010

Applied research proposals for specific areas related to water resources issues in the U.S. The program promotes collaboration between the IWR and university scientists in research on significant national and regional water resources issues. If interested, contact Karl Wood at WRRI (575-646-4337). The RFP is available at http://wrri.nmsu.edu/news/IWR-NIWR_2010_RFP.pdf

NMSU Conducts Advanced Water Treatment Research with Reclamation

By Audry Olmsted, NMSU University Communications

New Mexico State University has partnered with the Bureau of Reclamation on a $5 million cooperative agreement to develop technologies that will provide the citizens of New Mexico and the southwestern region with more affordable, potable water.

"One of the critical parameters for the growth and sustainability of communities is water," said Abbas Ghassemi, director of NMSU's Institute for Energy and the Environment and WERC. "Without water, we would not be able to maintain our standard of life, we would not be able to feed ourselves, and we would not be able to have energy. Water is the most vital resource we have."

Through the agreement, NMSU and the bureau will conduct advanced water treatment research at the Brackish Groundwater National Desalination Research Facility in Alamogordo, using the facility as a laboratory to study research, demonstration, education and outreach opportunities with brackish and impaired water.

Brackish water is salty, but without the amount of salinity as ocean water. For example, ocean water may have a total dissolved solids measurement between 35,000 and 40,000 milligrams per liter, whereas inland areas, like the Tularosa Basin, may have a TDS between 1,500 to 4,000 milligrams per liter.

In recent years, Reclamation has been expanding the search to augment water resources for the Southwest and desalination opportunities inland.

Ghassemi, who is the principal investigator with NMSU on the agreement, said former U.S. Sen. Pete Domenici and U.S. Sen. Jeff Bingaman charged the Bureau of Reclamation to develop a national research facility that would develop and demonstrate novel and affordable technologies to ensure water resource availability by utilizing inland water desalination. Areas like the Tularosa Basin are ideal sources of brackish water.

Through the agreement, NMSU and the bureau will look at new technologies that are cost-effective, easy to deploy, have low maintenance and are reliable. The team is gearing the research toward small communities and rural areas to give all New Mexicans a chance to maintain their way of life and not feel forced to move to areas with more resources, Ghassemi said.

NMSU and the Bureau of Reclamation will also look at challenges posed by brackish water such as developing pre-treatment and treatment technologies, the evaluation of renewable energy, technically and economically sound concentrate management, sustainable water and environmental awareness.

Ghassemi said they want to provide outreach to the communities and keep them informed about the progress of work associated with the agreement. Another goal, he said, is to offer formal and informal classes to students at NMSU in order to educate and train them in water-related degrees so they may continue the work being laid down through this cooperative agreement.

Ghassemi said that with the help of his collaborators Karl Wood, director of NMSU's Water Research Resource Institute, and James Loya and Karen Mikel, both project managers for WERC, the project has picked up momentum and is moving forward.

"We really have a lot of depth and breadth in water research, water education, water policy and water issues. This grant will culminate all of that together and put NMSU at the center of inland water research as related to brackish water," Ghassemi said. "A lot of universities claim that they are national centers, but they don't have that national facility. NMSU will have that national presence working with the agencies charged with water augmentation."

Left: Bureau of Reclamation Commissioner Michael L. Connor and NMSU President Barbara Couture signed an agreement recently to conduct advanced water treatment research at the Alamogordo facility. Right: Senator Jeff Bingaman, along with former Senator Pete Domenici, was instrumental in the development of the desalination research facility.(Alamogordo Daily News photos by JR Oppenheim)

Call for Presentation and Poster Abstracts

2010 New Mexico Water Research Symposium: Resource Interdependence

August 3, 2010

Macey Center
New Mexico Tech
Socorro, NM

The *2010 New Mexico Water Research Symposium: Resource Interdependence* will be held at the Macey Center on the New Mexico Tech campus on August 3, 2010. Abstracts for consideration for presentations and/or posters will be accepted through June 30, 2010.

Although abstracts related to any and all water research and management topics will be considered, this year's symposium will emphasize resource interdependence. Projects and models that address the interconnections among water, energy, and food systems are especially encouraged as is research that focuses on the impacts of climate variability and change on water resources.

This year's symposium is dedicated to the memory of Bobby J. Creel, longtime staff member of the WRRI (1986-2010). Dr. Creel was a devoted mentor to many undergraduate and graduate students over his long career in the water resources field. In his honor, a session will be devoted to water resources education in New Mexico and throughout the region. Abstracts relating to water resources education at any grade level are encouraged for inclusion in this special session.

Abstracts must not exceed 250 words and must be submitted online at http://wrri.nmsu.edu/conf/tc10/symposium.html. All accepted abstracts will be made available to participants. Presenters whose papers are accepted for oral presentations will be limited to a 20-minute talk.

All speakers and poster presenters must register for the symposium by July 29, 2010. The registration fee for everyone, including speakers, poster presenters, and other attendees is $20. The fee will be waived for students presenting an accepted paper or poster. The fee includes lunch, breaks, and a notebook with abstracts. All registration is online at http://wrri.nmsu.edu/conf/tc10/symposium.html. Final symposium agendas will be emailed to all poster presenters and speakers in late July and will be posted on the WRRI website.

We encourage you to share this call for abstracts with your colleagues and students.

Sponsored by the NM Water Resources Research Institute

In cooperation with Los Alamos National Laboratory, Sandia National Laboratories, University of New Mexico, New Mexico Tech, New Mexico State University, New Mexico Interstate Stream Commission, New Mexico Office of the State Engineer, U.S. Geological Survey, and American Water Resources Association–New Mexico Section.

Abstract Deadline - June 30, 2010

Notification of Acceptance - July 16, 2010

Online Registration Deadline - July 29, 2010

Symposium Reception & Poster Setup - August 2, 2010

Posters can be set up between 4:00 and 6:00 p.m.
Join your colleagues and get a bite to eat during this time.

Symposium - August 3, 2010