SESSION ONE

Setting the Stage: Where is the Water and How Much Do We Have?

Moderated by Phil King, New Mexico State University

Phil King is a Professor and Associate Department Head in the Civil Engineering Department at New Mexico State University, where he has been since 1990. He specializes in water resources engineering, and in addition to teaching, research, and service, he works as a consultant with Elephant Butte Irrigation District. Phil has PhD and MS degrees in agricultural engineering from Colorado State University, a BS in civil engineering is from Berkeley, and an MBA from NMSU. He served in the Peace Corps, as a Science and Technology Policy Fellow with AAAS at the National Science Foundation, and he is currently a Bill Daniels Fellow for Ethics.

New Mexico's Water Budget

Sam Fernald, NM Water Resources Research Institute

Sam Fernald was appointed interim director of the New Mexico Water Resources Research Institute (NM WRRI) in January 2011. As interim director, he will lead the institute in its mission to develop and disseminate knowledge that will assist the state, region, and nation in solving water resources problems.

The NM WRRI, one of 54 water institutes in the nation, encourages university faculty statewide to pursue critical areas of water resources research while providing training opportunities for students, and transfers research findings to the academic community, water managers and the general public. Professor Fernald also is a faculty member in the Department of Animal and Range Sciences at New Mexico State University.

Dr. Fernald's earned degrees include a 1987 B.A. in international relations from Stanford University, an M.E.M. in 1993 in water and air resources from Duke University, and a

I will start this morning with the drier part of my talk: water budgets. Figure 1 shows New Mexico's water budget—water coming into and water going out of the state. This diagram was produced by Bobby Creel of NM WRRI in 2005. In a typical year, we have 85.3 million acre-feet of precipitation, with most of that, 82 million acre-feet, going back to the atmosphere through evaporation from water, soil, and plants and transpiration—water that goes through plant roots up to the atmosphere. New Mexico receives 2.4 million acre-feet river inflow annually, and 3.4 million acre-feet on an average annual basis goes to downstream neighbors for compact deliveries. The state also loses another million acre-feet in deep percolation and other losses. An acre-foot is defined as the volume of water that would cover one acre to a depth of one foot. When it's all said and done, on average we have 1.2 million usable acre-feet of surface water in New Mexico.

One of my key points is that we have multiple perspectives concerning water and all are valid. If you look at the state's water withdrawals, we have about 2 million acre-feet of surface water withdrawals. Given that I just said we have 1.2 million acre-feet of usable water, how can that be? This is due to reuse of water. For example, we have studies of acequia irrigation in northern New Mexico where water is diverted from the Rio Grande, put into fields, with water seeping through fields and ditches, and in some of the wettest situations, only 7 percent of the diverted water is actually used and eventually goes back to the atmosphere. In other extremely efficient cases, we have nearly 100 percent consumptive use. So even though we have 1.2 million acre-feet of surface water hydrologically, in terms of withdrawals, we can have up to 2 million acre-feet, more or less, of surface withdrawals for the whole state.

Ph.D. in watershed science from Colorado State University in 1997. His primary research interests include water quality hydrology; land use effects on infiltration, runoff, sediment yield, and nonpoint source pollution; and effects of surface water/ groundwater exchange on water availability and water quality. Dr. Fernald received a Fulbright Scholarship to Patagonian National University, Trelew, Argentina in 2008, and another Fulbright Scholarship to the University of Concepcion, Concepcion, Chile in 2000.

Dr. Fernald currently is leading a multi-institutional, five year, $1.4 million water research project funded by the National Science Foundation. In addition to NMSU, partners in the study include the University of New Mexico, New Mexico Tech, Sandia National Laboratories, the New Mexico Acequia Association, and the Maxwell Museum.

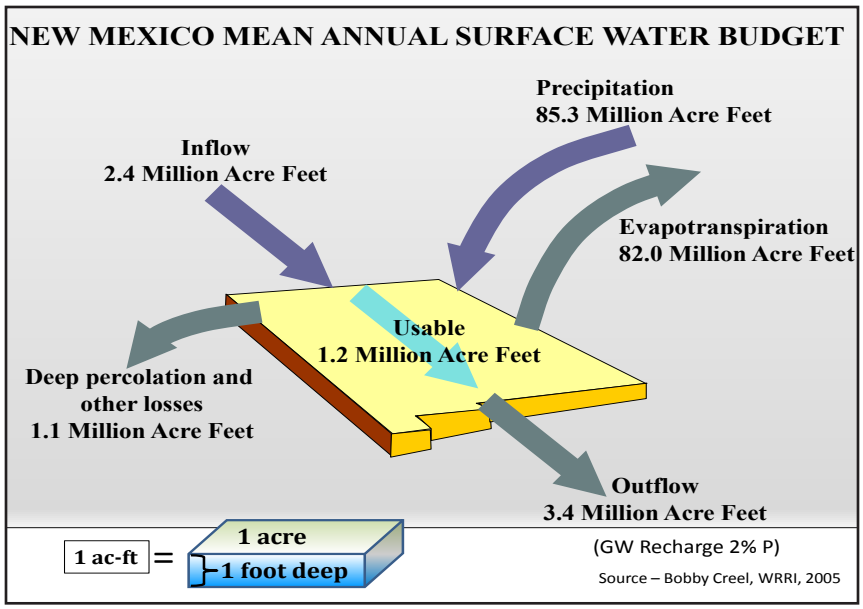


Figure 1. New Mexico mean annual surface water budget

Figure 2 shows New Mexico's water withdrawals for 2005 with agriculture using about 78 percent, public water supplies accounting for a little over 8 percent, and 1 percent for commercial/industrial, mining, power, domestic wells each. How do we get close to 4 million acre-feet of withdrawals with only 1.2 million usable acre-feet available? Groundwater makes up that difference. Groundwater is like a savings account or trust fund that we're drawing on and not saving for a rainy day. Groundwater has become part of our regular water withdrawals and represents about 47 percent of New Mexico's annual withdrawals. Thus different perspectives that are seemingly at odds, if looked at hydrologically, they can be compatibilized, if that's a word.

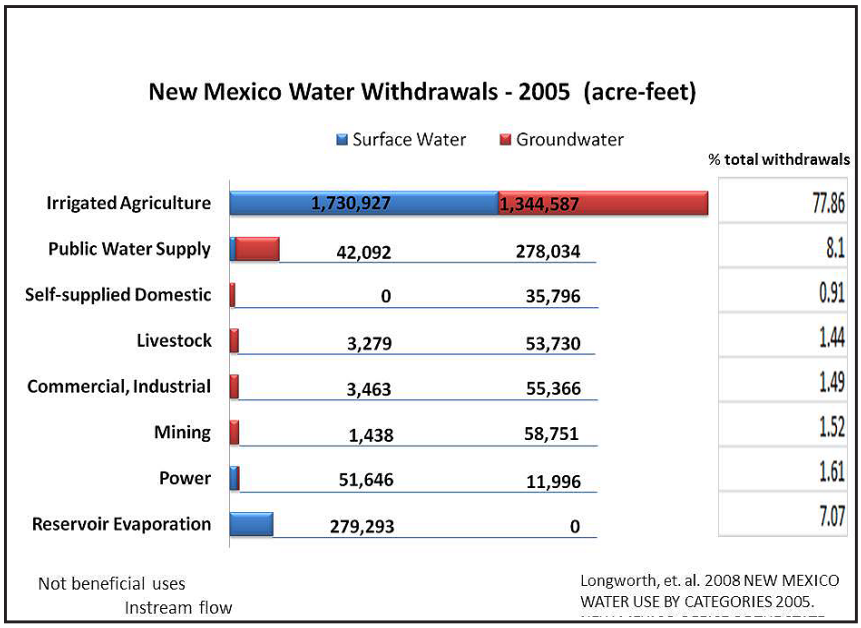


Figure 2. New Mexico water withdrawals - 2005 (acre-feet)

We have a groundwater sustainability story here in the Mesilla Valley—Burn Lake was formed when the water table was perforated during freeway construction and the excavation pit turned into a lake. During the drought in the 1950s, water levels in the Mesilla Valley dropped, and then came up in the 60s. After recovery in the 80s and 90s, the 2000s have seen water levels in the Mesilla Valley drop, and just this spring, Burn Lake dried up. We lost our visible, daily connection to the groundwater, to the water table—an indicator of sustainability.

If we maintain a connection between groundwater and surface water in our rivers, on an annual or multi-year basis, it's an indicator that we have sustainable groundwater use (Fig. 3). If we go over that into groundwater mining, we've lost our connection to the groundwater. Are we going to use our groundwater like a savings account that we want to build up and keep about the same balance, or do we want to spend it? This is a big part of our water management.

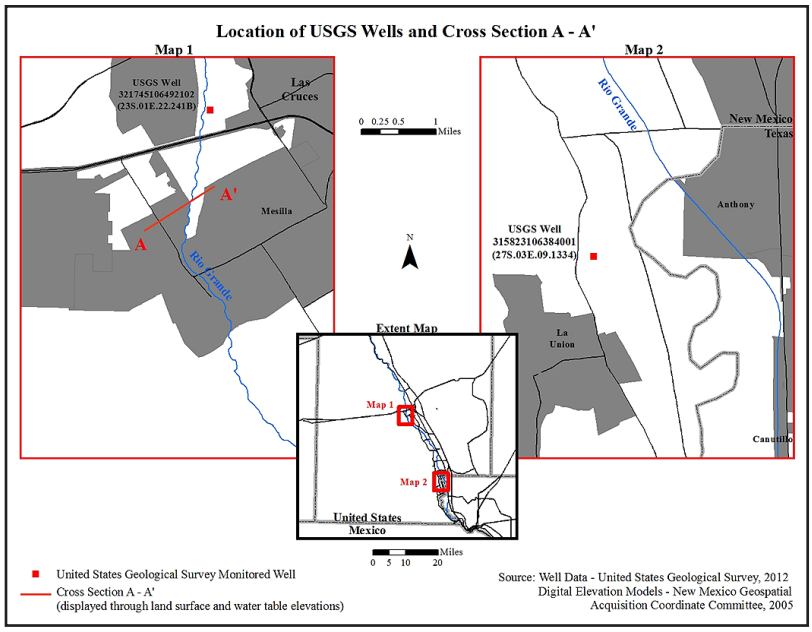


Figure 3. Location of USGS wells and cross section A - A'

To manage New Mexico's water, we must have all perspectives represented, and it's why this conference is so important. We really need to have all of the perspectives in this room. Consider examples in Roswell or the Taos valley where we have settlements after many years of negotiations, but are the solutions reflecting all the perspectives? I appreciate Senator Udall's perspective on this: instead of going to court, I'm going to the workshop room and bringing these perspectives together.

When we talk about solutions, a couple things come to mind that the Water Resources Research Institute is interested in—of course, research. We don't have a good map or quantification of our state's aquifers and our groundwater availability. How do we plan without having a good tabulation of what groundwater is available, both brackish and fresh?

We also don't have a good handle on variability. There is no normal year concerning our water sources; we have river flow that varies dramatically, precipitation that varies spatially and temporally, and our groundwater availability and use varies spatially. We need to document that variability. We need to come together just like we're doing today and get these perfectly-valid-at-the-same-time perspectives together to confront water management.

Climate Change

Dagmar Llewellyn, Bureau of Reclamation

Dagmar Llewellyn is a hydrologist, with an educational background in geosciences and civil engineering, and post-graduate studies in climate dynamics, paleo-climatology, river restoration, GIS, and water law and management. For the past 12 years, her work has focused on water-management and endangered-species issues in the Middle Rio Grande of New Mexico. Her work has involved water supply and demand evaluation, groundwater/surface-water interaction, irrigation efficiency, habitat and hydrologic requirements of endangered species, and accounting under the Rio Grande Compact. After 25 years in environmental and water-resource consulting, her interest in working for the federal government was sparked by the passage of the SECURE Water Act, which assigned to the Bureau of Reclamation a west-wide evaluation of the potential hydrologic implications of climate change. Since 2010, she has worked at the Bureau of Reclamation on programs authorized under the SECURE Water Act, as well as on Middle Rio Grande water management and endangered species issues. Dagmar is a member of the West-Wide Climate Risk Assessment (WWCRA) Implementation Team and a listed author on the SECURE report to Congress. She currently serves on the WWCRA Ecological Resources Team, which seeks to

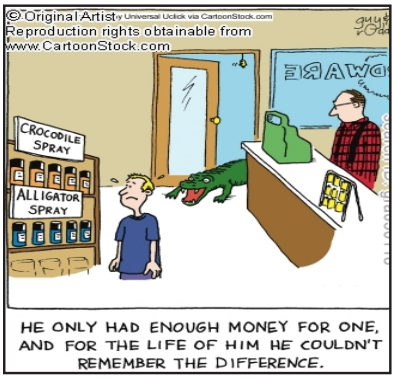
Good morning, everyone. I have some highly technical slides that I think Sam's daughter would approve of. Climate change is a topic that we like to find ways to avoid talking about but to some degree it is why we are all here today. It's incumbent upon us as scientists, engineers, and water managers to tackle the problems the climate change presents for our water supply.

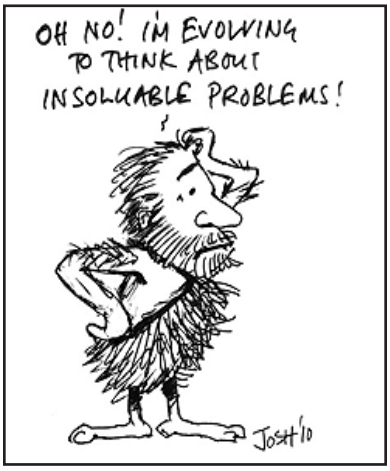
I'd like to introduce a particular work by Reclamation that came out of the passage of the SECURE Water Act by Congress in 2009, the Upper Rio Grande Impacts Assessment, which is a component of the West Wide Climate Risk Assessment, and a WaterSMART program. In the West Wide Climate Risk Assessment, we are trying to assess the hydrologic impacts of climate change, in major Western river basins, and in the Upper Rio Grande Impacts Assessment, we are doing so specifically on the Rio Grande in Colorado and New Mexico. Our report will be coming out within the year, and we are looking for partners amongst all of you to work with Reclamation to develop adaptation strategies to the hydrologic impacts that it projects.

This afternoon, Howard Passell will talk about some specifics of this study and present some ideas we have developed for possible adaptation strategies. Also, poster number 31 in the hallway presents some details of our analyses.

Climate change is, by definition, highly uncertain and what we need to do in environmental and water resource work is move forward anyway, embracing that uncertainty. As

determine ways to systematically evaluate climate-change impacts on ecological resources in the western US. She is co-lead of the Rio Grande Climate Impact Assessment, and Reclamation's project manager for the Santa Fe Basin Study. She is also Reclamation's project manager for an effort to enhance operations modeling for the Middle Rio Grande to support climate-change analysis.





a community, we have embraced the idea of adaptive management as a way of moving forward with our work in the face of uncertainty. As adaptive management is defined currently, it is not quite applicable to climate change because of the timescales involved. However, we need to develop some variant of that process that allows us to step forward in the face of uncertainty to begin to develop solutions to the challenges posed by climate change.

Taking action under uncertainty involves risk, whether we do something, or do nothing, or act on all of our options. We need to find a way to move forward to solve unsolvable problems. Discussions about climate change are very often about attribution...who is at fault...who believes...and who denies. I am not here to talk about those things. I'd like instead to look at some of the things that are common to all of the projections of our future climate and water supply, including Reclamation's current study, to help us move forward based on that common ground.

The first of these commonalities is that our usable, manageable life supply of water is going to decline or is declining already. We count on snowpack and the storage of that snowpack, both in the mountains and in our reservoirs, to provide us with our water supply for summer irrigation and recreation. That decline in our water supply and our ability to store it is occurring at the same time as our demand is increasing—so there is a growing gap between water supply and demand. As Sam pointed out, we respond to such gaps with an increased reliance on our nonrenewable groundwater resources. The use of those resources, in turn, will impact our surface water supply.

Further, it is projected that our state's water supply is going to be subject to increased uncertainty and increased variability, and it is a highly variable system to start with. Senator Udall referenced the graph on historical drought that recently appeared in the *New York Times*. The graph showed the drought and heat we've been experiencing over the last couple of years and how we are already outside of the historic norms for drought frequency.

A recent paper by Craig 2010 put it this way: "We are entering a world of continual, unpredictable, and nonlinear transformations of complex ecosystems." We are dealing with an already highly variable system that is stepping into even more variability and uncertainty. We must plan for those challenges as well as for changes in the spatial and temporal distribution of our water. The global models that we used for our projections don't really show this, but there's been some speculation about potential strengthening of our summer monsoons. We are not currently capable of making use of this possibility because our storage is upstream expecting snowpack. But this could present an opportunity for management changes that help us adapt to the future.

Another finding in our Upper Rio Grande Impacts Assessment is that San Juan-Chama project water is looking to be more reliable than our native Rio Grande water. This would have real socioeconomic implications in our basin. But again, this understanding is something that we can work with in our planning, as we try to distribute our water as fairly as we can.

Finally, feedbacks can lead to cascading impacts, and we've seen this sort of thing recently in New Mexico. More intense droughts and higher temperatures can lead to moisture deficit in our trees. These trees are then susceptible to beetle infestations. And the weakened and dead trees are susceptible to catastrophic wildfires. Thunderstorms tend to build up over the fire scars because they're black and they heat up. Then we have large rainstorms on top of the fire scars, which can lead to debris flows and to the flow of ash and debris into the river. The ash in the river can decrease the oxygen supply and lead to fish kills. Debris flows can dam tributaries and decrease our available supply downstream. In our management, we have to be cognizant that every action, everything that we change, has potential cascading consequences. Finally, everything impacted by climate change is compounded by all of the other changes that we're making to our landscape.

It is time to develop our plan.

Deteriorating Water Infrastructure and Impact on Supply

Del Archuleta, Molzen-Corbin Associates

Del Archuleta is a native New Mexican, raised in Clayton. He began his professional engineering career 36 years ago after completing his master's degree in civil (environmental) engineering at New Mexico State University in 1975. In 1990, he received NMSU's Emeritus Faculty Distinguished Alumni Award; in 1995 he was inducted into the Honorary Academy of Civil, Agricultural, and Geological Engineering; in 2004 he was named NMSU's Distinguished Alumni for the College of Engineering ; and in 2010 he received an honorary doctorate. He also served on the NMSU Board of Regents from 1996-2002, serving as president for two years. Del has been with Molzen-Corbin since 1975 and within 10 years, he became CEO and majority stockholder. Among other honors, Molzen-Corbin has been consecutively named one of the "500 Largest Hispanic-Owned Companies" by Hispanic Business Magazine for 19 years.

Thank you, Dr. King, for that introduction. My name is Del Archuleta, CEO of Molzen-Corbin Associates, and graduate of New Mexico State University. For the last 37 years, I've had the best job in the world getting to work with New Mexico's municipalities and local water systems all over the state, from little villages up to our largest cities. Hopefully I've added some value in managing and planning their water systems.

My topic concerns how we get water to the consumer in these communities and the status of the state's water supply infrastructure. A recent report by the New Mexico Section of the American Society of Civil Engineers presented the results of a survey conducted by a group of 50 professional engineers. Some interesting findings include the fact that 95 percent of community drinking water systems utilized a groundwater source, but 43 percent of the actual consumers served also consumed surface water. That's due, of course, to the larger systems in Albuquerque, Santa Fe, and other larger cities. Also, the report noted that a substantial portion New Mexico's infrastructure is over 60 years old and it was never intended to last that long. Thirteen percent of groundwater and surface water is allocated to drinking water and 70 percent or so goes to agriculture.

The survey looked at work categories such as capacity, condition, funding, operation and maintenance, public safety, and resilience. Overall they gave the entire system that they surveyed a C-. But with regard to the condition, capacity, and the safety and resilience categories, they gave it a C, or average grade. Regarding condition, funding, and operation maintenance—and operation maintenance in this case is really a category of funding, having the money to be able

to operate and maintaining systems—the score given was a D, or poor. That doesn't come as a surprise to many of us because we could find similar sorts of grades for other systems. The C grade for capacity, safety, and resilience doesn't really surprise me because what that's really about is making sure that we supply water to the consumer on a day-to-day basis and if that's not happening, if well or line goes out to particular user, elected officials hear about it. And we find the way to fix the problem.

But what is really concerning to me is the poor grade when it comes to preventative maintenance, the investment in infrastructure that is worth millions and millions of dollars that is being swept under the rug. One day this is going to catch up with us in New Mexico. Our infrastructure is in poor condition and it's not going to get better because in most places preventative maintenance is the last thing that we fund. We are not set up to fund maintenance and grants and other monies do not encourage budgeting for preventative maintenance. We have some of the lowest water user rates in the country in New Mexico, but we need to understand that we must start investing in maintaining our infrastructure.

Can we improve that situation? Certainly, and I want to offer three or four additional thoughts. First, we need to stress water conservation. Local governments are starting to do a pretty good job of requiring graywater, for example. But beyond that I think we need to have, perhaps at the federal or state level, more emphasis on leak surveys to make sure we have an accounting of what is going on with the water once we pump it or we take from the surface water or groundwater and it ends up with the consumer. We need more leak surveys, better watershed management, and funding should be done in a way that encourages better management. We need a data-driven system.

We need to do a better job with regard to planning and strategic execution. We have this silo mentality that's pretty common in lots of areas not just in this particular area. The federal government does a great job with the USGS and other agencies getting good data. The state has a state water plan and is running its programs, and local governments are working very hard within their own areas. But if we ran things as a business, we would do things very differently. We would cooperate if we really valued water as the senator pointed out earlier. Municipalities are required to have a 40-year water master plan and local governments do ICIP (infrastructure of capital improvement plans). Too often that's done as a check-the-box at the last minute deal as opposed to being data-driven or coming from the water master plans and appropriately signifying the highest priorities in local government.

If we were doing things more as a business, we would work together and understand where we should emphasize reuse in our state, where we should emphasize recharge, and where we should use surface water. We would understand our groundwater resources a lot better. And the funding mechanisms to help these communities would be geared in a way to encourage strategies that work in various parts of the state.

We need better coordination of funding. Currently the established programs are pretty good about requiring master plans and federal and

state money. But when it comes to capital outlay, as you know, we are a poor state and we have low water rates. We cannot afford to waste the little money we have. The way that capital outlay works in the state has been debated by the last administration and the current administration. We all understand that it's wasteful because instead of funding full projects that these communities need, they get a little bit of funding and then they can't use it, so it sits there for a long time. We have the same project requests year in and year out because we don't have enough money to fund the full project. I think we could do a lot better job of organizing and funding the needed projects.

Today we are going to hear about the need to use brackish water resources and we need to continue to encourage that use.

Lastly, let me say that the greatest recommendation I have is that as a state, as communities, and as individuals, we must face up to the true cost of water. We must understand the value of water. We need to allow our elected officials to budget adequately to run sustainable programs. The public must become educated in the true costs associated with these systems. We cannot continue to not budget for preventative maintenance, not allowing ourselves to have great systems. The people who are involved in these efforts do a great job with what they've got. They need more money and we need to allow them that money to do outstanding programs.

Thank you.

The Transboundary Aquifer Assessment Project

Mike Darr, U.S. Geological Survey

Mike Darr is a hydrologist with the USGS New Mexico Water Science Service Center, where he has served as Project Chief for the Trans-Boundary Aquifer Assessment Program (TAAP), helping to coordinate the efforts of research teams in Mexico, New Mexico, and Texas in the Mesilla Basin (U.S.) and Acuífero Conejos-Médanos (Mexico), as part of an international program to investigate hydrogeology and water resources in the border region. He earned his MS and BS degrees in geology from Northern Arizona University and the University of Texas. Mike has additional graduate coursework in biology from UNM and is proficient in Spanish and involved with cross-border initiatives in Latin America and the Caribbean. Most recently

My first figure shows that there are many aquifers that cross the United States/Mexico border. These aquifers occur in a similar way and are juxtaposed with political boundaries. Congress recognizes the critical nature of these transboundary resources and passed the Transboundary Aquifer Assessment Act in 2006. The goal of this Act is to provide sound scientific basis for appropriate management of these resources. The U.S. Geological Survey (USGS) was tasked as the lead agency to implement

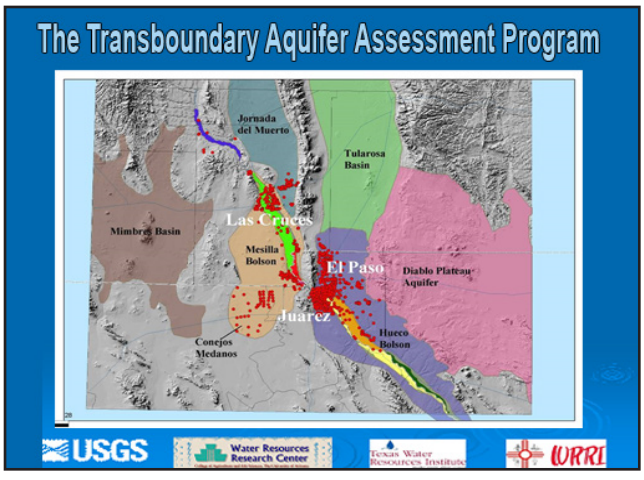


Figure 1. U.S./Mexico transboundary aquifers

he assisted with evaluating stream water quality effects from wildfire. Mike has applied debris-flow models to evaluate potential hazards from wildfire burn-scar areas in northern New Mexico.

the Act in association with the water resources research institutes here in New Mexico and also in Arizona and Texas. It was funded in coordination with the International Boundary and Water Commission (IBWC).

In New Mexico, we focused on the Mesilla Basin and its correlative in Mexico, the Conejos-Médanos aquifer. We recognize the numerous treaties that deal with surface water, which are closely watched and guarded. But we also recognize at the same time that there is very little in the way of groundwater understanding across these aquifers. We know through conjunctive use problems throughout our state and elsewhere that surface water and groundwater are intimately interrelated. The Transboundary Aquifer Assessment Program (TAAP) is focused on understanding those groundwater resources; to really get at the groundwater quantity questions and to help answer the questions of how much water we have and how we share it fairly.

Basically, in Arizona there were two basins analyzed, the San Pedro and the Santa Cruz and in New Mexico we focused on the Mesilla Basin and Conejos-Médanos. Figure 2 shows the Mesilla Basin on the left and the Conejos-Médanos on the right. What always astounds me about these diagrams is that there is always a blank spot on the map wherever the borders occur. It's the same aquifer and it is quite extensive as you can see from the diagram. The Mesilla (left) is shown on a model grid that has been developed by a number of researchers in the U.S. They worked on getting down to the minutia of the surface water/groundwater interactions and the aquifer characteristics on the U.S. side.

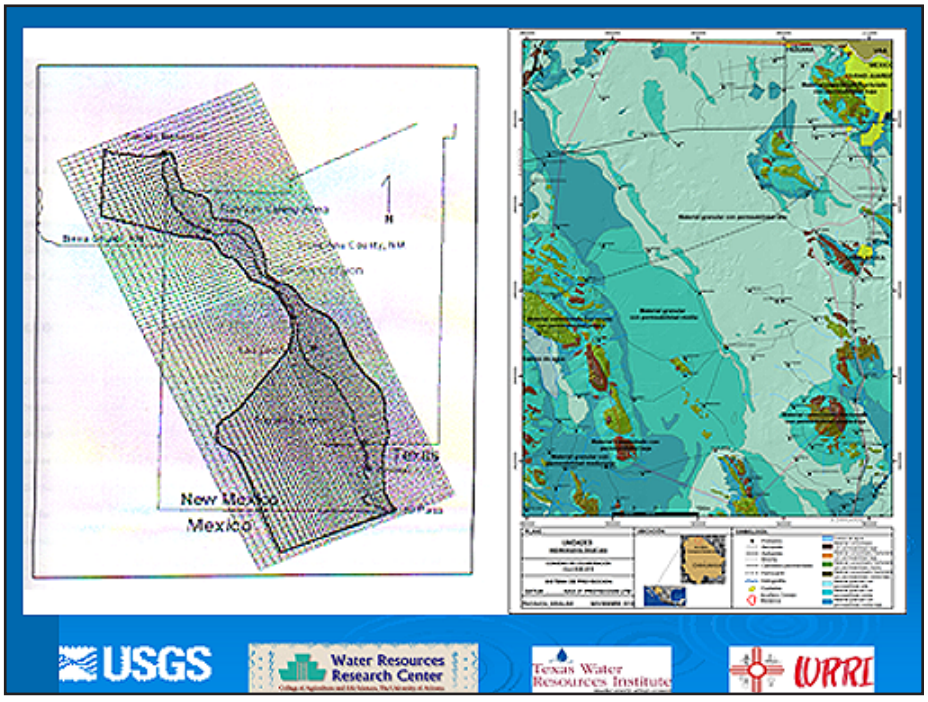


Figure 2. Study areas: Mesilla Basin (left), Conejos-Médanos aquifer (right)

As part of the transboundary program we were able to fund a regional hydrogeologic study through the Mexican geological service of the Conejos-Médanos Basin, which you can see in the figure with Juárez on the upper right. The basin is massive and extends quite a bit off to the south. This is a pioneer area in which both sides are trying to better understand the transboundary resource and to get a sound scientific basis on which to manage the resource.

The accomplishments of the transboundary work were limited by funding. Originally, there was a ten-year program that had an ambitious funding level. But at the end, only a couple million dollars were dedicated out of $50 million or so planned. We were still able to get quite a lot done with those limited resources and one of the main accomplishments was the regional hydrogeologic study on the south side of the Conejos-Médanos.

Another accomplishment was work done on a modeling study that helped to create a new tool for conjunctive water use management, which is integrated hydrologic modeling. The model accounts for all of the water all of the time, both surface and groundwater together rather than trying to partition them. Advances made in developing these new modeling tools were accomplished through the efforts of Randy Hanson and Wolfgang Schmidt.

Through the IBWC, the door has been opened to work with Mexico for data exchange, due in large part to the efforts of NM WRRI's previous director, Bobby Creel. Dr. Creel did so much to create an annotated bibliography and a shared database with Mexico. This has allowed people to share information that is being developed on both sides of the border. He also worked on updating the hydrogeologic work with John Hawley.

Another major accomplishment was an isotopic sampling study in much of Mesilla Park that we would have liked to have extended into Mexico. The study was done by John Bumgarner from USGS/Texas and involved environmental tracers, age, and surface water relationship definitions.

There is a lot of potential for additional advancements. In terms of next steps, an interim report to Congress is being prepared. Our wish list for future work involves continued work on the Mesilla and the Conejos-Médanos as part of the binational technical committees that were established. There is a lot of momentum there; there were a lot of contacts, and a lot of energy in the group that could be capitalized on. And in the next five years, if the program continues, we would like to begin work on the Mimbres and the Puerco.

Thank you.

Status Quo of Water Rights in Times of Shortage: Legal and Environmental Constraints

Steve Vandiver, Rio Grande Water Conservation District, Alamosa, CO

Steve Vandiver is a graduate of La Junta, Colorado High School and the University of Colorado with a BS degree in Civil Engineering (1972).

Steve worked for the Colorado Division of Water Resources as a hydrographer and dam safety engineer for 9 years, then 24 years as the Division Engineer for the Rio Grande Basin in Colorado for CDWR before retiring from the State. (1973-2005) He was on the initial Recovery team for the Rio Grande Silvery Minnow while serving as the Engineer Adviser for Colorado for the Rio Grande Compact for 14 years.

From 2005 to the present, Steve has been the General Manager for the Rio Grande Water Conservation District responsible for the Closed Basin Project local sponsorship. He is active in the Colorado Water Congress, the Intrastate Basin Compact Commission as well as a sponsor of the Groundwater Subdistrict formation and administration, the Habitat Conservation Plan for Southwestern Willow Flycatcher, and Natural Area administration with BLM on the river corridor along the RG from the Alamosa National Wildlife Refuge to the stateline. He is involved in Land Trust and River Restoration Projects throughout the basin.

Thank you and I appreciate very much being invited to speak today. I feel a little bit like the Lone Ranger as I look around the room and don't see any of my counterparts in the audience, but I do have a lot of friends here. I have a history here in New Mexico with my work as a Rio Grande Compact Engineer Advisor. I share your concerns and certainly understand a lot of the issues that are happening here. Unfortunately, Colorado is in the same situation as New Mexico as our dependence on surface supplies and groundwater supplies is incredible, and we are certainly outstripped in many instances in our ability to sustain our current system.

My topic here is to speak about the status quo of water rights in times of drought. I will suggest that there is no such thing as a status quo and you must have some kind of water rights system on which you can depend. Colorado is fortunate enough to have an adjudication system that goes back to the late 1800s, and we've been fortunate enough to keep that system going since that time. We not only have all of our surface water adjudicated but all of our groundwater adjudicated as well. We have a system in place and it provides a base from which we can operate. It is there day to day and from year to year and it's not something we have to guess about.

In Colorado we have is a very strong state engineer system that has division engineers and water commissioners in each of the drainage basins. They actually go out and administer water rights in priority; they have a hydrographic staff that keeps track of hundreds of gauging stations around the state and many in the San Luis Valley. We've also been fortunate to have put in a satellite monitoring system that records and monitors virtually all of the main diversions on the Rio Grande. We have the ability, on a day to day basis, to know where the water is in the system and who is diverting it. Plus we have a very strong system of allocation under our priority system to serve those water rights and priority.

The problem comes obviously in times of drought. I've been in the San Luis Valley since the early 70s and we've been in drought much more than we've been in ample years. Our priority system is first and foremost our allocation system. I've seen an open river where all water rights were being served, or when everyone was satisfied, only twice in forty years. Our priority system never goes away. It starts the first day of the irrigation season and continues throughout the entire year.

Throwing in Compact obligations on top of that, Colorado actively administers and curtails even pre-Compact surface rights in order to meet our Compact obligations to New Mexico and Texas. We physically shut off pre-Compact rights on a daily basis to ensure that water gets to New Mexico. That is obviously a result of many years of turmoil and in some cases conflict with New Mexico and Texas. But we learned

our lesson well, and from the late 60s to now, we have maintained our obligations on an annual basis. I am quite proud of that and it's taken a lot of work dealing with the water users in the San Luis Valley to help them understand that obligation and to be able to live with the consequences. About a third of our water generated in Colorado comes to New Mexico on an annual basis. When you already have an over-appropriated system and you take a third of that water and send it downstream, it doesn't play well with the water users and the water rights holders in the San Luis Valley.

One thing that I want to stress is that there is no status quo except for some institutional aspects. Things are changing everyday as we know. Climate change isn't new. We are arrogant to think that this is the first time there has been climate change. Senator Udall put up a chart showing that climate change has been going on forever and certainly with a lot worse conditions than we are seeing today. The problem is that all of us grew up in a time when there was a fairly ample water supply and so we think that's the norm. That's just arrogance and ignorance.

We have many examples of much more extreme situations than we are facing today. The problem is that we've added a whole bunch of people and a whole bunch of irrigation to the system that wasn't here before. Trying to adapt to that is our challenge today. Now we have new problems like dust-on-snow that I'm sure many of you have heard about where we get a new snowpack, it gets covered with dirt, and we wonder why it melts so quickly.

Also, there are general changes in hydrology. In the last three years we've had significant changes. In fact, since 1988, the headwaters on the Rio Grande have been down about 20 percent of the long-term average. As time goes on, that's getting worse and worse.

We are seeing changes in the law. You think critical habitats are in place. But what happens? We have to revisit them again. All of these changes are difficult to adapt to. Unlimited growth was mentioned earlier. We have a finite resource and we wonder why we are running out of water at the same time we are encouraging unlimited growth. It is the same all over the Southwest and at some point we have to face the fact that we can't continue to depend on a finite resource with an unlimited demand.

Budgets have also changed. The Water Conservation Board has had $175 million taken away from its water project funding in the last three years by the legislature, simply because it was an easy pot of money—it was seen as simply a severance tax that was laying around not doing anything except funding water projects, and it was needed for other things. Priorities change. We have some significant challenges ahead of us and we are trying desperately in Colorado to keep up with those challenges.