

New Mexico Water:
Past, Present, and Future
or Guns, Lawyers, and Money

50th
Annual
New Mexico
Water Conference

Corbett Center, New Mexico State University
October 19 - 20, 2005

**New Mexico Water:
Past, Present, and Future *or*
Guns, Lawyers, and Money**

PROCEEDINGS

50th Annual New Mexico Water Conference

**October 19-20, 2005
Corbett Center, New Mexico State University
Las Cruces**

New Mexico Water Resources Research Institute

50th Annual New Mexico Water Conference

New Mexico Water: Past, Present, and Future or Guns, Lawyers, and Money

NMSU economist, Lowell Catlett, got things rolling the first morning of the conference.



Baxter Black entertained participants at the evening banquet.



Former WRI Director Tom Bahr gave his talk, "My Life and How to Make Wine" at Thursday's luncheon.



Chuck DuMars (left) talked with WRI Director Karl Wood before giving this year's Utton Memorial Water Lecture.



Many excellent presentations were given at this year's conference including those by UNM law professor Em Hall (left) and New Mexico Representative Joe Stell.



Forty-nine years of water conference proceedings were on display at the conference.

Water conference participants had many opportunities to chat with friends and colleagues.



TABLE OF CONTENTS

Director’s Statement	iv
Water Conference Advisory Committee.....	v
Conference Program	vi
Photo Contest	ix
First Water Conference Participants	x
21 st Century Agriculture in a 21 st Century Urban World Lowell B. Catlett, New Mexico State University	1
Albert E. Utton Memorial Water Lecture Prior Appropriation Law and Future Water Allocation: Preserving Water for Future Generations Charles DuMars, Law and Resource Planning Associates, P.C.	9
The Bureau of Reclamation: The Last 103 Years and the Next 47 William E. Rinne, Bureau of Reclamation	21
Back to the Future: Regional Differences in New Mexico Water Rights G. Emlen Hall, University of New Mexico School of Law	27
Historical Review of Water: Water Challenges Past and Present Joe Stell, New Mexico Representative	33
Ralph Stucky Proclamation.....	38
Homage to Ralph Stucky, First WRRI Director John Hernandez, New Mexico State University Bobby Creel, Water Resources Research Institute	39
Long Term Demographic Uncertainty and Water Demand in New Mexico Jim Peach, New Mexico State University.....	43
Urban Water Pricing: A Historical Perspective and the Challenges for the Future Janie M. Chermak, University of New Mexico	49
Institutional Barriers to Water Conservation in the Rio Grande Basin: Challenges and Opportunities Frank A. Ward, New Mexico State University.....	57
Economic Development and Land Use: How Do We Continue to Grow while Living within Our “Water Means”?	71
Moderated by Bill Hume, Office of the Governor	

Janet Jarratt, Middle Rio Grande Conservancy District farmer	
Tom Phillips, Bureau of Land Management	
James Rivera, Pueblo of Pojoaque	
David Steinborn, Real Estate Developer, Las Cruces	
Karyn Stockdale, The Trust for Public Lands	
John Stomp, City of Albuquerque	
The Two Q's: The Connection between Water Quality and Water Quantity	
Ron Curry, New Mexico Environment Department	97
Creating Effective Source Water Protection through Regional Collaboration	
Matt Holmes, New Mexico Rural Water Association	103
New Mexico's Experience with Interstate Water Agreements	
John Whipple and Estevan López, New Mexico Interstate Stream Commission.....	109
Active Water Resource Management	
John D'Antonio, Office of the State Engineer.....	125
Active Water Resource Management in the Lower Rio Grande: Adapting to Basin-Specific Requirements	
Phil King, New Mexico State University	131
Adjudications: Getting to "Finished"	
Judge Jerald A. Valentine, Third Judicial District Court.....	135
Indian Water Rights Settlements – Bringing Certainty to Uncertain Water Resources	
Stanley Pollack, Navajo Nation	141
Structuring Voluntary Dry Year Transfers	
Bonnie Colby, University of Arizona	149
Western Water Markets and Price Diversity	
Ari M. Michelsen, Texas A&M and Tom Brown, U.S. Forest Service.....	155
Regional Trends in the Use and Reuse of Impaired Waters	
Mike Hightower and Rich Kottenstette, Sandia National Laboratories and	
Larry Webb, City of Rio Rancho.....	167
El Paso's Municipal Reclaimed Water Program	
David O. Ornelas, El Paso Water Utilities.....	173
Environmental and Ecological Issues: History and Future of ESA, NEPA, and the Clean Water Act	
Sterling Grogan, Middle Rio Grande Conservancy District.....	177
Participant List	183

Director's Statement

We celebrated 50 years of annual New Mexico water conferences this year at the site of the first 25 annual conferences, New Mexico State University. Nearly 300 participants including 50 students attended this milestone conference to discuss the history of water in New Mexico, our situation today in meeting a myriad of challenges, and the prospects for New Mexico's water future.

A warm autumn day greeted folks who traveled to Elephant Butte Dam for the pre-conference tour. The afternoon tour began in Truth or Consequences with an overview of the Rio Grande Project presented by staff of the Bureau of Reclamation. The group then visited the Dam and viewed it from a couple of lookout points. A sudden cloud burst had the group scattering back to the tour buses just as the tour was coming to an end. A reception followed the tour that evening at NMSU's new Stan Fulton Athletics Center. The reception provided another opportunity for participants to network among friends and colleagues, many of whom have been attending WRI water conferences for many years.

Several long-time attendees were acknowledged as the conference got underway including several who had been to at least 20 WRI conferences, including John Hernandez, Tom Bahr, Bobby Creel, Fred Hennighausen, and Wayne Cunningham.

Opening remarks were made by NMSU agricultural economist and speaker extraordinaire, Lowell Catlett. Catlett woke up the early morning group with his musings on the aging Baby Boom generation and how agriculture has evolved over the past 50 years.

He was followed by UNM School of Law Professor Emeritus Chuck DuMars who gave the 2005 Utton Memorial Water Lecture, "Prior Appropriation Law and Future Water Allocation: Preserving Water for Future Generations." Chuck began the lecture with some personal recollections of his good friend and former colleague at the UNM School of Law, Albert E. Utton, and their work together over many years.

Interstate Stream Commission Director Estevan Lopez talked about New Mexico's experience with interstate water compacts and related agreements. Estevan and colleague John Whipple have prepared an excellent paper summarizing, by basin, the history of compact development and administration as well as related litigation and Congressional action. The paper, along with all papers presented at the conference, is contained in this proceedings and all papers are posted on the WRI website at:

<http://wri.nmsu.edu/publish/watcon/proc50/proc50.html>.

Everyone seemed to enjoy themselves at the evening banquet where Cowboy humorist and poet Baxter Black performed. Baxter stayed after the show to autograph his books and CDs. The featured luncheon speaker was former WRI director Tom Bahr who led the institute from 1978 until 1999. In addition to reflecting back on his tenure as director, Tom gave us a quick seminar on one of his retirement activities – how to make good wine.

The 50th Annual New Mexico Water Conference was dedicated to H. Ralph Stucky, the first director of the New Mexico Water Resources Research Institute. New Mexico Governor Bill Richardson declared October 19, 2005 as Dr. H. Ralph Stucky Day. John Hernandez and Bobby Creel paid tribute to Dr. Stucky and presented the proclamation to Dr. Stucky's two children who attended the conference, John and Creta.

The water conference advisory board members seem anxious to begin planning the next water conference. We wish them well and look forward to another 50 years of New Mexico water conferences.



M. Karl Wood
Director

Funds for the proceedings publication were provided by registration fees, the U.S. Department of the Interior, and state appropriations to the New Mexico Water Resources Research Institute.

Photos by Stephen's Photo Service.

WATER CONFERENCE ADVISORY COMMITTEE AND REPRESENTATIVES

Wayne Cunningham, *Arch Hurley Conservancy District*

John D'Antonio, *Office of the State Engineer*

Jim Davis, *New Mexico Environment Department*

Tom Davis, *Carlsbad Irrigation District*

Doug Earp, *City of Albuquerque*

Gary Esslinger, *Elephant Butte Irrigation District*

Susan Fry Martin, *Los Alamos National Laboratory*

Chris Gorbach, *U.S. Bureau of Reclamation*

Matt Holmes, *Rural Water Users Association*

Fidel Lorenzo, *Pueblo of Acoma*

Julie Maitland, *New Mexico Department of Agriculture*

William McIlhaney, *New Mexico Farm and Livestock Bureau*

Nathan Myers, *U.S. Geological Survey*

Bill Rinne, *U.S. Bureau of Reclamation*

Craig Runyan, *Extension Plant Sciences, New Mexico State University*

Blane Sanchez, *Interstate Stream Commission*

Daniel Sanchez, *Pueblo of Acoma*

John Tysseling, *Energy, Economic and Environmental Consultants*

Anne Watkins, *Office of the State Engineer*

Linda Weiss, *U.S. Geological Survey*

Mark E. Yuska, *Army Corps of Engineers*

50TH ANNUAL NEW MEXICO WATER CONFERENCE

NEW MEXICO WATER: PAST, PRESENT, AND FUTURE *OR* GUNS, LAWYERS, AND MONEY

Corbett Center Auditorium

Wednesday Morning Session, October 19, 2005

- 8:15 am Opening Remarks: Director Karl Wood, Water Resources Research Institute
- 8:30 **21ST CENTURY AGRICULTURE IN A 21ST CENTURY URBAN WORLD**
 Lowell B. Catlett, New Mexico State University
- 9:00 **ALBERT E. UTTON MEMORIAL WATER LECTURE**
2005 Utton Memorial Lecture Speaker Introduced by Tom Bahr, Former WRI Director
- Prior Appropriation Law and Future Water Allocation:
Preserving Water for Future Generations**
 Charles DuMars, Law and Resource Planning Associates, P.C.
- 9:45 Break
- 10:15 **THE BUREAU OF RECLAMATION: THE LAST 103 YEARS AND THE NEXT 47**
 Deputy Commissioner William E. Rinne, Bureau of Reclamation
- 11:00 **WATER POLICY IN NEW MEXICO: FROM THE CONSTITUTION AND EARLY
STATUTES TO TODAY'S DEMANDS AND TOMORROW'S NEEDS**
Back to the Future: Regional Differences in New Mexico Water Rights
 G. Emlen Hall, University of New Mexico School of Law
Historical Review of Water: Water Challenges Past and Present
 Joe Stell, New Mexico Representative
- 12:00 Lunch on Your Own

Wednesday Afternoon Session, October 19, 2005

- 1:30 **TRIBUTE TO RALPH STUCKY, FIRST WRRI DIRECTOR**
 John Hernandez, New Mexico State University
 Bobby Creel, Water Resources Research Institute
- 2:00 **WATER USE PROJECTIONS: MEETING FUTURE DEMAND**
 Long Term Demographic Uncertainty and Water Demand in New Mexico
 Jim Peach, New Mexico State University
 Urban Water Pricing: A Historical Perspective and the Challenges for the Future
 Janie M. Chermak, University of New Mexico
- 2:30 **AGRICULTURAL WATER USE**
 Institutional Barriers to Water Conservation in the Rio Grande Basin:
 Challenges and Opportunities
 Frank A. Ward, New Mexico State University
- 3:00 Break
- 3:30 *Panel Discussion moderated by Bill Hume, Office of the Governor*
- ECONOMIC DEVELOPMENT AND LAND USE: HOW DO WE CONTINUE TO GROW**
 WHILE LIVING WITHIN OUR “WATER MEANS”?
 Janet Jarratt, Middle Rio Grande Conservancy District farmer
 Tom Phillips, Bureau of Land Management
 James Rivera, Pueblo of Pojoaque
 David Steinborn, Real Estate Developer, Las Cruces
 Karyn Stockdale, Trust for Public Lands
 John Stomp, City of Albuquerque
- 6:00 Dinner at Corbett Center Ballrooms (3rd Floor)
 Entertainment by Baxter Black, Cowboy Poet

Thursday Morning Session, October 20, 2005

- 8:15 **WATER QUALITY: THE LOOMING CRISIS**
The Two Q's: The Connection between Water Quality and Water Quantity
Ron Curry, New Mexico Environment Department
Creating Effective Source Water Protection through Regional Collaboration
Matt Holmes, New Mexico Rural Water Association
- 9:15 **NEW MEXICO'S EXPERIENCE WITH INTERSTATE WATER AGREEMENTS**
Tanya Trujillo and Estevan López, New Mexico Interstate Stream Commission
- 10:15 Break
- 10:30 **WATER MANAGEMENT IN NEW MEXICO**
Managing Water in New Mexico, John D'Antonio, Office of the State Engineer
Active Water Resource Management in the Lower Rio Grande: Adapting to Basin Requirements, Phil King, New Mexico State University
Adjudications: Getting to "Finished", Judge Jerald A. Valentine, Third Judicial District Court
Indian Water Rights Settlements - Bringing Certainty to Uncertain Water Resources, Stanley Pollack, Navajo Nation
- 12:00 Luncheon at Corbett Center
PERSONAL REFLECTIONS ON THE WRII PROGRAM
Tom Bahr, Former WRII Director

Thursday Afternoon Session, October 20, 2005

- 1:30 **WATER MARKETS**
How Voluntary Transfers Can Be Structured to Address Community, Environmental and Other Third Party Concerns
Bonnie Colby, University of Arizona
Western Water Markets and Price Diversity
Ari M. Michelsen, Texas A&M and
Thomas Brown, U.S. Forest Service, Rocky Mountain Research Station
- 2:30 **WATER DEVELOPMENT: IS THERE REALLY "NEW WATER" OUT THERE?**
Regional Trends in the Use and Reuse of Impaired Waters
Mike Hightower and Rich Kottenstette, Sandia National Laboratories and
Larry Webb, City of Rio Rancho
El Paso's Municipal Reclaimed Water Program
David O. Ornelas, El Paso Water Utilities
- 3:00 **ENVIRONMENTAL AND ECOLOGICAL ISSUES: HISTORY AND FUTURE OF ESA, NEPA, AND THE CLEAN WATER ACT**
Sterling Grogan, Middle Rio Grande Conservancy District
- 3:30 Adjourn

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE 2005 HIGH SCHOOL WATER PHOTO CONTEST

The WRRRI sponsored its first ever high school photo contest this fall. High school students from around the state of New Mexico were invited to submit up to three photographs. Photographs were judged in two categories: *Water in Nature* and *Water at Work*.

First Place winners in each category received a check for \$200; Second Place winners received \$100, and several honorable mentions were awarded in each category.

We received 86 photo entries; 50 in the *Water in Nature* category, and 36 in the *Water at Work* category. Photo entries came from Oñate High School, Las Cruces High School, Del Norte High School, Albuquerque High School, Navajo Prep School, Rio Grande High School, West Mesa High School, McCurdy High School, Eldorado High School, La Cueva High School, Cliff High School, Santa Fe High School, and Sandia High School.

Winning Photos

Water in Nature

First Place: Shawna Libeau—Oñate HS Senior
Second Place: Martin Burch—Santa Fe HS Senior

Honorable Mention:

Mike Valerio—McCurdy HS Junior
Cynthia Barringer—Rio Grande HS Sophomore
Nichole Valdez—McCurdy HS Junior
Amanda Baca—Rio Grande HS Senior
Jake Pett—Albuquerque HS Senior
Shawna Libeau—Oñate HS Senior
Andrew Pacheco—Rio Grande HS Junior
Britta Mortensen—Sandia HS Senior

Water at Work

First Place: Keila Dominguez—West Mesa HS Senior
Second Place: Shawna Libeau—Oñate HS Senior
Chad Griffin—Albuquerque HS Junior

Honorable Mention:

Steven Tallas—Navajo Preparatory School Sophomore
Amanda Baca—Rio Grande HS Senior
Sara Eliason—Albuquerque HS Junior
Donnie M. Jones—Navajo Preparatory School Senior
Ivan A. Bencomo—Rio Grande HS Senior
Jaclyn Ortega—McCurdy HS Junior
Esmé O. Vaandrager—Albuquerque HS Senior

Our thanks to WRRRI's student assistant, Sara Ash, for organizing the photo competition. We also appreciate the efforts of this year's judges: Bobby Creel, Victor Espinoza, Don Martin, Darren Phillips, Jud Wright, and Karl Wood.

Winning photos are displayed on WRRRI's homepage at wrrri.nmsu.edu.

*FIRST ANNUAL NEW MEXICO WATER CONFERENCE
PARTICIPANT LIST - 1956*

<i>John A. Adams Jr.</i>	<i>Morris Evans</i>	<i>J. C. Overpeck</i>
<i>M. H. Alexander</i>	<i>Ben Fritz</i>	<i>Jack M. Parker</i>
<i>Odelio F. Baca</i>	<i>J. L. Gardner</i>	<i>James Parra</i>
<i>William E. Barbee</i>	<i>Willie L. Garner</i>	<i>F. G. Penzig</i>
<i>W. G. Bartlett</i>	<i>John W. Gaume</i>	<i>John A. Phinizy</i>
<i>Leslie G. Batton Jr.</i>	<i>J. W. Gilstrap</i>	<i>Claude Pilley</i>
<i>B. W. Beadle</i>	<i>Manuel E. Gonzales</i>	<i>H. B. Pingrey</i>
<i>Don L. Bengé</i>	<i>C. J. Grace</i>	<i>Atilio G. Portillo</i>
<i>Eddie Binns</i>	<i>Morton Gragg</i>	<i>Lewis T. Putnam</i>
<i>Robert H. Black</i>	<i>John L. Gray</i>	<i>Steve E. Reynolds</i>
<i>O. P. Blaich</i>	<i>Eldon G. Hanson</i>	<i>Phil Robinson</i>
<i>Horace L. Bounds</i>	<i>George D. Hardaway</i>	<i>Eugene Runes</i>
<i>Jupe Bounds</i>	<i>Charges Harris</i>	<i>Ben Shantz</i>
<i>W. C. Bradshaw</i>	<i>G. D. Hatfield</i>	<i>Karl Soards</i>
<i>Charles A. Brink</i>	<i>Clarence A. Henderson</i>	<i>Robert E. Stearns</i>
<i>Frank Bromilow</i>	<i>Ted C. Hogsett</i>	<i>William P. Stephens</i>
<i>F. H. Bushman</i>	<i>Lloyd Jenkins</i>	<i>Stuart Sterling</i>
<i>Lloyd A. Calhoun</i>	<i>David Jones</i>	<i>H. Ralph Stucky</i>
<i>Evan Carroon</i>	<i>Paris D. Jordan</i>	<i>B. J. Stratton</i>
<i>Don H. Chappell</i>	<i>John O. Kling</i>	<i>Jacob Tejada</i>
<i>Ira Clark</i>	<i>Joseph Landis</i>	<i>James L. Thomas</i>
<i>John W. Clark</i>	<i>Bill Langenegger</i>	<i>John W. Thomas</i>
<i>Robert Emmet Clark</i>	<i>C. W. Lauritzen</i>	<i>M. A. Thomas</i>
<i>P. W. Cockerill</i>	<i>Ross W. Leamer</i>	<i>John R. Tomlin</i>
<i>J. F. Cole</i>	<i>Leon A. Livingston</i>	<i>A. E. Triviz</i>
<i>C. L. Connover</i>	<i>Joseph C. Lujan</i>	<i>Elwood J. Umbenhauer</i>
<i>R. B. Corbett</i>	<i>Richard G. Marek</i>	<i>W. E. Utterback</i>
<i>Philip E. Crystal</i>	<i>John Martin</i>	<i>K. A. Valentine</i>
<i>James J. Culbert</i>	<i>Gerard Martinez</i>	<i>Lawrence D. Vigil</i>
<i>Albert L. Curry</i>	<i>Stuart Meerscheidt</i>	<i>Cleo G. Webb</i>
<i>Dwight Davenport</i>	<i>Wallace T. Miller</i>	<i>Stewart Wither</i>
<i>D. R. De Graftenreid</i>	<i>E. G. Minton</i>	<i>J. C. Yates</i>
<i>J. L. Dirnberger</i>	<i>Albert M. Mitchell</i>	<i>R. A. Young</i>
<i>Walter Donaldson</i>	<i>Billy T. Mitchell</i>	
<i>Bob Donham</i>	<i>William A. Moery</i>	
<i>E. J. Dortignac</i>	<i>D. D. Monroe</i>	
<i>Peter C. Duisberg</i>	<i>A. M. Abo Nabia</i>	
<i>Ray Eicher</i>	<i>Walter O'Brien</i>	
<i>Harold B. Elmendorf</i>	<i>Leonard E. Orsak</i>	

Lowell B. Catlett is a Regent's Professor at NMSU. His Ph.D. is in economics from Iowa State University. Lowell is the author of numerous books and articles and won the university's highest award to a professor, the Westhafer Award. He works nationally and internationally with corporations and organizations doing futuristic planning. Lowell also works with the U.S. Departments of Agriculture, Labor, Interior, Defense, Education, Energy and the World Bank. He has been a visiting professor or delivered invited presentations at over 80 universities. Lowell and his wife, Joni, share their home in Las Cruces, New Mexico, with several dogs and cats.



21ST CENTURY AGRICULTURE IN A 21ST CENTURY URBAN WORLD

Lowell Catlett
Agricultural Economics & Business
MSC 3169
New Mexico State University
PO Box 30003
Las Cruces, NM 88003

Thank you, Karl. I want to know how in the world you figured out I was from Texas? It's a pleasure to be here. Good morning; everybody awake? For those of you new to the campus or here for the first time, welcome to New Mexico State University. Those of you who have visited the campus before, welcome back. Those of us who are fortunate enough to work on this beautiful campus we know how lucky we are. For those who are visiting for the first time, if there is anything that you would like to see or do or participate in, let one of us know. We will be glad to help you figure out how to go about doing what you want to do. This university is truly one of New Mexico's crown jewels and New Mexico has several. So let one of us know if we can help you out, we are very, very honored that you are here.

I'm filling in today or pitch-hitting for our president, Michael Martin, who I understand is in North Korea at the moment. Hopefully our governor and Mike will convince the North Koreans that perhaps they need to feed themselves first before creating nuclear weapons. Hopefully it will be a good trip for them.

It's a pleasure to be here. Karl said it's the 50th water conference. I don't know about you, but every time a birthday is celebrated, I think about this gentleman who was celebrating his 100th birthday and a newspaper guy got wind of it and called him up and got an appointment with him. He asked the old man what he contributed his longevity to and the old man said, "I think my longevity is attributed to never letting that demon 'alcohol' touch my lips. The reporter writes this down and asks him if there is anything else. He said,

“Yes, I think the reason I’ve lived 100 years is because those bad foods, demon foods, have never touched my lips.” The reporter writes this down and asks if there is anything else. “Yeah, I think it’s because that demon ‘tobacco’ has never touch my lips. I’ve never smoked or chewed or dipped.” The reporter asks if there is anything else. “Yes, I never stayed up late or caroused around, that’s what I contribute my longevity to. And tomorrow, I’m going to celebrate my 100th birthday! The reporter looked at him and asked, “How?”

I think you have a wonderful program ready to go. I’m kind of weird folks, so I’m going to make this griefless and painless for you. I’m an economist and I’m just weird as can be, and all economists are weird. The longer I’m in the profession the more I know we are weird because we view the world differently. Most

...we have left the production world and entered the consumer world.

importantly, have you ever heard an economist say anything good about anything? We have correctly forecasted 15 of the last five recessions. It’s true, for

every recession that comes along we have said three would happen. We are always telling you, oh this, oh that. We are the people who are telling you today why yesterday’s forecast was wrong and then we repeat, and then we repeat because we are always wrong. I’ve come to realize the difference between a dog and an economist at your back door is, when you let them both in, the dog quits whining. We whine, we moan, and we complain, but I’m not going to do that today.

I’m going to talk to you today about two major drivers that I think are changing water, changing natural resources. I think they are changing the way we live and I think they are changing agriculture. First and foremost the thing we like to talk about in my profession is called money. Never in the history of the world, and we have about 6,000 years of recorded history, have so many people had so much cash. It’s true. My estimate right now is you have 106.6 million households in the United States, in cash, that means you can spend about \$7 trillion. That’s \$7 trillion. But I saw a program not too long ago where another economist said, “Stop telling people it’s \$7 trillion, I don’t think that’s right, I think it’s \$9.7 trillion.” That’s a big difference. Then I saw another program with another economist and he said, “Quit telling people it’s \$7 trillion, I think it’s \$4 trillion.” Big difference folks between \$4

trillion, \$7 trillion, and \$9.7 trillion. So I was doing some work not too long ago with the Federal Reserve. These are the people that count your money, keep track of it, and cause it to be printed, so they should know. So I said, “Guys, help me here. I have all kinds of answers going on here.” And being an economist I had to give it to them in this way. Is it (a) \$4 trillion, is it (b) \$7 trillion, is it (c) \$9.7 trillion, (d) none of the above, or (e) all of the above? Their answer was, “Yes.” They don’t know! People that count it, keep track of it in this society don’t know. We’ve never had so much money. It’s never happened in history. The Canadians keep better records than we do and we know they have \$2 trillion, the Japanese keep better records than we do and we know they have \$4 trillion, Australians have \$1 trillion, and Europe, \$8 trillion. Never in the history of the world have so many people had so much idle money floating around. I tell you this because you never hear it from my profession and you never hear it on the news.

I saw another program with another economist not too long ago, and for 30 minutes he beats up on the audience. He tells them that Americans have never been in so much debt, which is true. But all the time he is telling them this, I’m thinking that when beer goes on sale, I’ll fill up the garage! Debt has never been cheaper in 54 years. He’s an economist. Please understand that I’m not telling you to misuse debt, but what he didn’t tell the audience was this – it is true that Americans have never had so much consumer debt, but it is also true that it’s never been cheaper in 54 years, and a prudent person would have some. More importantly, what he did not tell them is that the number that matters the most is the relationship of debt to your income. That’s what matters.

Fifteen years ago to pay your mortgage and to pay all of your consumer debt, it took 16.1 percent of your disposable income; today it takes 15.75. Yes, we have never had more debt, but we have never been more capable of handling that debt as a society. What I’m trying to tell you is that there has never been so much money, and money changes people. Money causes us to do weird things. Money does change people.

At the end of WWII, there were 51 sovereign nations on the planet, today there are 206. If Quebec secedes, it will be 207. Money causes us to change things. We differentiate or segment. My mother said it to me crudely when I was 13 years old and I’ll tell you what she told me. “People bitch the loudest when their bellies are full.” Now bitching is an old Southern term for complaining real bad. When you are hungry, kidney

pie sounds pretty good, but when you get a little bit of money, what do you start to do? You start wanting to complain or differentiate. “I don’t want kidney pie any more, I want Steak Tartar.” Whatever that is. You start differentiating or segmenting.

What I’m trying to tell you is that at the end of WWII we stopped manufacturing war goods and starting manufacturing consumer goods. The world right now, folks, has a 40 percent excess capacity for producing things, including food. Do you understand what I just told you? We are real good at producing things now. We have a 40 percent excess capacity in the world for producing things. We know how to do that now. But we did not during WWII. In 1942, during WWII we quit manufacturing automobiles. We didn’t start again until the model year of 1946. In December 1945, the first model of the 1946 year rolled off the assembly line. Now if you offered to my father’s generation, which did not have any money let me tell you, if you offered that generation a 4-door autographed Chevrolet, their first response was, “Yes, thank you, we will take it!” If I offered you a 4-door autographed Chevrolet today, know what you would tell me? [waving fingers under chin] You know what that means? That’s a French expression for ‘No thank you!’

What I’m trying to tell you is that we have left the production world and entered the consumer world. And the consumers have more money than they ever had and what do you think? Do you think they are going to differentiate, or bitch or complain more or less? [nods yes] Which means my father’s generation was happy to put food on the table and was happy when they got sick to share a semi-private room in the hospital. Now what in the world is a semi-private room? What I’m trying to tell you is that that’s gone, and in its place are the most demanding, complaining consumers on the planet and they aren’t just here. It’s happening all over the world. It’s called “progressive affluence” and it’s not just an American phenomenon. It’s a phenomenon that’s happening all over the world. We are going to differentiate, we are going to segment, and we are going to be consumers and that changes the whole paradigm.

To differentiate and segment is called money, never had it before and if you don’t believe that, understand a couple of other things. Now I’ve said this to many of you before, but it bears repeating again for you who deal with money. In my father’s generation, 10 percent of them got to graduate from high school and 4 percent of them got to go to college. Let’s see, is there a relationship between income and education? Hello!

Kind of! Guess what? If you get a college degree today, it is worth \$1.4 million more than a high school degree. \$1.4 million more! There is a relationship between income and education. My father’s generation who didn’t get to go to college said to my generation, “We are going to send you to 3,791 institutions of higher education.” Sixty-two percent of my generation, Baby Boomers, have had some college, one-third of us have a college degree.

We are the largest mass-educated generation that has ever existed on the planet and there is a relationship between income and education. I know. My generation today has 62 percent more money adjusted for inflation than my parents had at any point in their lives. I have no PowerPoint today – I’m my own PowerPoint – three

It’s happening all over the world. It’s called “progressive affluence” and it’s not just an American phenomenon. It’s a phenomenon that’s happening all over the world.

dimensional. We have 62 percent more income, and as I said, excess capacity to produce things, including food. In 1969, how much of our disposable income did we spend on food? It was 31 percent, and today we spend 10 percent. If you are a household that earns \$75,000 or more, incidentally that’s one out of four households in American today (which doubled in the last decade), you don’t spend 10 percent of your income to eat, you spend 4 percent. Darn near free. So let’s see. I have 62 percent more money, and I don’t spend jack to eat.

At the end of WWII we quit manufacturing war goods and started manufacturing consumer goods. What’s happening to the real price of every appliance that makes your life better? That’s dishwashers, washing machines, and color television sets. Have they gone up in price or down in price? The average person who lives in poverty, which incidentally today, ladies and gentlemen, has an income level of \$19,200, \$800 less than my annual salary at my first job here at New Mexico State University 27 years ago. That’s a person who lives in poverty. In 1955, 22 percent of Americans lived in poverty, today it’s 11 percent. Do you understand what I’m telling you? Poverty is \$19,200 bucks. It’s an incredible number, there’s some money. Guess what? The average person who lives in poverty today has more dishwashers, washing machines, and more

television sets. They have 2.3 color television sets. The average person who doesn't live in poverty has 2.4. So are you with me here? Sixty-two percent more money, you don't spend jack to eat, and you don't spend jack to have a nice life. The difference is called disposable income. Hello! That is the biggest pressure on natural resources on the planet. It has changed natural resources forever.

Texas, the old country – those places that you stumble over to find a better place to run cattle in my father's generation – is a beautiful part of the world

Give people what they want, when they want it, and where they want it, and where's the price? If I truly give you what you want, when you want it, where is the price? It's never in the top 10 – never.

except it's filled with water moccasins, ticks, airborne and water-borne diseases of the likes of which cattle don't like, humans don't like, and dogs don't like. You can't touch a

100-acre ranch in the Texas hill country for under a million bucks because it's not about running cattle anymore. It's about a disposable income that's higher than any other time in history, and we buy things not because of their utilitarian value, but because we are weaker. Money causes us to be weird as can be. If you don't believe so, understand that my generation grew up in 1,400 square foot homes, .9 bathrooms, and 4.2 people lived in them. Point nine bathrooms – either you go or you don't go. I don't understand that number.

Now we just saw the new numbers updated in January 2005. The average home in America is now 2,400 square feet with 2.5 bathrooms, and 2.6 people living in them. Wait a minute, we used to have 4.2 people living in 1,400 square feet with .9 bathrooms; we have 2,400 square feet with 2.6 people and 2.5 bathrooms! We call it the SUVing of homes. You've got a house that's just a little bit bigger than you need because for 28 years the number one selling vehicle in America has not been a car but is in fact a truck. Have you looked in the back of those trucks? They are not hauling jack. They're just trucks. For 13 years the number one selling vehicle by sales increase category is SUVs, off-road vehicles. Ninety-eight percent of all off-road

vehicles have never been off the road. Hello? So we have a bigger vehicle, bigger house, and fewer people because we are a bunch of spoiled brats. That's what money does. It's not wrong or right, it just changes what we want in things.

It's called progressive affluence, and it's changing every aspect of agriculture's natural resources. If you don't believe so, understand this: the fastest growing little food chain in America, well not so little a chain anymore, just surpassed a month ago \$1.2 million. They are called Whole Foods. Or as people who go to them call them 'whole paycheck'; there is one in Albuquerque and one in Santa Fe. The president of that company understood about 62 percent more money and households making \$75,000 more and spending 4 percent of their disposable income on food. He thought, "I think I'm going to get more of you." And he does, everyday.

If you don't believe that, understand right now that every year we slaughter about 35 million head of cattle. And guess what? Only 2 percent of them make the grade of prime. But the people who slaughter and sell them say, "Guess what? If you would give us three times that amount we will sell it. We can't produce enough prime beef; we could sell three times more of it. At the upper end of the choice range, if you can double it, then we can sell it." I just ran the numbers last week. If we did that in agriculture, it would mean to the cattle producers a mean one billion more dollars because consumers today are saying we want more prime beef. We want more high-end choices, we want it different. My father's generation was just happy to have meat on the table. Now we have a lot of money and are saying we don't want just meat on the table. I want prime, high-end choice meat, and I want it smart – I want you to certify to me that you know where it came from. I want you to certify to me that it came from 'happy' cows. I want you to certify to me that the natural resources to produce it were prudently used and produced. It's called 'smart meat.' And if you don't think we are going to do the same for smart corn and other smart food, just hang on because we have a bunch of spoiled brat consumers who say they now have the money to back it up, so give me what I want. It is forever changing the face of agriculture. It is opening up new avenues to making money like you've never dreamed possible – new avenues to monitor and get paid for ecological service fees, to be paid for being prudent stewards of the land, and prudent stewards of

water use. We now have the mechanism in place to do that. Consumers have proved in many cases more than willing to pay for it.

We know, for example, in Australia they have done this with utilities. Several utilities users have gone to producers in and around the cities of Sidney and Melbourne and said to the farmers, "If you will let us monitor the crops that you produce, let us change a bit of the mix of them and you can sell your products into the marketplace like you normally would, just let us monitor them." Because you know what plants do – they scrub out phenomenal amounts of carbon dioxide and give the world a lot of life-giving oxygen. These utilities would monitor it and then say, "Guess what? We cleaned up the air. We can prove it. We've scrubbed out the carbon dioxide and certain other nasty chemicals, and we've given back more life-giving oxygen." Then they went to the Australian government and said, "We are making it better to live around Sidney and Melbourne. How about giving us a tax credit?" And the government did! Win. Win. Win! It's a more prudent use of natural resources; farmers make more money, and consumers are better off. Never in the history of the world did we have a better chance of integrating agriculture and natural resources than today in ways we never dreamed possible. Phenomenal opportunities and the driver is money because people got it and they don't know what in the hell to do with it. Take some of it. They will give it to you if you have what they want.

There is an old axiom in economics, folks. Give people what they want, when they want it, and where they want it, and where's the price? If I truly give you what you want, when you want it, where is the price? It's never in the top 10 – never. But if I don't give you what you want when you want it, where's the price? It's always in the top 10! It's always number 1. If I want you to drive a 4-door autographed Chevrolet, I better cut the price, but if I find out what kind of car you want...and well it happened to me two years ago in Albuquerque driving a rental car past the Mazda dealership; I saw a taxi-cab yellow Mazda Miata with the top down. I woke up when I was on the phone with my wife and she said, "You bought what?" You know what? It was what I wanted, when I wanted it, and I have no idea what I paid for it.

If you give people smart water, price will not be an issue, but it better be smart. That applies to lots of things. Do the right thing and price won't matter. This

is the most affluent world we live in, and that's the major driver.

Second major driver, you've heard this one before but let me frame it for you. Let me put it in terms you've heard – we're a bunch of old people. Or more correctly, we are an aging society. Every 6.8 seconds someone in my generation turns 50 and will until the year 2014. Folks, 15 years ago 36 percent of the population was 18 and under. Today, it's 24 percent; five years from now it will be 21 percent, in the year 2018 it will be 18 percent of the population, 18 percent 18-years-old and under. In my generation 40 percent of the population was 18 and under. When you are 40 percent of the population, people listen to you. Heck, we made them listen to us. We are the generation that protested on college campuses, smoked dope, and did drugs. Heck, we still do drugs, but now it's Prozac and Metamucil. We are a large number. Eighteen percent of the population won't have a political voice. It will be attributed to how well we are. There is an old saying, "How civilized a society is, is how well they treat their minorities." The greatest minority we will have very quickly in this society is young people – 18 and under. They will be different just as every generation is different. There is an old saying, "people are more like the times they grow up in than their moms and dads." We have a fancy name for it in economics, cohort analysis. You're more a function of what you buy, how you live, of the times you grew up in than your mom and dad. Maybe your character comes from your mom and dad. What you buy, what you eat, the clothes you wear, the music you listen to, that's a function of when you grew up.

Understand that each generation changes. What is a luxury to one generation becomes a necessity to another. A generation is mathematically 19 years. Go back 20 years, 1985 – we'll just call it a generation. Can you believe as recently as 1985, only 1 in 8 Americans had never flown in an airplane? Today, the average American has flown eight times. It was a luxury in my father's generation to get to fly, and I guarantee it is a necessity to this one. Southwest Airlines has made it so, and in the process they are the most profitable airline that has ever existed on the planet because they are giving people what they want, when they want it, and where they want it. Guess what? The next generation will consider air travel an absolute necessity.

It was my father's generation that went through the Great Depression, saw contaminated water wells,

and went on a great rampage to see that there was enough food to put on the table for everybody. They were going to try and make sure that nobody died from contaminated water and thank God they did because we have the safest public water system in the world. You can turn on any water hose in rural or urban America and feel like you can drink the stuff. But since 1991, the fastest growing seller of any drink has been bottled water. All soft drink sales are flat at 1 percent since 1991, but bottled water is at 9 percent. Bottled water grows 9 percent a year. Well, last year it grew 12 percent so it's not slowing down. The darn stuff is

In an aging and affluent population, demands on us not only require meat on the table, but smart meat; not only food on the table, but smart food. What that implies is a smart use of our natural resources, everything from the water to the way we handle the runoff.

free. It's not wrong or right, we are just the most affluent world that has ever existed that can buy bottled water. And then we have water tastings. "Oh, I think the Evian has a slight little flavor above the . . ." Who knows?! It's not wrong or right, it's just the reason

we have 241 balsamic vinegar choices. Heck, I didn't even know what balsamic vinegar was until two years ago. We have 241 choices now. I think that's enough to hold me for awhile. It's not wrong or right, it's a differentiated world. The thing about aging is your 'got to' view is different. It's that cohort analysis.

Let's take that 18- to 33-year-old generation. A new phenomenon just came out a few weeks ago. If you are a young man age 18 to 33, guess what's happened to your TV consumption in the last decade? It's gone down 50 percent. People don't watch TV anymore to speak of, but what's more than doubled is their time on electronic or video games. It's driving advertisers cuckoo. Before they reached people by TV, but guess what? You can't reach them there anymore. Advertisers are trying to figure out how they can get into video or electronic games because that is where young men spend most of their time. If you are a 33- to 55-year-old male, a new phenomenon came out just a

few weeks ago. It's called the Starbucks Affect. Seems that 33- to 55-year-old-men are leaving for work 30 minutes earlier every morning, supposedly to stop at a Starbucks to get their morning coffee. We are so lazy that we can't even perk it at home anymore. My father's generation would not have purchased a Starbucks. The average Starbucks customer goes to a Starbucks 19 times a month and spends an average of four bucks. A good cup of coffee, as my late father would say, was ruined by too dang much money. They call it lattes, and it's entered into our societies so much that we are leaving home 30 minutes earlier to get a dang cup of coffee; we don't even make it ourselves anymore – foolish changes. Then that aging point comes back – we are weird. What a luxury is to one generation becomes standard to another, a necessity to them. They must have their Starbucks, got to have that choice. It's not wrong or right, but you must have it though. We are more like the times we grow up in.

Take the big drivers, the Baby Boomers, and understand why you need to know them and natural resources because the car companies missed us bigger than Dallas. The car companies said about the Baby Boomers, "Oh, they're just 82 million." Well, they got that wrong. They called it 76 million, and they don't even upgrade their numbers for immigrants. Eighty-two million Baby Boomers were born between 1946 and 1964. They used 76 million – wrong as can be, that's a big miss. But 82 million of us, and guess what? They are going to be just like the rat in the python. They are going to move through society, and as they move through society and get older they are going to want to drive 4-door autographed Chevrolets, and they won't want to drive convertibles. So by 1989 how many convertibles could you buy in the United States? None, squat, nada, because they didn't understand us and quit making them. The average convertible owner today looks a lot like me – 51 years old and balding. Follow them, they're just a bunch of balding men. So how many convertibles can you get in American today? Forty-three, we add three a year – because we are different.

Were you like me at age 16 and wanted a motorcycle? I begged by late father, please dad, please, please, let me have a motorcycle. "No, boy. You're as wild as a March hare. You'll be dead in 2 years," he would say. He wisely didn't let me get a motorcycle. Now we buy them at age 47, which is the average age of an owner of a Harley. They are a bunch of fat dentists.

Then we are dead by 49. It's not wrong or right, it's just we're different. Put those two together, aging and affluence, and you get the implications to water and natural resources and agriculture.

First and foremost, an aging and affluent society demands, number one, more services. The demand for services is growing by leaps and bounds. I restore old cars, and I haven't changed the oil in them in 5 years. It's changed. I just don't do it anymore. Even in Las Cruces, New Mexico, every hundred yards there is a Jiffy Lube or someone that will do it for me for three bucks. And, oh, by the way, while they are doing it, I can have a latte. The demand for services for all dimensions is going to grow and what do you think the demand for equality will be for those goods and services? Will it go down, or will it go up?

Folks, my father's generation was just happy to have meat on the table, have food on the table. In an aging and affluent population, demands on us not only require meat on the table, but smart meat; not only food on the table, but smart food. What that implies is a smart use of our natural resources, everything from the water to the way we handle the runoff. If we will make all those natural resources smart, you will own it, and price will not be a problem. Sounds complicated, but maybe it isn't. Maybe it's as simple a message as what my father told me about a farm. "If you water it and it dies, it's a cash crop. If you pull it out and it comes back, it's a weed." I didn't understand that until I became an economist. It's really very simple folks. Let's make them smarter, we can, and in the process we will have better food, a better environment, and more income.

The Water Resources Research Institute at this university has had 50 years of this conference and has tried to figure out what those needs are. It has done an outstanding job. It has an excellent record of trying to help you solve these problems. Jim Halligan, the former president of this university, said it very well one time when he said, "Universities exist to solve people's problems." The only way we know what these problems are, is to ask them and be them. It's not what water can do for water, it's what you've done for water for 50 years. Continue to do so, continue to ask us, and we at New Mexico State University will do our best to help you. We've not real smart, but what you do with water is smarter than you are.

Thank you for letting me be a part of this program. Have a great conference!

Charles T. DuMars is Professor Emeritus at the UNM School of Law. For over 25 years, he has taught courses in water law, constitutional law, and comparative Mexican and United States law as well as Indian water rights law and constitutional issues in natural resource law. He is a consultant to the World Bank on water marketing and allocation mechanisms for groundwater in developing countries. Chuck has served on committees for the National Research Council of the National Academy of Sciences relating to water, including a study of protection of the Mexico City water supply in which he served as Co-Chair. He is currently a shareholder with the law firm Law & Resource Planning Associates, P.C. in Albuquerque, where he practices water and environmental law. An author of numerous articles in both English and Spanish relating to water law and Mexican environmental law, Chuck has served as a guest lecturer on resource issues at the Universidad Autonoma de Guadalajara, Universidad Autonoma de Guanajuato, and at the Instituto de Investigaciones Juridicas in Mexico City. He has worked on cases involving equitable apportionment of waters between states in the United States Supreme Court as well as interstate compacts and is currently a Special Assistant Attorney General to the State of Georgia, where he was one of the draftsmen of the proposed Interstate Compact between Georgia, Alabama and Florida. Chuck recently testified to a Senate Subcommittee on proposed amendments to the Endangered Species Act and is currently involved in the endangered species litigation on the middle Rio Grande. Chuck earned his J.D. from the University of Arizona and a B.S. in psychology from the University of Oregon.



ALBERT E. UTTON MEMORIAL WATER LECTURE

PRIOR APPROPRIATION LAW AND FUTURE WATER ALLOCATION: PRESERVING WATER FOR FUTURE GENERATIONS

Charles DuMars
Law & Resource Planning Associates
201 Third Street NW, Suite 1370
Albuquerque, NM 87102

**A MEMORY OF AL UTTON, PERSUASION
THROUGH CIVILITY AND HUMOR**

Thank you Tom for that introduction. It is indeed an honor to be here today to give the Utton Memorial Lecture. Before going into the substance of my talk, I want to say something about Al Utton and what he did for water law in New Mexico and all around the country and the world. He was a man who lived a commitment to a principle that I share: the principle that approaching people with fundamental honesty and civility under all circumstances, in the end, will yield positive results. An example of this comes to mind. Al once put together groups of experts in Belagio, Italy, to discuss transboundary water issues. The groups came from all over the world. Their goal was to have a discussion about optimal resolution of international and interstate water conflicts.

At the opening session some participants from regions involved in a tacit cold war with one another refused to speak.

We must have spent five minutes, maybe 10, maybe 15, looking for the green flash and then Al says, “there it was!”

Rather than yield to this behavior, he simply observed, “I understand the dissonance, but we can work through this.” It was an amazing phenomenon to see Al charm people into

resolution of heated issues. I also observed him use these skills as chairman of the New Mexico Interstate Stream Commission and as Dean of the law school where he was a fellow colleague of mine. He wrote prolifically on a number of topics and always within the text of a conflict discussion he signaled a way out with a compromise making both sides better off.

I remember in Belagio at that conference he turned to me as we walked into a room of angry faces and said “looks like this might be a hard audience.” There was a Palestinian water lawyer, an Israeli water lawyer, and a Russian. They had already had heated arguments and were not speaking. The sun was going down, and we were scheduled to begin our opening session. Bad feelings filled the room. Suddenly Al said “see that sunset over there?” They all looked. “Just before the sun sinks into the ocean there is a moment of green, a green flash. You’ve got to look for it.” All turned to look. These enemies were all looking for the green flash. Al suggested he had heard it was caused by the weather. This led to a discussion of the weather in a

border part of Russia where the rivers were facing drought. The representative from Israel looked unconvinced. We must have spent five minutes, maybe 10, maybe 15, looking for the green flash and then Al says, “there it was!” They all said, “I didn’t see it.” And Al said, “I did,” and I said, “I saw it.” The topic turned slowly to the Jordon River and the death of the Black Sea and a number of topics that were very important to these people, all of which happened to be on the agenda for the meeting. I don’t believe there was a green flash in the sky, it was a flash of affective brilliance that defused borders and brought people together in a way few will ever duplicate today.

It was really a loss for me when Al passed away. There was something the other day that I found that refreshed my recollection as to his incredible sense of humor. He did funny things, but not always so funny if you were the recipient. Because he was known around the world he would get a lot of different material on water law. The humor was that he would often like to “share.” One day when I arrived at my office at the law school, I looked on my desk and there were five, big, 5-inch thick notebooks. On them was a note written in Al’s large handwriting. He said “Chuck, I know in your work with the World Bank, this should prove very useful to you.” And on the caption of the notebooks it said: The Water Law of China. I thought this is incredible; this is great. Then, when I opened the first volume and looked, it was all in Chinese.

Another example of Al’s humor was his behavior on airplanes. He would get on an airplane, turn to the flight magazine and make gifts to people of all the free offers from those planes. He would sign you up for free information on obscure acupuncture correspondence courses or information on strange get rich schemes. He would fill out the postcards with something like your name and the law school address. I once received three huge magazines on cosmetics and youth potions addressed to Charles Dinglemars, Professor Shyster Emeritus of lawyering. That was his sense of humor. That humor, that respect for others and his gift of charm made him a man I and many of you in the audience will miss today and continue to miss in the future.

THE PRIOR APPROPRIATION DOCTRINE, ITS BENEFICIARIES AND THE NEED FOR CHANGE

The topic, prior appropriation, requires a little bit of definition. Most of you understand the basic definition, but we sometimes lose track of which members of society benefit the most from this doctrine. The prior appropriation doctrine of water law is of course that the first person to place water to beneficial use has the better right to use of that water. It exists in virtually all Western State constitutions. The principle is that if you beneficially use the resource, then you are entitled to have a better right in times of drought than someone else, that right being determined by the date you first applied the water to beneficial use.

Who are the beneficiaries of that doctrine? The beneficiaries in the Western United States can be loosely described as follows. Our economist friend will like this functional definition; the beneficiaries are the hardy risk-taking individuals who invest capital first by diverting the water and creating wealth. They are rewarded for their investment by being allowed the privilege of receiving the most water in times of shortage. There is, in effect, a bargain struck between those expending their capital to develop that resource and produce things and the state. For expenditure of their capital and producing wealth, these individual water right owners are given the best right in times of shortage.

There are other beneficiaries. The courts throughout the nation recognize that Congress or mere aboriginal presence can offer benefit under that doctrine. Native American tribes are provided a priority date. Their quid pro quo for receiving an early priority date is not the actual use of the water but their mere presence of holders of an historical equity in the resource irrespective of use. If we think about it, if it were not for the prior appropriation doctrine establishing an early priority date, their aboriginal presence or the latter date of their treaty, or act of Congress creating a reservation, would be assigned a value of zero. The tribes would be forced to bargain in today's society for a share of the resource in a way that under values their special value to the overall culture of this nation. Thus, the prior appropriation doctrine is vital in preserving their special place in our society.

A third set of beneficiaries in New Mexico is the traditional Hispanic cultures of New Mexico, built around acequias. These are families whose use of water and physical presence predate the Treaty of Guadalupe Hidalgo and are the earliest documented non-Native American uses of water in this region. While the rights of land grant residents were dramatically watered down by the unfortunate Supreme Court cases interpreting the treaty of Guadalupe Hidalgo, the prior appropriative water rights of these groups survived

those cases and give them a deserved special place as a function of their early use of the resource.

Finally, the most important characteristic of the water resource under the prior appropriation doctrine is that the rights can be transferred, sold, or leased to others in times of shortage. The beneficiaries of this

Finally, the most important characteristic of the water resource under the prior appropriation doctrine is that the rights can be transferred, sold or leased to others in times of shortage.

characteristic are the entities that do not have sufficient water to survive a drought, but who can acquire rights from others in dry years and survive the weather extremes of our arid state. This ability to acquire rights from others through a market transaction is of course now loosely referred to as acquiring water rights in the water market.

Prior appropriation doctrine works best if water can move from one set of users to another while maintaining the same priority date. In this example, economists would tell you that both the buyer and seller are made better off when such a sale or transfer takes place. Under this system, people with early priority dates will get the benefit of the capital value of that water right and the property it represents. This benefit could come in the form of a cash exchange to a private individual, a government loan or grant to build a water system for an Indian tribe in exchange for a sharing of shortages, or a program of forbearance whereby individuals are paid to forbear from use of their priority date and leave water in the stream for wildlife purposes.

PRESSURES TOWARD THE POLITICAL ALLOCATION OF WATER

The prior appropriation doctrine has currently come under fire from a lot of individuals. Who would you expect those to be? It takes very little thought to surmise

...creative methods of voluntary adjustment of the right to use water in times of shortage are developing in many basins of New Mexico and this is a good thing.

that the people challenging the doctrine would be the people who put the water rights to use most recently and have low priority dates or in the case of environmental groups seeking

water for species, no priority date at all, or politicians who realize that the movement from a property based priority system to a politically allocated resource process would yield incredible political clout to the holder of that resource. As Robert Dahl wrote in his famous treatise "Who Governs," politics is the allocation of resource among alternative political ends, and in New Mexico the most precious of all resources is water.

Someone who has the low priority date or no priority date, will immediately conclude in times of drought, wait a minute, "this is a bad doctrine, this makes no sense, I should be able to – we need to allocate this resource politically. We need to look at society together as we reallocate it. What is this prior appropriation stuff? Why should the date you first used water be relevant? Society has changed."

It is easy to understand the frustrations of environmental groups who see other values in the resource, such as the needs of the riverine systems themselves. They voice very legitimate concerns. Likewise, and often more powerful on the political spectrum, you will find the major municipalities, urban interests, developers who need the resource to fuel the engines of capital promoted by growth.

New users balk at the notion that somebody with a lower value use in economic terms or making up a minority portion of the population should control this resource. So there is a lot of opposition, a vague and unlikely alliance between New West environmentalists and major developers seeking to quench the thirst of growing Western megalopolis demand in places like Denver, Colorado. While they may fight each other

for the resource, they both share the common perception that it should be allocated politically. This of course raises the adage you have be careful what you wish for.

The opposition has grown so great, in the *High Country News*, in a book called *The Water Handbook* a very good personal friend of mine named Charles Wilkinson pronounces the doctrine as dead. He took it upon himself to write the obituary for the prior appropriation doctrine. It reads:

"As has been so widely reported, Mr. Prior Appropriation passed away in January of 1991 at age 143. Prior was a grand man who led a grand life. By any standard he was one of the most influential people in the history of the American West. But sadly his day has passed."

Well that would be the view of the *High Country News*. It might be the view of those who believe they have the political clout to allocate the resource among subjective political ends, but I am happy to say this view does not really reflect the reality of today.

The prior appropriation doctrine is alive and well because people cannot come up with a better idea. Even if they don't agree with allocating water by priority, people don't want to let it go. Most people don't like the idea of relinquishing power completely to the "right thinking" government in Santa Fe who could reallocate it in the wisdom of philosopher kings.

CONTEMPORARY SUPPORT FOR THE PRIOR APPROPRIATION DOCTRINE

From what I can tell, the prior appropriation doctrine has a whole host of constituents who are supporting it today in spite of the fact it is under siege. The principles of prior appropriation are stronger than they have been for a long time because of the nature of the system of water allocation and because of the increase in scarcity. People are searching for efficient and fair ways to deal with shortage, and alternatives to rejection of this doctrine in favor of pure politics do not get far in the legislature in Santa Fe. However, creative methods of voluntary adjustment of the right to use water in times of shortage are developing in many basins of New Mexico and this is a good thing. The provisions for sharing of shortages in the San Juan Basin come to mind.

Em Hall is going to speak today on the origins of water law doctrine in New Mexico and how the doctrine varied historically by region within the State. And that will give us a very interesting discussion. The reason the prior appropriation doctrine has been so durable can be found in its evolution. Today's times are not the only times when businesses have clashed with farmers, when politics have pressed private property.

EVOLUTION OF THE DOCTRINE AND THE LESSONS APPLICABLE TO TODAY'S WORLD

From the 1800s to the 1850s, there was really very little need for water law in the Eastern or the Western United States. In the Eastern United States there was little need for water law because there was more of it than they needed. Population centers had ample water supply. The riparian doctrine of water law in the East borrowed its principles from the common law of England. The common law simply holds that if somebody is bothering your water source, you can stop them as a nuisance if their actions are interfering with your reasonable use of this common resource.

But the English common law never addressed in any sense the consequences of natural scarcity that exists in the West. Eastern streams did not dry up when a person upstream took all the water from a downstream user in an ephemeral stream leaving someone's cattle to die.

In the Western United States, there are a number of factors that led to the need for the development of this doctrine. We look at expanding populations in the new Western cities, but Western population expansion is as old as water scarcity in the West itself. It is interesting to look at the numbers on urbanization and how, from 1850 to 1900, the gold mining influences, the 49ers, that whole period of time from '49 to '72 and up to the Great Depression of 1886, populations more than quadrupled. During that period of time, the West changed dramatically. The small streams with erratic flows, which had previously been quite adequate, were now found to be very inadequate because during times of scarcity there wasn't enough to go around. There were federal proposals throughout the West at that time to encourage settlement. There were land programs that encouraged people if they could find a water source to homestead.

A combination of land development policy, which encouraged settlement and the actual needs of certainty for those who had invested their capital in what turned out to be a "dry farm" in June and July, or a place mine that needed water called out for a water law that would work. The answer was prior appropriation, it was not and is not perfect but it provided a method to adapt to shortage that was acceptable.

No one was going to invest in a mine or invest in agricultural development that used water or anything else in the West in the 1880s unless they had some real certainty for the people who were putting up the capital. The identical fights over the appropriateness of the doctrine appear in cases of the 1890s. No doubt, an obituary to the doctrine was written by a politician of the period hoping to move water to his constituents as a means of staying in office.

The answer was prior appropriation, it was not and is not perfect but it provided a method to adapt to shortage that was acceptable.

But, there was insufficient capital in many cases to take advantage of the hydrographs of the regions. The Reclamation Act of 1902 recognized that if you were going to harness Western rivers, you needed to have reservoirs. Erratic flows and huge variability required that if you were going to produce with water you needed to be able to store it and release it at a rate which would be useful during the irrigation season and you also needed to store it for flood protection.

The Reclamation Act of 1902 paid for and encouraged infrastructure; the Desert Lands Act of 1877 vested water rights in private individuals. Both encouraged development and rewarded people for coming out and using water resources of the West. These laws were bottomed in the notion that there was a separate set of water needs and water right needs in the West distinguishable from those in the Eastern United States.

There is no doubt that some of the choices of federal subsidies for projects with negative cost/benefit ratios and the absence of the knowledge of the effects of some of these reservoirs and projects were short sighted. But seen through the lens of the engineers of the time, those choices generated wealth for those seeking to better their lot and willing to farm to make their lives better. Making the desert green may have of course been a double entendre that at times resulted

in skewed results, but the effect on water law doctrine is unmistakable and the issues were not so different then from what they are today. The interesting part to me was how both the Eastern and Western systems flourished, and yet lawyers trained in the Riparian Doctrine almost never communicated with lawyers born and bred from the Prior Appropriation doctrine. At least from 1900 through 1930 a review of the legal literature yields virtually no articles comparing the doctrines.

THE UNIQUE NATURE OF THE DOCTRINE AND WHAT THE FUTURE MAY HOLD

So if my topic today is prior appropriation doctrine, where are we now and where are we going in the future, I thought it would be really useful to do some research and figure out why it is that the two separate doctrines going on at the same time in the United States evolved so separately and essentially failed to cross pollinate to yield changes in the doctrine.

No other law is so region based. You look at the law around the country; property law is essentially the same all over the United States. Personal property law is a little different among regions, but not really very different. Whether the property law is private or public sector, private lands or public lands in the West, the law is essentially the same, but water law from East to West is night and day and the twain never met historically.

So I began to look at the physical characteristics of the resource itself. What I have learned during my 30-year career (John Hernandez knows what I am talking about) is that water, the substance water, if you try to really understand it and for lawyers who have to teach water law in class and seek doctrinal clarity, water will drive you insane.

Water is both a public and a private resource. It comes in rates and amounts and qualities that vary; they are not constant so one constant set of rules is extremely difficult. When I say public/private resource, I mean that for the environmental group it is movement through space that generates a public value, but for the farmer who diverts it in acre-feet to grow crops, owning it is a very private act.

The simultaneous dual characteristic of the resource brings to mind an analogy to physics. I remember when I took physics; I was perplexed by attempts to define sunlight. What is sunlight? Is it a

wave; that is one of its characteristics. Or is it a particle? It behaves like a wave and bends and adjusts through materials, but it can be measured in chunks or units. I told my professor it cannot be both, but he simply said yes it can. He pointed out for any scientific explanation to work, it had to be both because it needs both of those characteristics to perform its functions.

Water is the same as sunlight. It changes form; it provides benefits, and to be “water,” it must be multiple things to multiple peoples. Water is a public good because we need it to be members of the public at large: it supports flora and fauna, it is part of a cycle that no one controls, it can be used in multiple ways, it can change form or substance. The fact it freezes from the top down is the basis for modern civilization; if it didn’t do that we wouldn’t have the civilization we have now. If water froze from the bottom up the Northern hemisphere would be a wasteland. Water in streams creates wonderful insulation; it is the best universal solvent. Yet it can be sold in bottles that I am embarrassed to say I bought this morning for too damn much money as the economists would say, but it was too far to walk to the Rio Grande from here in Las Cruces, and farmers are using it to grow pecans, which I will also pay too much for.

Water can be arranged in chunks as ice; it can be allocated for irrigation and when it comes back as return flows it can be used again, but if its leaches out too much salt, it creates pollution. But if you don’t have return flows for others to use, you may reduce stream flow and further endanger species. It is indeed a puzzlement.

GOOD WATER LAWYERS ARE BI-POLAR

I have decided that in order to understand the resource water and to be a water lawyer like the ones I see in this audience, you have to be essentially bi-polar. Looking at my friends over the years, that’s kind of who they are. They can stand this unending unclarity. For those of us who have learned as academics to stop worrying and embrace cognitive dissonance we survive. But as populations expand and scarcity increases, considering that water is the most vital resource, there is an incredibly significant need to resolve the tension between those who want to let the market allocate the resource and those who would treat it as an exclusively political resource. How the gap between those two perspectives is going to be bridged

is incredibly significant for the future of society and, in my view, is the most important question.

THE MORE THINGS HAVE CHANGED, THE MORE THEY HAVE STAYED THE SAME

Now that I am part of a private practice I can afford law clerks. So I told my clerk to find the leading historical article on water law. I need to know something about the evolution of water law and how this debate was addressed in years past. He said, okay I found an article for you for Professor. I said, don't call me Professor, I'm a lawyer now; I reminded him that I had never lost a case in class. Of course, I lost a few since I left the law school, but in class I never lost a case.

The article he found is entitled "Fifty Years of Water Law." It can be found in the highly prestigious *Harvard Law Review*. See 50 *Harvard L. Rev.* 252 (1936). I said, how did I miss that article? I have read every article in the last fifty years. He pointed out that the date of the article was 1936. Hmmm, I said this might be interesting. Surely things were different then; surely the debate was more rational in 1936 before society became so fragmented and complex. The article is written by Samuel C. Wiel who is the author of treaties and a very famous author in the area of water law. The date, fifty years, celebrated the first fifty years of publication of the *Harvard Law Review* prior to 1936. The amazing thing is that his concerns and his perspective in 1936 as to what is and what needs to change could be written today. It was fascinating to read the article.

He talks about the *Lux v. Hagen* case made famous in California - a case where the biggest cattle baron in the country had flood water rights, and upstream they were trying to build an irrigation project and how even the Supreme Court was afraid of getting its ass shot off. But after 200 pages, finally gave up and said, we don't understand it and let both doctrines exist simultaneously in California. The debate there could have been the same debate that is ongoing in the middle Rio Grande over the needs of farmers and the needs of the endangered Rio Grande Silvery minnow. You have to be bi-polar to practice water law and learn to accept the perpetual tension created by the multiple characteristics of the resource.

But here is the part I found interesting. He says this: "In all events and just in uses that are now on hand, it [the transfer of water rights] seems to be getting

more attention than additional development." He concluded that in 1936, from his perspective, the system is fully appropriated so it is the water transfer that is where the action is in terms of the law and moderating principles of prior appropriation with principles of reasonable use. He further notes, "The riparian doctrine seems to be outstripping use of rights by priority of appropriation in general esteem and will carry the day." So in 1936, Professor Wiel predicted that certainly the rule of reasonable use of riparian doctrine will take over and prior appropriation will disappear. That shows what bad predictors we law professors are. He did say something very entertaining about water lawyers that is certainly true today. He said this, "very evidently the 50 years of water law have been of divergence and conflict" (that's true). "Review of them [the leading cases] could easily be jargon often among different rulings of the same court." Hmm, courts contradict themselves in water law? Here comes a slap at me as a water law professor, which I resent but which is undoubtedly true of all of us in this field. He says, "the ancients express the mysticism of restraint or sprain by a spirit of water to whom a temple was erected. Modern water law practice is apt to express it by mystical devotion to linguistic charm." Water law as mystical devotion to linguistic charm, well maybe, but not completely. I like to hope there is some sound policy and adaptation of law to changing times.

The next document I came across was one written by Joaquin Lopez, a good friend of mine who is one of the most famous water lawyers in Argentina. Although he wrote it in 1960, it was republished in the University of the Republic of Argentina Journal and entitled, "Adjusting to the New Water Law Areas of Conflict 1960 in Argentina." This is my translation so who knows what it really says. He states:

He [Samuel C. Wiel] concluded that in 1936, from his perspective, the system is fully appropriated so it is the water transfer that is where the action is in terms of the law and moderating principles of prior appropriation with principles of reasonable use.

“The constitution of Argentina contains two vital and conflicting provisions, the power to regulate and legislate regarding water for the good of the general welfare and the obligation to protect the private property rights of water for each user.”

Sounds familiar, it seems that within the Argentine water law they were trying to regulate and allocate the resource because of changing politics at the same time they were calling out for protection of the private property rights under the Argentine constitution. It’s the same debate that Professor Wiel discussed in 1936, the same debate that came up during the hearings on the Reclamation Act. And it is the same argument that was raised in the United States Supreme Court as recently as last year.

TWO FOOLISH ACADEMICS TRY TO PREDICT THE FUTURE OF THE WATER MARKET IN THE 1970’S

In 1977, two very foolhardy people, three actually, set out to analyze water markets in New Mexico to determine whether they actually existed, whether water was a private commodity traded in the market place, and if it was what its price might be in the future. The book is called *Forecasting Future Market Values of Water Rights in New Mexico*, by Brown, Khoshakhlagh, and DuMars.

We said, “We’re smart people; we can go out, we can analyze prices, we can tell you right now, in 1977, what a water right is going to cost in 1990 using economic projections, and we can predict after evaluating the circumstance and make some wise observations.” Before I get to the quote from what we concluded, let me tell you what our observations were back then.

The actual prices: in 1975 a water right in the Rio Grande Valley sold for \$502 per acre-foot. Okay, that’s the bottom line. We then got together and said suppose you ran through every damn escalator you can think of, suppose you then fudged a little and don’t want to be embarrassed by undervaluing the escalation of prices for the resource: what would we come up with for predictions in 1990 for the value of an acre-foot consumptive use of water? Oh hell, let’s go with it as wild as it gets; let’s go with \$1,100 an acre-foot. \$2,250 an acre-foot. \$2,500 if you really speculate. \$3,200 was tops. Boy was that insanely high we thought and

embarrassed and when it came out. Some people laughed and said that makes no sense, there is nothing in the literature which suggests that is true professor.

Well what do I know? The last transaction I dealt with in the Rio Grande, the people showed up at closing, they had sold it for \$6,500, demanded \$2,000 more, and the person wrote a check immediately for \$8,500 an acre-foot consumptive use. Water rights are now selling for \$10,000 an acre-foot.

But a rapid price increase tells you it is thriving in the market place as a commodity, but it does not necessarily tell you whether society at large is getting the value from this complex resource that it should. Lee Brown and I had a basic concern then; I talked to him the other day, and our concern was that not all the values reflected in water are a function of its true market price in terms of what it would bring if you sell it. The key is to ensure those values are protected in the market place, but not allow complete displacement of the market through rigid political intervention.

Water markets in New Mexico face the inevitable unclarity required to accommodate non-economic values in water; there is also a kind of frightening, lack of information as to policy as to transferability and the extent of the commodity itself. Policies can simply appear. What was once thought to be a characteristic of the right can suddenly be modified by policy without public input. This is not a good thing. If you don’t have good market information you cannot value the resource properly for public or private purposes. We concluded the following in 1977:

“the overriding need with the region (the Albuquerque region) is for increased flexibility as water consumption as it inexorably approaches its physical limits. It is easier to take steps now to begin the slow evolution towards this increased flexibility than it will be to wait until a rigid humanly constructed barrier is breached.”

By rigid humanly constructed barrier, we meant artificial, politically motivated actions, in effect the social engineering of a resource, because they are so unpredictable that individuals cannot make wise choices how to acquire or conserve the resource.

THE GOVERNOR'S WATER LAW STUDY COMMITTEE RECOMMENDS CREATION OF A GROUND WATER RESERVE FOR FUTURE GENERATIONS

In 1986 Governor Anaya, noting that virtually all of the water in New Mexico was nearing full appropriation and that other states coveted the resource, created the Water Law Study Committee to evaluate and answer four questions: How much water is there? If there is not enough, what are we going to do about it? And what is the interstate demand for that resource? To what degree can we assure that we have that resource stay in the state of New Mexico? We found in that study, and I think it is quite accurate, that there are large amounts of unappropriated ground water in New Mexico that are currently unavailable by existing criteria, appropriation criteria. We calculated the amount with the help of the State Engineer's Office. There remained 80 million acre-feet unappropriated of potable ground water, much of it in the southwestern part of the state, much of it near planned growth areas in Mexico and some of it near Tucson.

We also correctly found that these water resources are vital for the future of New Mexico. Pure market solutions might not work to preserve those resources for New Mexico's future. We were very concerned then and we suggested, and I still can suggest, in my view, with respect to that part of the resource, it is vital to come up with some method of strategic ground water reserve to evaluate those resources, calculate our future needs and get a real handle on that. One of my suggestions was to really focus on that unappropriated ground water, admit it is there, not deny it is there for political reasons or otherwise, and make sure that it is available for future New Mexicans. But that is really not a prior appropriation issue per se, it is a water planning issue. We concluded that the public nature of the resource meant that we should declare the conservation of that water in storage a beneficial use within the meaning of the prior appropriation doctrine and that it should remain forever for New Mexicans.

The Water Law Study Committee consisted of Robert B. Anderson (Robert O. Anderson's son), Gerald Thomas from New Mexico State, Les Davis of the CS Ranch, Carol Christiano and myself. Tom Bahr was involved; Al Utton was involved, along with a number of others who were very, very useful.

What we were concerned about were the effects on the water market that was inexorably moving toward expansion where price reflects scarcity in agriculture and where agriculture cannot compete. And the loss of agriculture to New Mexico would be devastating culturally and economically in many sectors. I now must confess my bias, my background. I grew up on a ranch. That's what I know; that's what I've done all my life. But the reality is, of course, that there is a water market that will evolve, needs to evolve, and there needs to be clarity in that market, and those water users who cannot compete must adapt and adjust. But a state consisting only of condo dwellers importing water to gravel backyards was not then and is not now my dream for New Mexico.

One of my suggestions was to really focus on that unappropriated ground water, admit it is there, not deny it is there for political reasons or otherwise, and make sure that it is available for future New Mexicans.

What the Committee concluded then in 1986 was that agriculture may not be able to compete with municipalities and other industries for water from a strictly economic viewpoint yet the long-term interests of the state may best be served by sustaining the healthy agricultural industry in selected areas. Because the state values its best agricultural land, its unique cultures, and other fundamental resources such as the bosques and wildlife, the state may have to acquire water rights in the market place to keep them, that is to say hold them in trust to ensure that it is possible to sustain agriculture. This water trust coupled with various kinds of research and support could sustain this special culture. I am happy to say that now in the legislature years later precisely these kinds of water trusts are being created for multiple purposes.

We also included on the cover of our report the following: "let it not be said in one or more decades hence that the present society knowing the foreseeable conditions neglected to confront them in all possible ways." That was the challenge of New Mexico in 1986. That is the challenge today.

POSITIVE NEW DEVELOPMENTS BODE WELL FOR THE FUTURE

A number of things have happened since that study - some good, some not so good. I think one of the best things that has happened is that the Interstate Stream Commission has evolved into a responsible representative political body. Our study recommended that the Interstate Stream Commission, which is a representative body throughout the state, move forward and play a leadership role in promoting and developing water policy.

That leadership has stepped forward. Under new leadership it has sponsored legislation, which I think is really helpful with the idea of acquiring water, supporting rural infrastructure, enforcing interstate compacts, and serving as a source of useful information.

The other thing that has happened is that the legislature passed the legislation recommending support of regional water planning. Regional water planning has done a lot of really useful things for us and it has involved the education level of individuals who are out there working in water, but there is something that is occurring now that I think addresses the future of the prior appropriation doctrine.

The purest prior appropriation doctrine has never really existed much in New Mexico in the middle and lower Rio Grande valleys, and in some ways this has been a good thing.

We are not really in that bad of shape. The purest prior appropriation doctrine has never really existed much in New Mexico in the middle and lower Rio Grande valleys, and in some ways this has been a good thing. Certainly the Native Americans are entitled to enforce

priorities, but conservancy districts and irrigation districts buffer the effect of that doctrine by requiring a sharing of shortages.

For example, if you have a group of 10,000 farmers, each of whom has a different priority date, and you're trying to enforce priorities down to the minute as to who diverted first, it is not going to work. So what has happened in the middle and lower Rio Grande valleys and has happened in most Western states, there have developed local institutions that have banded together. They were created as political subdivisions with elected boards to allow at the

grassroots level a method to allocate water in times of drought by sharing shortages. In the Middle Rio Grande Conservancy District, for example, when there is a short year, everybody shares shortages. If the Board is unfair, it gets voted out of office. This local control can be critical.

THE CHALLENGE WILL BE TO STRIKE A BALANCE BETWEEN PURE ECONOMIC ALLOCATION AND SELF INTERESTED POLITICAL MANIPULATION OF THE RESOURCE

There is a principle that I have witnessed everywhere I have worked, and I have worked in quite a few different places. That principle is the more scarce the resource, the greater the tendency to take it out of private hands and to place it at the mercy of raw political power. It is the nature of things; it is the nature of politics. I remember interviewing once the head of the National Water Commission in Mexico. Article 17 of the Constitution allocates all of the resources as a political good. They allocate it to the regions based upon their alliances with the various political parties. In the interview, he said to me something that I will not forget. He said, "El poder debe ser absoluto." He said, "The power of my job must be absolute." To obtain the power to allocate water to wield it pursuant to one's own political instincts is natural, but is dangerous. Yet, as I said earlier, there is a critical tension. Back to my sun metaphor, there is a tension on the one hand, between the desire to let the economy allocate the resource by price and forcing other users to react to the scarcity by adjusting to the marketplace by conserving. And, there is the political desire to subsidize, to control the price, by mandated alteration of the cropping patterns. There is a desire to have that "poder que es absoluto."

Now in New Mexico, we are facing those tensions in this state more and more every year. The test will be to regulate the market but not manage it to the point of political manipulation. You have the Office of the State Engineer; that Office faces an incredible challenge. I can say from my own personal experience that the local offices of the State Engineer that I deal with are wonderful organizations at the grassroots level that do their best to help people cooperate. Yet at the top government levels, impatience with the water markets can bring about mandated changes based upon

politics of value judgments beyond those of requiring conservation and the dissemination of information.

The economist who preceded me in this lecture insists that there is a tremendous amount of disposable income in today's society more than ever in history. If the prior appropriation doctrine is to work, though, we have to let the institutions, the users, the consumers, those people with all that money make the rational choices he talks about. He argued that an educated society buys products that promote and protect the environment, that using the least water preserves the most wetlands. I sincerely hope he is right. If we in fact have all of this disposable income out there, and if there's the ability to buy smart water - water obtained through conservation, and if we can grow the specialty crops without excessive pollution, and if conservation can pay, and I think it can, then the people who use the resource make the choice that blends the public and private values of the resource.

WATER RESOURCE AVAILABILITY, ITS VALUE IN PRODUCTION AND IN SUPPORT OF THE ENVIRONMENT MUST BE MADE COMPLETELY TRANSPARENT IN EVERY FORUM

The prior appropriation doctrine is not going away. Anglos, Hispanics, Native Americans, acequias, and the conservancy and irrigation districts with their early priority water rights are not going to give up those rights. They cannot be taken because someone filed a lawsuit saying that the Rio Grande silvery minnow should get the water in times of scarcity rather than farmers. Society will not tolerate that result. The system is going to stay in place. But society will also not tolerate a life space without farms, without wetlands, and without a diverse habitat for its people and its creatures.

The first thing every economist will tell you is that you need good market information. You need to know about the resource. Where can you go today to find out anything about the value of water rights in New Mexico? Bill Turner knows, and he isn't telling. There is no place to get the information about the value of the good. There is no place to go. There is no common source of information about this commodity.

In contrast, there is a great deal of information on the environmental side. They are terrific, and they do a great job. While their view of the data may be skewed

from some perspectives, they are there. They know the resource they want to protect; they are protecting it, and it is vital that they do so. They will tell you how much water the silvery minnow needs, what is going to happen, and the consequences of not protecting it. But on the market private sector side, from the production value of water, there is no common place to find out the value of water in production, its overall supply and how to obtain it. This must improve for the system to function in the future.

Not only is the absence of good information a serious problem for good water policy, another thing that the prior appropriation doctrine of water markets cannot stand is policy surprises. If there is to be a change in the policy about whether you can use ground water to offset water rights in certain communities and other wells, it needs to be a public process where everybody goes. If rules for conservation change, the changes must be made public through a public process. The problem is one of scale. If the prior appropriation doctrine is to work, the development of process will be vital. The system works well within a small acequia where everybody knows everybody, and you know if they are not digging out their part of the ditch or are using too much water.

When you have 10,000 farmers or you have the City of Albuquerque paying a lot for San Juan-Chama water, and you have a decision made by a court that will affect investments already made, then without full public process, by the recognition of new rights in water not heretofore understood, the result can be chaos. We need to do it better than this.

The third thing we need to do is we need to take a real close look at the way in which we clarify the

...there is a tension on the one hand, between the desire to let the economy allocate the resource by price and forcing other users to react to the scarcity by adjusting to the marketplace by conserving. And, there is the political desire to subsidize, to control the price by mandated alteration of the cropping patterns.

commodity itself through the adjudication process. Thank goodness Judge Valentine is chairing a committee of brave souls appointed by the New Mexico Supreme Court trying to move the adjudication process into warp speed and clarify the adjudications rules to see if we cannot expedite that process.

Not only is the absence of good information a serious problem for good water policy, another thing that the prior appropriation doctrine of water markets cannot stand is policy surprises.

There are some really exciting things going on there. It is going to take a lot of resources from the legislature to make it work. But if we can work to get those rules clarified, and we can speed up the adjudication

process to make it work even better, I think the prior appropriation doctrine will work. It must work.

My prediction is that water for the future will be a much better understood resource; I'd say that we need to start now, immediately, to produce more transparency as to the value of water, not just economics, but also aesthetics. This is what the environmentalists do.

We need to illustrate the value of agriculture better, the value of production, if we want it to remain in agriculture. Finally, we need to try to reduce conflict from yelling and litigation to just talking and educating. I look around this group and think you cannot find a nicer group of people, with a few exceptions, who mean well. The water bar of lawyers is a wonderful group of people to be around. Those who work in this region are wonderful to be around - bipolar so they can stand to work with this complex resource, but wonderful people.

CONCLUSION

And if we can get everyone looking for Al Utton's little spot of green at sunset, and all get on the same page, and make available in every forum the information about the water resource, the markets, the water law, and the steps for rational reallocation, I believe we have a tremendous future under the prior appropriation doctrine.

Thank you.

William E. Rinne was named Deputy Commissioner, Director of Operations for the Bureau of Reclamation in June 2003. A Senior Executive Service member, he works with Commissioner John Keys to ensure Reclamation's effectiveness at operating all of its projects consistent with federal and state laws, interstate compacts and international treaties, while also meeting the Administration's objectives and priorities. Bill, who has more than 26 years of federal service in Reclamation exclusively, served as Deputy Regional Director of Reclamation's Lower Colorado Region in Boulder City, Nevada and has served as an area manager, regional liaison in the Commissioner's office, regional environmental officer, regional fisheries biologist, and project biologist. In these capacities, Bill was actively involved in managing environmental and operations programs for the agency's Lower Colorado River area in Arizona, California, Nevada, and Mexico. In 1996, he was awarded the Department of the Interior's Meritorious Service Award. An avid outdoorsman, Bill particularly enjoys fishing and gardening. He is originally from Burchard, Nebraska. He received his B.S. degree in biology from Peru State College in Peru, Nebraska, and an M.S. degree in zoology from the University of Nevada in Las Vegas. Bill and his wife Jan have two children and six grandchildren.



THE BUREAU OF RECLAMATION: THE LAST 103 YEARS AND THE NEXT 47

William E. Rinne
U.S. Bureau of Reclamation
MS 7060
1849 C. Street, NW
Washington, DC 20250

Thank you, Karl. Good morning. It is indeed a privilege and an honor to be here on behalf of Commissioner John Keys. Before I get started, I have to say a few things about John. I know a lot of you know him quite well. He was badly torn about whether to be here today or not to be here today. In fact, he was hanging on to this as early as the first part of this week, but he does have commitments that he had to favor.

Prior to the last 3 ½ years in Washington I spent most of my career before that on the Colorado River so I've spent time in Yuma, Arizona and Las Vegas, Nevada. My heart is in the West. I told John I felt badly he wasn't coming, but I would gladly take his place to get back out here to the West.

I also want to congratulate you on having your 50th water conference. I guess it's obvious that it says a lot about the important issues that you are dealing

with to continue on for 50 years. Looking at the topics and looking at the speakers, I'm really impressed. I'm certainly not going to try and out-do the first speaker – that guy was something else and I really enjoyed him.

We have several Reclamation employees here today and I want to acknowledge our area office in Albuquerque, our deputy regional director from the Salt Lake office, Darryl Beckmann. We also have Bert Cortez and a lot of his staff. I bring this up because they are the right people to talk to about your issues. We think they are a great crew, and I always appreciate the things that they do for us. I encourage you to meet with them.

Thinking on this topic *The Last 103 Years and the Next 47* – there is an old saying that I like, “We don't know what we don't know.” I actually grew up in the mid-west in the state of Nebraska. We were dry-land farming and as a boy grew up loving the outdoors, hunting, fishing, and farming. I was just tied and wed to that. I did okay in school, but I also relished the day that I could get out of school and back out on the farm or to the outdoors. One of the courses in school was history, which I did okay in, but at the time, the great value of American history, civics, and local history, I did not see. I couldn't see what it had to do with where I was and where I was going. But as I have grown older, I have replaced that attitude and have found out how little I know, especially in the last three years working in Washington where I've had a broader view of Reclamation's work, west-wide. I think it is very significant, and we must remember where we are in life and where we are in our program; it has a lot to do with where we have come from. I think the first speaker said that very well. I want to talk about three things: the history of Reclamation and our dam building era; then I want to talk a little bit about some of the challenges I think we are facing along with you; and then finish up by talking about what we are doing to meet those challenges with the help and support of all of you.

Much of the Reclamation history is tied to the construction of dams. In fact, I was talking with Woody who brought me over from our El Paso office last night; we discussed that outside of the West here, people ask, what's your Bureau of Reclamation? But that does not always connect. But when people ask what we do, I can answer that we are in the area involved with the construction of dams, like the Hoover Dam. Reclamation is tied very tightly into the dam building area. In 1902 after we were formed, Theodore

Roosevelt set about trying to get water projects, and within the first few years we undertook about 20 projects. Between 1902 and 1970 we constructed many dams. The count today of dams and dikes that Reclamation is involved with is around 471 in the 17 western states. This past May marked the 70th anniversary of the construction and completion of Hoover Dam, which we consider one of our best known Reclamation projects. We think that a project such as Hoover is truly an American landmark. It doesn't belong to Reclamation. We are proud of this achievement. But in these new times we are facing new challenges, so we have to recognize that and build from there.

Some of the things I will touch on will be how to maintain our infrastructure. Remember I said from between 1902 through 1970 we built almost all of these dams, so we have a very old and aging infrastructure, but I want to hastily add that these are also very well kept infrastructures thanks to some of the water users and some of the things that we do. And we do tend to the critical maintenance. I'm not saying they are falling down, but they are older. Definitely looking after these older dams is one of our challenges along with all our partners throughout the West.

Second thing is how do we meet the demand associated with the population growth, the increasing demands for water? I'll put this one aside for a little bit till I talk about Water 2025. Finally, the challenge we meet is stretching water and meeting the demands of users in finding ways that are acceptable in our society; this is really the challenge.

In addition to preparing for the future, we find ourselves from time to time in a public agency having to deal with unexpected challenges. I think the tragedies such as the hurricanes along the gulf coast, Katrina and Rita really bring this out. The Reclamation states don't have a presence along gulf areas so we don't have jurisdiction along the coast. But what Reclamation does have is a long history of working with the Corps of Engineers. We have worked in the past with them in Florida. We actually have a Memorandum of Understanding with the Corps of Engineers where we go in and assist them.

The Department of Interior has been very active in what is called the National Response Plan, and at times we have had to deploy 1500 to 2000 employees at one time. Reclamation is coordinating through the Department of Interior one of the emergency support functions called ESF-3, which is number three of the

National Response Plan. It has to do with engineering and public safety. We have about 300 people who are deployed that are either Bureau of Reclamation people or from other bureaus within Interior. I'm talking about the Park Service, Minerals Management, and the like. So while we go on with our mission and while we can't use the dollars that we have appropriated for our projects, we do try to help out with these kinds of things. Like the Corps of Engineers, we have fully refundable money under FEMA. We actually get paid for the work that we are doing on the gulf coast.

I want to mention one thing we did even in the state of New Mexico. We had the water purification unit over in Tularosa that we dismantled upon request and took down to a gulf coastal state. We set it up in Biloxi, Mississippi. The unit when it was running at its peak was providing drinking water, actually above EPA standards, to the Biloxi Regional Medical Center. At its peak, it was pumping 260 gallons per minute, and in acre feet that's a little over an acre foot a day. There was a lot of water that needed to go to that medical facility in that area. I understand from the Upper Colorado River people that the unit is now being dismantled to be returned to Tularosa. So like everyone else we step up and try to work with the public and do our part.

What are we trying to do in other ways to meet these challenges? A couple of things. For example, over the last year we've had the National Academy of Sciences looking at our organization of the Bureau of Reclamation. What we are trying to find out is if we have about the right organization in place or if we have an organization that needs to be tweaked or changed to help us meet the challenges we have now and where we are trying to go in the future. We don't know the outcome to that yet, but the National Academy is of course a very independent kind of a process, which is what we want. They have interviewed many water user groups of the West and have interviewed us. We are expecting the report toward the end of this year or early next year. We will get a report from Commissioner Keys and are looking forward to using this report to see if we are meeting the challenges of today and what we think are our challenges are for tomorrow.

Another thing is appropriate legislation in helping us. We don't try to go in and get legislation on everything. One example of some legislation we think has helped us is the Safety of Dams Cost Ceiling Adjustment Act passed by the last Congress. That bill

did three things pretty significantly. It increased the authorized appropriation ceiling for the program over all so we are able to continue funding this important program. The Act raised the ceiling by \$540 million. We believe this ceiling should be sufficient over the period of the next 10 years. As opposed to going back on a given safety dam fix and getting specific authority, we will have appropriation authority in place and the funds are there.

It also increases the threshold for the reporting requirement to Congress. If a project cost was going to be more than \$750,000, we had to send a report to Congress in advance of initiating a safety modification, lay a report in front of them, and then get approval. We've now moved that up to \$1.25 million. I think that indicates some confidence from Congress that we are paying attention to dam safety and are administering the way we should be.

We had the water purification unit over in Tularosa that we dismantled upon request and took down to a gulf coastal state. We set it up in Biloxi, Mississippi. The unit when it was running at its peak was providing drinking water, actually above EPA standards, to the Biloxi Regional Medical Center.

And finally, this may be one of the most important things. It actually puts the project beneficiary, water district users at the table as we are going through safety dam fixes. Hopefully, we have less bureaucratic faceless interface where we are actually meeting with the beneficiaries and telling them that we need to have this fixed for a precise reason. Beneficiaries are required to repay 15 percent of that. This gives them an opportunity to react to this and work with us and provide input. We think these are three ways that legislation has helped.

Another thing that always comes up as we meet these challenges of how to stretch water supplies and increased demands is storage. And storage can of course be quite controversial in terms of points of view. You have some people that are looking for new dams who say the drought over the last several years has demonstrated that we need new dams. And you have other people that say no, tear them down. We need to

look at it for other resources. So we always have to maintain a balance.

We at Reclamation are convinced of the benefits of storage, and we have learned over the past six years, especially in the last five years where we have had severe droughts in the West and some even compared to the Dust Bowl Age, maybe some of the most extreme droughts on record. I think that the bottom line is that on a happier note we are not in crisis throughout the West. I'm not saying that water users have not suffered, but what I'm saying is that the dams and storages facilities have carried us very well. They have been like life insurance policies. The water in these reservoirs has been a help to people. I think this is a tribute to our forefathers. This goes back to my point on history.

They had a lot of foresight on flood control and water storage and we've reaped the benefits. I always like to turn to the Colorado River Basin as much as anything probably because of my familiarity with it, but that particular system has enough reservoir capacity

The Challenge Grant project provides innovative ways to head off problems by conserving and distributing water more efficiently and more effectively through water conservation, collaboration, efficiency, and markets.

to store about four year's annual water supply. So around 60 million acre ft. that has served us very well over the last five years. That has enabled us in

the upper and lower basins to meet virtually all our water needs, especially the lower basin, without creating any kind of shortage. We continue to meet our Treaty obligations to Mexico; it's a very important thing because we have never missed on our Treaty obligation to Mexico since 1944. So these storage reservoirs have really served their purpose.

On a positive note, we seem to be getting some little hints in the last year of some lessening of the drought. I don't think we, like anyone else, are predicting the drought is over, but it is always good to get that relief, even in this area as I understand. As I flew in, I saw evidence of water in some of the low places. Las Vegas, NV had a good storm over the last few days. Today we had this in the Colorado Rockies, while in the northwest it continues to be fairly dry. It's a mix

and a match, and I don't think we can tell you that it is over. Even in the Rio Grande Basin, I've been thinking about that. There have even been some good rains there. This isn't the snowpack time of year, but hopefully this will help us, and it is encouraging.

What about new water storage? Let's focus on this a little bit. We have a fair amount of people telling us they think the answer might be to get more storage and build more reservoirs. In fact, a recent energy act passed in Congress has a section in there, Section 1840, that asks the Bureau of Reclamation within 90 days to provide a report to Congress listing all those facilities that have hydropower as a component, and of course along with that any of them that ever had storage. So we are completing that and there are a lot of old, old projects here. I'm not saying that they have feasibility today, but there are a lot of them there, so there is some pressure to look at these storage facilities. One of the constraints is that we have to be realistic and look at cost factors today as well as other constraints, environmental factors, and the balances society prefers. What this means is that it is challenging to get these things started and completed.

For example up in the northern California area, the CALFED program. Congress has authorized us to take a look at increased storage there, a feasibility study. We have three or four areas there that may have potential, but I think even if there is potential these things don't happen over night. It takes a lot of years to put something like this in place. So what this leads me to is that in the near term the better we can apply technology, the better we can work with our conservation and efficiency that will hopefully help us to stretch our supplies. I think this is what we have to do to carry us through as we look for longer term solutions.

The maintenance of our aging infrastructure is one of the things that Reclamation is doing. Our reservoirs and dams average over 50 years old, so we know that there will be some major fixes that will have to be done, rehab and upgrading done over time. I'm not saying they have already extended their lives, not like some irrigation facilities, but dams have a longer life so we think that they are doing fairly well. We do have some substantial resources directed to these areas in operations and maintenance through 2006.

Another area that I would like to bring up is the idea of cooperative efforts. Approaching these problems with cooperative efforts has to be the answer. I think we are no longer in the days of the large federal

water projects where the federal government is going to come in and pay for all this. I think it has to be a local and federal cooperative effort. Whether it be a rehab or a new storage facility, I think it's just the pressures of reality on the budget that are just there. Besides, we need to have cooperation between the local and federal government, which is real critical.

One of the things we are trying to do in this area has to do with tools. We are trying to make it better and easier for some water districts that have to fund their own maintenance rehab. What I'm talking about here is that we are exploring and working with the potential loan guarantee program that would be somewhat modeled after the Department of Agriculture program. It's just a concept that still has to be worked through administration. The concept would provide additional help to water users in getting loans for major rehab or betterment of facilities where it comes under operations and maintenance, which requires that you have to be paid yearly incurred costs. Some districts are stretched so thin that this loan guaranteed program might be helpful with more lending institutions providing capital as a loan to the water district with a little guarantee from the federal government with a percent of that. Keep in mind that most of these facilities are federally owned facilities that may be operated by non-federal entities. We have some hope; we don't think it's a fantasy that we can get in there and help out.

I would like to now talk about population growth because I mentioned that as one of the challenges. I don't mean population control or growth control. It's more about how we deal with what we have in front of us. I think in the West we know it's the fastest growing region in the country. The explosive population growth increases our demands. Between 1990 and 2000, I checked on the population through the census – the population of Utah, Colorado, and Idaho increased by more than 30 percent while Arizona's population increased by more than 40 percent and Nevada's increased by more than 60 percent. It's pretty obvious that these kinds of pressures are coming from the urban areas and will only continue as it relates to water. Drought as we talked about can be a challenging problem, but it's not the only cause of water shortage. One of the greatest concerns that we have is that even in normal years if you added growth in the West you may find that basins simply do not have enough water to go around with the way that it is working now. The

challenge is to work with and supply more around where needed.

Having said that, we think there are numerous opportunities where water supplies can be managed more effectively. Water markets can be developed; collaborative solutions can be found, and new technologies can be researched. The response we are trying to help out with is Secretary Norton's Water 2025 initiative. We think it's a confident water management strategy; it faces the harsh reality that federal funds can't do it all, but federal funds placed with local interest can help us with leverage and do more with these projects. This really stresses local decision making. Through Water 2025 we can partner with local decision makers and focus on limited funds in areas that have the greatest affect.

There are five key tools that we talk about. I'm sure that you've heard it before, starting back with Assistant Secretary Bennett Raley and from Commissioner Keys. In fact we are going to have a little ceremony upstairs at noon. We have three Water 2025 Challenge grants that are being awarded here in New Mexico. We really feel it's a great program throughout the West.

One of the tools involved in Water 2025 is the idea of collaborations. Our work is guided by Secretary Norton's 4Cs: cooperation, consultation, and communication, all in the service of conservation. We believe that, to live it, and try to work it through ideas like Water 2025.

Another tool we use for Water 2025 is the technology that can help identify a new water supply and help reduce the cost as we slowly adopt some of these technologies. Then we can do things with brackish water. We might be able to desalinate that and maybe in some cases substitute that through a long series of pipelines for rural water.

To give you an idea of some of these technologies: in 2003, we delivered nearly 93,000 acre feet westwide of reclaimed water to local customers. This means that there is 93,000 acre feet of potable water that we did not have to use for irrigation or industrial uses. The amount of reclaimed water increased nearly 110,000 acre feet in 2004. And we think it will grow to over 135,000 acre feet this year.

We are putting a lot of emphasis on the desal area. We are not trying to compete with the ocean desal; it does have that component but we are emphasizing research R&D on brackish water, and we are trying to help get the costs down.

I want to talk a little about the Challenge Grant Program. I mentioned that we have this ceremony later today. It's the heart of our Water 2025 program and is in its second year. The Challenge Grant project provides innovative ways to head off problems by conserving and distributing water more efficiently and more effectively through water conservation, collaboration, efficiency, and markets. It's a 50/50 cost-share program, and it's a competitive program. In 2004, 19 projects representing 10 western states received Challenge Grants totaling \$4 million. These projects will return almost \$30 million in on-the-ground water delivery system improvements. That is a return seven times greater than the investment.

The projects that received Challenge Grants last year are already under way. They include

...after September 11th we evaluated our security and took it very seriously and moved it up in funding and priority. We have evaluated our security needs in every Reclamation dam, some 290 of them and more. We are implementing changes as a result of this.

improvements in monitoring and delivery, and market solutions such as water banking. This has been one of the things that we have wanted to do when we started this program. It's like with so many things that you do,

you have to have some successes, and we wanted to see things hit the ground and happen fast. We feel that these projects we started in 2004 are really doing their part, and we've seen lots of progress.

In 2005 Congress provided Water 2025, a line item in the Bureau of Reclamation budget, with \$19.5 million, \$10 million of which was dedicated to the Challenge Grant Program. This year with that funding we have received 117 proposals. We selected 43 projects from 13 states and awarded \$9.9 million in Challenge Grants. If you include the contributions of the non-federal partners, the projects represent more than \$27 million in water improvements. Reclamation contributed about one-third in finance. Again our local partners have really stepped up, which is really appreciated.

I want to say a word about security before I wrap up. Of course after September 11th we evaluated our security and took it very seriously and moved it up in funding and priority. We have evaluated our security needs in every Reclamation dam, some 290 of them

and more. We are implementing changes as a result of this. Our goal is, of course, to protect the facility, the public, and our people.

The day of huge water projects might be over, but we don't have a shortage of challenges. We think that the work that is ahead of all of us is to meet the many demands of agriculture, hydropower, recreation, environmental needs, and municipal needs. Every place you go there is a constant pull on the water supply.

Some projects will probably be looked at in the long run because of tough financial, social, and environmental hurdles. In the near term, we think that innovation such as water banking will further improve our available supply. I guess that I would move forward to conclude that we really value our partnerships. I just don't see how any of this will work without it.

We used to have an old saying when I first started, do this and do that. I remember when I first started my career as a bureaucrat you could do things a lot quicker. Today when you have an idea your circle is much more involved with many interests, some of which seem to be competing, it just takes more time. Having said that I don't think it's good or bad, it's where we find ourselves, and I think partnership and collaboration is critical to that.

There is an old Teddy Roosevelt photo that I just love – there are four or five men all around a campsite. They look to have been there for days from the growth of their beards and they look to be pretty worn out. The picture has a caption that reads, "You never know a person until you camp with them." This is a message we try to send loud and clear that when you get to the table with your partners and they don't know you and you don't know them, it is human nature to always keep something in your back pocket. When it's time to deal with tough issues, you want to know people better if you can. I really push for getting to know your partners or people you are dealing with better.

In conclusion, I will say that challenges are different today, but I think that the 21st century is just as exciting a time for water management as the times of the great old construction projects. As I looked around the room this morning, I saw a lot of us older gray people, but I see a lot of what I see as 'new blood' that I hope will carry us over the coming years. This is critical in both our bureaucratic, individual, and non-federal entities in collaborations. So I commend all of you again for a wonderful conference and thank you for letting me come and speak and for your partnership that is so important to us.

G. Emlen Hall is a law professor at UNM's School of Law. He received an A.B. from Princeton University and a J.D. from Harvard University. Em is editor in chief of the Natural Resources Journal. His research and writing focus on the history of land and water in the Southwest. He has written two books on water issues: Four Leagues of Pecos: A Legal History of the Pecos Grant from 1800 to 1936 (1984) and High and Dry: The Texas-New Mexico Struggle for the Pecos River (2002). Prior to joining the UNM law faculty in 1983, he spent seven years at the Office of the State Engineer. During his time there, he wrote an administrative history of the Pecos River Compact from its inception in 1949 to 1974. This was the beginning of his research for his recent book, High and Dry. When Em first arrived in New Mexico in 1969, he wrote for and edited the New Mexico Review, a monthly investigative journal. He also practiced law in Pecos, where he lived, and served as village planner, attorney, and municipal judge for the Village of Pecos. He has worked for Northern New Mexico Legal Services and the New Mexico Land Grant Demonstration Project.



BACK TO THE FUTURE: REGIONAL DIFFERENCES IN NEW MEXICO WATER RIGHTS

G. Emlen Hall
University of New Mexico School of Law
1117 Stanford NE
Albuquerque, NM 87131-1431

Thank you very much. One of the pleasures of coming from Albuquerque to Las Cruces is the chance to see so many people from Albuquerque. In Northern New Mexico, I hardly see them except when I come to Doña Ana County. I am reminded what a pleasure it is to see people I have worked with in a variety of capacities and to think about the generosity of spirit that people who deal with water in New Mexico over long periods of time have shown to each other, even though we have significant differences and even though we say things about each other that might not pass in public conversation. There is a sense that we are all involved in a common business. We all do it because we love water and we love New Mexico. I am pleased

to be here, and thank you for the opportunity to talk to you for just a little bit this morning.

I had understood that Joe Stell and I were going to speak together about different aspects of New Mexico water history, and I think Joe Stell will follow me shortly. Joe Stell and I are history in New Mexico. You are getting the old folks to come talk to you about ancient institutions. I am pleased to be paired with someone like Joe. I am reminded, with respect to Joe Stell, that I thought that priority in time gave the better right. Joe Stell is older than I, so I thought he would go first, but we all know there is no such thing as priority in courts in New Mexico. I am here as the junior historian and the junior among senior presenters here this morning.

You could say that I am here this morning as an advance man of tomorrow's detailed talks on the active water rights management regulations that were recently adopted by the Office of the State Engineer, because I am going to talk about those a little bit in a historical context. You could also say that I am here to warm you up to that topic, so that you are ready for tomorrow's detailed controversial discussion of those. My job as the warmer up may be simply to inform you about the acronym that people are using in my world to describe those new active water rights management regulations, because no body can manage that. The people with whom I work and who are concentrating on them call these the AW(O)RM regulations. The AWRM regulations are sort of what happen to a third base-man like A-Rod when he gets reduced to a garden byproduct. But these are the AWRM regulations that I would like to talk to you about this morning. I said I would like to talk about them in context, and I don't want to talk about them specifically. Instead, I want to point out one general feature of those in an administrative scheme, and I want to set the feature I am going to focus on in the history of water law in New Mexico. Believe or not, I would also like to set it in the context of the development of an analogous public land law that is going on in a related field, and that is the use of the Antiquities Act in the 21st century to establish new controls over federal public lands. That is my plan.

Let me begin today by setting up the general AWRM scheme obviously to understand where I am coming from in respect to that. As I said, I am not interested in the details of it, but I am interested in the two levels of administration it proposes to adopt in New Mexico. First, there is the set of general regulations that will apply to all basins administered under AWRM as I understand it. These general regulations have been promulgated, and they have drawn the ire that their controversial nature probably deserves. The issue and validity of those is now pending up the Rio Grande in the district court in Socorro. If we can find a district judge who could stick with it long enough, we might get a decision with respect to the validity of those general regulations that would apply statewide to all basins subject to that administration. The judges in Socorro willing and probably the New Mexico Supreme Court, those universal regulations will be followed by specific regulations geared at a special problem within particular areas to be administered. I take it that implementing these on the ground AWRM regulations

will differ from place to place, depending on the local situation. At the top of the regulatory hierarchy that we are about to see in New Mexico, there will be one regulatory water law. At the bottom where the rubber hits the road, or I guess more accurately where the shovel hits the water, there will be many regulatory schemes differing from region to region and tied to different local conditions.

I am interested in this two-tiered structure – general regulations and specific implementing regulations in different basins – because it parallels the Clinton jurisdictional grab of large areas of the West between 1996 and 2001 using the 1906 Antiquities Act and building a new federal scheme of new federal management using that Act. I'll come back to that at the end of the talk today.

At the moment, let me take you back to history, a history that precedes both myself and Joe Stell. Let me take you back to 1898 at a time when the territory of New Mexico was looking down the business end of Dr. Nathan Boyd's plans for the private development of the Elephant Butte Reservoir. Scott Boyd is here today, so some things never change. And I am pleased to see that the Boyds are still as aggressive in New Mexico water as they ever were. But in 1898, the problem was the proposed private development of the Elephant Butte Dam and the private development of land between Elephant Butte Dam and the Texas border. They were looking down that problem in 1898, and they were looking down the problem of Francis Tracy's extravagant vision of what was possible in the Lower Pecos, partially in Roswell using surface water, but primarily in Carlsbad irrigation using the flows from the Pecos River to be stored in a series of dams upstream from Carlsbad, beginning with Avalon Dam. It was the Boyd private plans and the Tracy private plans that provide the backdrop to the 1898 scenario that I want to describe for you.

New Mexico territorial officials worried at the time that New Mexico water law was not up to the scope and the drive and the nature of those vastly expanded proposed private developments. The territorial legislature in 1897 did what all great legislatures do when they are stuck with a problem that looks like it could be really serious. They appointed a committee. On March 19, 1897, the legislative assembly of the territory of New Mexico created a commission, among other things, to "examine the laws upon the subject of irrigation that existed in 1897 and water rights enforcement in this territory and to recommend to the

next legislative assembly [Legislative assemblies met in alternative years at that time, as they did up until very recently] such legislation as in the opinion of the commission shall meet all requirements on the subject.”

The commission members included a couple whose names you might recognize or that will give you an indication of the prominence of these people. One was Antonio Joseph, who was an Ojo Caliente and Taos area Hispanic politician. He was very powerful and very astute. He was one member of the commission. The other was W.S. Hawkins, who was really the first great water lawyer in New Mexico. He cut his teeth in the Tracy visions for the Lower Pecos trying to organize the water rights on the Lower Pecos to support his vision for huge, private irrigation below Carlsbad. Hawkins then went from the Tracy's over to South Central New Mexico and began to organize for the new railroads the water rights that they would require in order to push the railroads through. Hawkins was really the first great New Mexico water lawyer, and you almost never hear his name. He is worth following as well. He was connected with A.B. Fall, and Fall was another famous water lawyer. Hawkins and Joseph were on that committee along with three others.

I think the federal officials thought at the time that the committee would recommend a complete overhaul of New Mexico water law. As they saw it, New Mexico water law was at best fragmentary in 1898, in the words of the commission. And if not fragmentary, then nonexistent in the words of W.W. Follett, a federal official who came out and looked at New Mexico's water institutions and water law in particular as of 1898. I think they were banking on the fact that this commission would recommend a centralized overhaul of the fragmentary water law in New Mexico and the establishment of a single set of water law for the whole territory of New Mexico, and thereafter for the state. And if you watch, in 1905 and then in 1907, you've got from the territorial legislature what were essentially centralized water codes culminating in the 1907 water code, with some basis for the belief that this was what this commission would recommend.

The commission surprisingly filed its report in 1899, and it found that no such radical step, no comprehensive legislation, was needed for New Mexico nor would it serve New Mexico's interests. True enough, the commission reported in 1899, there was no one body of water law for the whole territory of New Mexico. The acequia laws of Northern New Mexico bore little relationship to the situation in Carlsbad and below

Elephant Butte. The water needs of the ranching country in northeastern New Mexico bore almost no relationship to the water needs of developments in southwestern New Mexico where the mining industry was about to come online.

New Mexicans agreed, the commission reported on the very basic principles. These were the principles that New Mexicans could agree to in 1898: “The right to appropriation of surplus waters of all streams is recognized and upheld, qualified only by the doctrine that priority in time is priority of right, that rights claimed unperfected with new energy, that the appropriation must be made for beneficial use and is limited to the amount of water needed for such purposes.” This is what the commission said New Mexicans could agree on in all the different parts of the state.

Now if you take that language and straighten it out just a little bit, not much, what you end up with is Article 16 of the New Mexico state constitution which is the most general statement of

The commission surprisingly filed its report in 1899, and it found that no such radical step, no comprehensive legislation, was needed for New Mexico nor would it serve New Mexico's interests.

what the basic water law in New Mexico is. In 1898, the commission said we can agree with just less than a page description of the fundamental attributes of New Mexico water rights. But beyond that, the 1899 commission recommended there was no need for more comprehensive legislation. New Mexico differed from other western states, it said, and it would be inappropriate to “engraft,” as the commission described it, the law of any other western state in New Mexico. That is, when you read the law report, they say we follow the Colorado doctrine in New Mexico, and they always put that in quotes.

In fact the water law in the 1907 code comes from the Wyoming statute that set up the state engineer system and a system of permits, and it was drafted by Morris Bean from the Bureau of Reclamation. They had a powerful influence in New Mexico. They gave us our basic water code in 1907. This commission said don't follow Colorado doctrine, don't follow Wyoming, don't follow Utah, don't follow any other western state because New Mexico is fundamentally different from those states. They are all prior appropriation states,

but this commission said that New Mexico was different. Indeed, the commission said, “it is the varying condition of nearly every section of this territory as to these essentials which render the works of your commission in determining what laws should be made applicable a difficult one. General principles, of course, can be made to apply all over the territory. But when it comes to the regulation of water rights upon which irrigation is dependent in detail, those regulations which

The community ditches of New Mexico had a long history that set them apart in terms of how they administered and dealt with the water rights of the other regions of the state.

would be highly beneficial in one section of the territory would doubtless be found detrimental to other sections thereof, depending upon altitude, climate, different character of the soil, and the

different necessities of the New Mexico people.” If this sounds to you like the AW(O)RM advocates pushing and touting their two-tiered administrative scheme in 2005, remember that this was a commission in 1899 pleading for the same kind of very general base law at the top and very different local implementation at the bottom.

The fundamental differences that the commission found in the New Mexico conditions led the 1899 commissioners to recommend that the territorial legislature attempt no comprehensive overhaul of New Mexico water. As I said before, they went against that advice in 1905. Then they really went against that advice in 1907. The territory went the other way, and New Mexico adopted a water code. Among lawyers, what a code means is that this is a closely integrated, comprehensive single body of law that will govern water resources across New Mexico. By 1907, they had gone the other way in a code that did not recognize on its face the differences in regional applications that the commission had found to be so essential to New Mexicans.

For awhile after 1907, the legislatures and the courts followed for the most part the course set by the 1907 water code. What I mean by that is that they essentially treated as homogenous all the water rights in New Mexico and tried to get it going on a single path toward the future. A couple of examples of this will suffice.

One example is the community ditches. The community ditches of New Mexico had a long history that set them apart in terms of how they administered and dealt with the water rights of the other regions of the state. What first the territory legislature, then the courts, and then the state legislature did was to try and get them back on track, mostly by reducing the powers that they had. This is complicated, but they started out by doing it in 1891, when they involuntarily incorporated New Mexico’s community ditches. That gave them a legal status. It allowed them to sue, but it also allowed them to be sued. They were dragged into the centralized legal system in that way.

It is a complicated matter, but let me give you a few other examples of how the community acequias quickly lost, under the homogenous doctrine of the 1907 water code, a couple of independent powers that were crucial to their special status. First, they lost the power to the state engineer to determine when and where there was unappropriated water in the systems which they shared. Historically and prior to the water code, the power to determine who to let on to a community irrigation ditch in a common source system primarily belonged to the local acequias. They lost that power when the state engineer, not the local acequias, got the power to determine unappropriated water. Then the community ditches lost to their own parciantes, as they are called, their own people who are irrigating under their ditches, the legal ownership of the water that was delivered to those separate tracks. Historically, in New Mexico and prior to this process that I am describing for you, it was assumed that the community ditches owned the water rights, not the owners of the tracts underneath. The owners of the tracts underneath had a communal interest in those tracks of land, but it couldn’t be conveyed or sold. It belonged to the community. They lost that power very quickly under this new uniform territorial system. And as a result, the community irrigation ditches became hollow versions of what they had been prior to 1890 under this homogenous water law.

The 1907 water code noted a judge in the New Mexico Supreme Court, had “nationalized” New Mexico water, in the sense that it had control over it, it had been centralized and sent to Santa Fe. In a world like that, there was not much room for the rich diversity that characterized different community ditches and other basic institutions. Of course, there were always cracks in the face of this nationalized system. Most

appeared in the state's relatively late treatment of groundwater.

For example, the highly esoteric question of when a new groundwater appropriation impaired existing appropriations quickly showed regional variations, if you knew where to look for them. The prohibition against impairment applied across the state, but the method of determining it varied from region to region. In the Lea County underground basin, how a new water right would impair another water right was determined by time. If a new water right would reduce your 40 year supply that was impairment. On the other hand, in the Mimbres underground basin, it was not time that determined impairment, but lift. What you are guaranteed as an existing water right holder is that no new appropriator could force you to lift water higher than was economically possible at the time. Those are two different systems for defining what impairment is. It is a highly technical term, but there were regional differences always in the water law. I don't mean to suggest to you this morning that these variations in impairment definitions are manifestations of truly local differences. They just happen to be differences in how really smart people at the state engineer's office thought that it would be appropriate to define impairment.

The Mimbres underground basin regulation which defined lift, that is, you couldn't be forced to lift water more than 230 feet or drill a new well that would cause you to lift water higher than 230 feet, impaired that right. That wasn't the invention of Luna County farmers, but that was the invention of Gene Gray who was a very smart and astute employee of the state engineer's office who drafted the Mimbres regulations. He got the 230-foot figure from a study by a New Mexico state economist in 1981 estimating using farm budgets at the time and the cost of generating electricity, and how much you could afford to lift it and continue that way. You'd be glad to know that they are still following that definition still based on 1981 studies of the economics of farming in Luna County.

But I use those examples to suggest to you with at least in respect to groundwater, there always were big regional differences in New Mexico when it came to the actual definition on the ground of what impairment was. If AW(O)RM works right, we are likely to see the same regional differences in New Mexico water rights that the 1897-99 commission saw when it surveyed the turn of the 20th century scene.

The prior appropriation doctrine is much more flexible than anyone in 1907 ever thought was possible. It has had the capacity to incorporate claims under the Endangered Species Act. It has had the capacity in a back door way to acknowledge that instream rights might be worthy of the status of a water right in New Mexico and might deserve the legal protection, though this is slowly coming to the surface. The 1907 code showed a lot of flexibility. And in fact the 1907 code was never envisioned as being a general statement of law where the particular application would vary region to region depending on people's own definition of what impairment was, their own definition of what unappropriated water was, their own definition of these things.

Something like the same thing is emerging in the area of executive control of federal lands. First of all, I have been around this business for thirty years, and we generally think that water is one thing and land is another. There is a growing sense that these things need to be treated together, that land use and water use are inextricably tied together and that they need to be treated, especially in a prior appropriation state, as the single resource that they are. I am particularly encouraged to note that the City of Santa Fe has done precisely that, for the first time, in using land use controls to genuinely control water accessibility and vice versa, treating them as interchangeable resources. I am glad to see that happen, and I think it is appropriate to end today by talking to you a little bit about land use controls under the 1906 Antiquities Act.

I like the 1906 Antiquities Act for a couple of reasons. One is that it falls right in between the 1905 and the 1907 water codes. So you have the 1905 water code, the 1906 Antiquities Act, and the 1907 water code. They come out of the same sense about what it meant to manage resources in the 20th century. It is worth our paying attention to at the turn of the 21st.

The federal Antiquities Act, like the 1907 water code, was enacted to bring some order out of the chaos of the treatment of the Southwest's archeological resources. The Act was the work of Santa Fe's Edgar L. Hewitt, one of the leading archeologists there. It aimed to protect the magnificent resources of the Pecos Pueblo ruins, Bandolier, and the Four Corners Area. It aimed to protect those ruins by securing control of

The prior appropriation doctrine is much more flexible than anyone in 1907 ever thought was possible.

the land around them. This act could have been simply directed at the ruins themselves, but instead it was a land based act. The 1906 Antiquities Act authorized the president unilaterally to set aside the smallest amount of land necessary to protect ruins and other natural curiosities. That is what the Act said in 1906. You have to take that Act in 1906 and transport it to the 21st century. The reason you need to do that is that the 1906 Antiquities Act is the last act to authorize the president to unilaterally designate lands for particular and reserved federal uses.

The Federal Land Policy Management Act of 1976 took the power away from the executive branch and assigned a much more active role to Congress, except for the 1906 Antiquities Act. It was the only one that survived giving unilateral power to the president to make special reservations of federal land.

The 1906 Antiquities Act authorized the president unilaterally to set aside the smallest amount of land necessary to protect ruins and other natural curiosities.

between 1996 and 2001 used the remaining power to him with a vengeance, beginning in

1996 with the presidential reservation of the Grants Staircase Escalante National Monument in southwest Arizona and continuing right up to the day he left office when he reserved unilaterally the Tent Rocks, beloved to all of us, just north of Albuquerque as national monuments because he had the power to do so.

Now you can imagine the local interests who said, "Is this the smallest amount of land necessary?" The Grants Staircase Escalante National Monument was over 1 million acres, and some of the other reservations he made were equally grand. It was that problem of the language. Is it the smallest necessary? What does it have to do with ruins, which was the purpose of this? A lot of western interests screamed about the elevation of environmental protectionism, because they assumed that the newly created national monuments would be administered by the National Park Service, surely one of the least locally sensitive federal agencies of all the federal land management entities.

Now I need to tell you the rest of the story about the national monuments, because instead of giving the National Park Service control of those large areas, and they justified them on the grounds that the landscapes themselves were other natural curiosities

and that to protect the landscapes you had to preserve large, large areas of land. That was the way they justified it, and everybody was terrified that it would go to the National Park Service and that there would be no local control of it at all.

There was another half of the Clinton plan. He assigned control over those to the Bureau of Land Management. He didn't give it to the states, which the states probably would have loved more than anything. To give it to the Bureau of Land Management was to give it to the federal agency that was most susceptible to local input with respect to the management of those resources. So what you have in the 1906 Antiquities Act as it is brought to the 21st century is the same thing I think you are seeing with respect to the AW(O)RM regulations. That is the assertion of very general broad jurisdiction, and then implementing that with regional definitions of what is important in the different areas of a place like New Mexico.

I began thinking about this because Bruce Babbitt, the ex-governor of Arizona, the ex-Secretary of Interior, and now author of a recent book that has been well reviewed, has been crisscrossing the West hawking the book and hawking this plan for a new model of federal regulation of land which builds in both federal power and local control.

I think that may be the direction that the AW(O)RM regulations are heading in New Mexico. I do not mean to pair John D'Antonio with Babbitt, because he might not like that comparison, but I think they are doing something of the same thing. It may measure something of the trajectory of natural resource management that we may see in the west both with respect to water and with respect to land. With that, I leave you to the senior member of the history team, Joe Stell.

Joe M. Stell is in his 10th term representing District 54, which includes Eddy, and Otero counties. The Representative is the chair of the Agriculture & Water Resources committee and a member of the Energy & Natural Resources committee. A rancher for many years, Joe received a B.S. from UNM, an M.S. from WNMU, and has 50 hours beyond an M.S. from NMSU and ENMU.



HISTORICAL REVIEW OF WATER: WATER CHALLENGES PAST AND PRESENT

Joe Stell, New Mexico Representative
District 54 - Eddy and Otero Counties
22 Colwell Ranch Rd.
Carlsbad, NM 88004

Welcome to everyone. It is good to see some of my old friends and acquaintances that I have and to make some new ones. Karl introduced Lowell Catlett as being a Texan. I wonder what part of Texas he is from, because he talks a lot faster than any Texan I have ever heard. He must have changed after he got here. You have to talk slower or Texans cannot understand you. I can say that because I am from Texas, but I have been in New Mexico for 77 years. I also want to say a couple of other disclaimers. Although I am in the legislature and this is my tenth term, any of the comments that I make are not comments of the legislature. They are my own personal comments. I do feel humbled to be here after such presenters as Em Hall, Lowell Catlett, and Chuck DuMars. The other presenters are great. If you have

not read Em's book *High and Dry*, you need to get a copy of it, because it is a great informational book.

I had a few things prepared, but as the others kept making comments up here, I kept writing different things down on my script, so it is somewhat changed. Keeping to the historical theme, let me go back a considerable amount further than Em did. I will talk about maybe some situations seven or eight thousand years ago and go back further than that in geological time.

I came across a publication by Dr. Walter Clay Lowdermilk who used to be with the Soil Erosion Service, now known as the Natural Resources Conservation Service. He made a trip over into the Holy Land or Lebanon, Iraq, and Iran in the 1930s. He went there for the specific purpose of studying historical agriculture. Starting out about 7,000 years ago, I am

going to build into this theme of change in weather and the climate.

In 7,000 B.C., they had a wetter climate. There was a group of people called the Sumerians that were pretty progressive. They were intelligent people, and they started diverting water from the Tigris and Euphrates Rivers and learned how to efficiently till the land. They had rich alluvial soil, and they were very efficient at tilling it. They learned to do things other than farm. When one fellow could produce enough food for one family or a whole group of people that

The main reason for their [Sumerians] failure was that silt and sediment from their irrigation projects plus population growth made their fields where they were not productive and became higher than their diversion point and their canals. They couldn't produce enough food and fiber.

left some time for others to do things other than farming. Thus, they developed other things of importance. We can't thank them, for example,

for the wheel, which they credit to the Sumerian people. Also the sixty minute units in an hour and a twenty-four day came from those people. They were very intelligent people.

In diverting this water from the Tigris and Euphrates Rivers, they built long canals. As they became successful in their agricultural processes, the population grew. One common thread that binds all of these 11 different civilizations together that existed several thousands years BC is that they diverted water, and they were successful. They did have military conflicts that taxed their resources but the main reason for their failure was that silt and sediment from their irrigation projects over decades of time plus population growth made their fields unproductive. The fields became higher than their diversion point and their canals. They couldn't produce enough food and fiber. Consequently, their civilization eventually crumbled.

In Mesopotamia — by the way there are many of these towns that are mentioned in the Bible that we have never found, but as we excavate more and more we are finding those places, and we are finding the Bible to be pretty accurate. There was a town named

Kish, the capital of Mesopotamia 2,000 years B.C. They had a big flood. I don't know which flood. That town was inundated, and that civilization crumbled. The nation failed.

Babylon was about 600 B.C. It also met the same fate. I have a quote here. This is during King Nebuchadnezzar's reign. He did some great things. He even had freshwater canals going to his horse stables, which he had hundreds of. This has been found in writing, credited to King Nebuchadnezzar: "That which no king has done before, I have done. A wall like a mountain that cannot be moved, I have built. Great canals I have dug and lined them with burnt brick laid in with bitumen and brought abundant waters to all the people. I paved the streets of Babylon with stones from the mountains. Magnificent palaces and temples I have builded [Builded here is not a misquote]. Huge cedars from Mount Lebanon I have cut down, with radiant gold and overlaid with jewels and I adorned them..." This was his own testimony about what he had done for the people of Babylon. But as you know, the province of Babylon would meet its demise, and it did. Babylon is covered in silt and mud like a lot of the others, but Babylon is being excavated.

A similar situation like the ones in the Middle East occurred in Egypt in North Africa. Egypt was a very developed and accomplished civilization also. They diverted water from the Nile River. Sediment and silt did the same thing to their fields, even those people who built the pyramids and the sphinx suffered the same fate that the people of Mesopotamia had experienced.

When talking about silt and irrigation work failing, I want to talk about the Pecos River momentarily. The Pecos River was having the same problem. They had a dam that used to be north of Carlsbad about 15 miles called Lake McMillan. That dam silted in where it was no longer efficient and could not serve the Carlsbad Irrigation District storage needs. A new dam, called Brantley Dam had to be built. The same thing has happened here in a way that happened to early day civilizations.

Even carrying it further than that, as you know the Rio Grande is quite a different river. In the upper regions of the Rio Grande it has snow melt, fresh spring water; the water is clear and pretty. When it gets down near Albuquerque, you have the Rio Jemez above Albuquerque and the Rio Puerco that have floodwaters and sediment filled waters flowing into the Rio Grande and into Elephant Butte Reservoir. A huge delta of silt

and sand has developed at the upper end to the point where it had to be dredged to make a channel to get water more efficiently to the lake itself. However, the lake still has many years of useful life left.

Let me now go to another aspect of ancient history. I will talk about this very area itself. Five-hundred-seventy million years ago, the area below Las Cruces, down around El Paso and 75 miles down into northern Mexico and northward into the Tularosa Basin across the other side of the Organ Mountains was all at the shallow end of an inland sea. That was 570 million years ago.

One-hundred-forty million years ago, changes occurred. Some of the land masses raised and some lowered. The seas drained. However, we had a glacial period with a receding ice cap at that time. The seas were re-formed. As the glaciers started melting, the sea filled up again and overflowed. The overflow cut a drainage path that intersected with the Rio Grande river and drained all the way to what is now known as the Gulf of Mexico.

Two million years ago, the ice age advanced again. The ice age brought a lot of water into the area. Seventy-five thousand years ago, that ice cap started melting and refreezing and slowly receded to the north. Thirty thousand years ago, there was a straight now called the Bering Strait, a land formation between Siberia and Alaska. People came across that straight and started settling in North America. Eleven thousand years ago, which is not much in geological times, we had a wetter climate than we do now. That wetter climate also allowed for the fact that there were tropics in this area at the time. It started getting colder from the advancement of the ice cap, and then it started getting warmer as the ice cap receded. Some of these people crossing the Bering Strait settled in the Clovis, New Mexico area, and they became known as the Clovis culture. Through the El Paso area, we find some of their fluted arrow points and the skeletons of mammoths and giant bison that they killed. The Curry and Roosevelt Counties in the Blackwater Draw area are testimony for scientific findings about those cultures.

Also, a lot of people started living in the mountains. The cliff dwellings occurred. People started using agriculture in New Mexico. Because of the receding ice cap, the weather was getting drier and drier. There were occasional years of wet weather with periods of drought. One particular drought in 1280 caused a lot of cliff dwellers to move to more stable water situations,

which would be on the Rio Grande and San Juan Rivers.

We have had some more recent droughts. I was at a drought summit two years ago in 2003, and we were in the middle of the last drought statewide. One of the presenters said that based on temperatures of El Niño and La Niña and temperatures of the ocean water, we would see no relief in New Mexico and Colorado for at least five more years. The next year, 2004, we got 30 inches of rainfall in parts of the state. This past year, 2005, we have received about 15 inches of rainfall in the eastern part of the state, a total of 45 inches of rainfall in two years. When you divide by the 10-12 inch average, I guess starting next year, we are going to have some four-inch rainfall years to bring that average back down to ten.

We have had other droughts. The 1950-56 drought was a terrible one in New Mexico. There was another drought in the 1920s. One that is really recorded quite often in the early day historical books was in the latter part of the 1880s, 1886-1889. I read a book about George Washington Littlefield, one of the founding fathers of the

A huge delta of silt and sand has developed at the upper end [of Elephant Butte Reservoir] to the point where we have had to dredge it and make a channel to get water more efficiently to the lake itself. However, the lake still has many years of useful life left.

University of Texas. He ran large numbers of cattle over on the east side of the Pecos River. Over that three or four year drought, large numbers of cattle died, an estimated 90,000. You could walk across the Pecos River stepping on the carcasses of dead cows. That documentation is written in more than one book. A little more gross description of how bad it was: A chuck-wagon cook set up camp along the banks of the Pecos River. A cowboy rode up to the wagon and went to the river to get a drink of water. The cook said, "No. Don't drink that water. I have some black coffee made." He had strained the water for the coffee through a sock, and the sock was full of maggots from the carcasses of the dead cows in the river. We have had some droughts!

Having told you about dry spells and irrigation, I want to pull it together by saying that the climate has

changed and has been changing over many thousands if not millions of years. I do not know whether it can be blamed on the warming climate and the greenhouse gases or if it is a naturally occurring thing from the effects of the receding ice cap, which is still receding.

I would like to look more recently to some of the problems the state is facing. We have some conflicts starting to occur over water. We have some

We have water. It is just not where the population is and where it is needed.

communities that are starting to develop problems. Ruidoso and Ruidoso Downs, for example, have had a water rationing program for the last several years. Cloudcroft had to haul water two years ago

and maybe even this past summer to keep their residents and their households with water. Cloudcroft proposed drilling some wells near Mayhill to pump the water back up to their water storage tanks. There was a disagreement between those two communities over the proposed solution.

My point is that we are starting to have some water shortage problems show up around the state. In Gallup, the water level of the city wells is dropping. We have had on paper for several years a proposed Gallup/Navajo pipeline to divert water from the San Juan River and pump water through the pipeline to water stations on the Navajo Nation reservation and on down to the City of Gallup. I understand the State Engineer and the Interstate Stream Commission are near an agreement, maybe even are in agreement, with the Navajo Nation on the division of the water on the San Juan River, but the plan presented to Congress has not been accepted at this time.

We have another area, the Ogallala Reef, whose water level has been declining steadily for years. The end could be in sight in fifteen or twenty more years on the Ogallala Reef. We have proposed help to the communities on the eastern side of the state with a pipeline from the Canadian River down the east side of the state to supplement the water supply of several communities. The problem is that these pipelines cost huge dollars. I think the Gallup/Navajo pipeline was estimated around \$600 million. The Ute pipeline was \$200 to \$300 million. But when you get to the legislative function and responsibility, each legislator is elected (we have 70 representatives and 42 senators) to represent their own district of people and they sometimes are reluctant to give any of their share of

the available funding to a project that will be of statewide benefit.

In the late 1980s, New Mexico had to pay \$14 million to Texas for under delivery of water for the Pecos River Compact over a 34-year period. The legislature came up with a lease purchase plan about 1990 to resolve the under-delivery problem. It is a lease purchase plan to lease water from the farmers and release it to Texas to build up an over-delivery credit of water to comply with the Pecos River Compact and to buy land and retire it from being farmed. There is not a lot of water available. It is a very complicated issue because we have the community of Ruidoso that brings a lot of dollars into the state of New Mexico because of tourism. Tourism makes them valuable to the state.

There are solutions. We have water. It is just not where the population is and where it is needed. We have, for example, a supply of water in the Salt Basin aquifer. The water from the Salt Basin on the New Mexico side is good potable water, with 100,000 plus or minus acre-feet of recharge per year. It would take a large amount of money to get that water transported back up north to use it but many people think it would be a good investment. One idea would be to build a pipeline from there all the way to Santa Fe with branches going off to the east and the west. I do not think the state would be able to finance it, but I think that a public-private partnership could. It is not a new idea. The Public Service Company of New Mexico (PNM) did own the Santa Fe water system and the lake in the upper canyon until the City of Santa Fe bought it from PNM. We transport natural gas all over the state. I do not see why we cannot do the same thing with water.

Back to a comment that Em Hall made regarding W.A. Hawkins. The Carlsbad Irrigation District, so called now, used to be the Pecos Valley Land and Irrigation Company, which failed because a couple of floods washed out the wooden water conveyance canal that crossed the Pecos River. It cost a good amount of dollars in those days. It washed out a couple of times. So then of course, the soon to be Bureau of Reclamation built a concrete flume. Carlsbad Irrigation District has been in business ever since.

A man named C.B. Eddy was one of the organizers of that project. After Eddy, who promoted the Pecos Valley Land and Irrigation Company, went broke due to the floods washing out the wooden structures across the Pecos River, he moved to El Paso and bought a

railroad project in El Paso. He named it El Paso Northeastern and built the railroad from El Paso to Tularosa and Carrizozo (Alamogordo was not established at the time), on up to Santa Rosa, New Mexico.

They used steam locomotive engines in those days. Steam engines were refilling the boilers with water from the Carrizozo area, but the water tanks would get corroded and had to be chipped out. Eddy decided there was a better way. He went up to the Sacramento Mountains and bought up water rights from the early-day settlers. He bought their homesteads and water rights, he put them to work with teams of horses and built a wooden pipeline made of wooden slats with metal straps around them.

They sent the water down to Carrizozo. It was fresh mountain water, not corrosive to their steam engines. Their waterline also went south toward Tularosa. C.B. Eddy was given the land by Oliver Lee for C.B. Eddy to plat the community of Alamogordo. They also had other pipelines from the Sacramento River further southwest to Oro Grande, New Mexico. The pipeline going northeast from Carrizozo supplied water all the way up to Pastura, New Mexico.

Eventually, railroads stopped using steam engines and started using diesel locomotive engines. Diesel engines did not use water for boilers so the railroad did not need as much water. The railroad sold their water rights to the City of Alamogordo, New Mexico.

Eventually the pipeline from Bonito Lake to Alamogordo had to be replaced. Alamogordo transferred some of their water rights from Bonito Lake to the federal government in exchange for federal funding to replace some of the older pipeline. The City of Alamogordo provides water to Holloman Air Force Base. One interesting point though is that to rebuild the pipeline from Bonito Lake, which is part of the City of Alamogordo and Holloman Air Force Base water system, and interestingly enough it takes water from the Pecos River basin and transfers it over to the Tularosa Basin, which does impair to some degree the water rights of the Pecos Valley Artesian Conservancy District and the Carlsbad Irrigation District and the Pecos River Compact. In contracting to have that wooden pipeline replaced, it took longer for the construction contractors to build a new steel pipeline than it took the old timers to build the wooden pipeline.

There are solutions. We have the water, it is just not where we need the water. We do have the water

to sustain New Mexico's economic needs for some years into the future. It is a matter of transporting the water to the areas where it is needed.



STATE OF NEW MEXICO EXECUTIVE OFFICE SANTA FE, NEW MEXICO

Proclamation

WHEREAS, this year marks the 50th anniversary of the Annual New Mexico Water Conference and the 100th birthday of the late Dr. H. Ralph Stucky; and

WHEREAS, Dr. Stucky chaired the first New Mexico Water Conference in 1956, and continued to serve as chairman through 1971; and

WHEREAS, Dr. Stucky was appointed as the first Director of the New Mexico Water Resources Research Institute in 1964, and served as director until 1971; and

WHEREAS, in addition to his dedicated work for the State of New Mexico, Dr. Stucky tirelessly served the water resources community at the local, federal, national and international levels, and contributed significantly to literature in the water resources field; and

WHEREAS, Dr. Stucky's lifetime of devotion to the field has richly benefited water research and development, and we honor him for his many years of service to our great State;

NOW, THEREFORE I, Bill Richardson, Governor of the State of New Mexico, do hereby proclaim October 19, 2005 as:

"Dr. H. Ralph Stucky Day"

throughout the State of New Mexico, and dedicate this 50th Annual New Mexico Water Conference to his memory.

Attest:

Done at the Executive Office this
6th day of October, 2005.

Rebecca Vigil-Giron
Rebecca Vigil-Giron
Secretary of State

Witness my hand and the Great Seal
of the Great State of New Mexico

Bill Richardson
Bill Richardson
Governor



John Hernandez, NMSU Professor Emeritus, has been associated with the New Mexico WRRRI for many years, most recently as a consultant on several projects. John received a B.S. in civil engineering from UNM, an M.S. in sanitary engineering from Purdue University, an M.S. in environmental engineering from Harvard University, and a Ph.D. in 1965 in water resources from Harvard University. John was a faculty member at NMSU from 1965 to 1999, including service as the Dean of Engineering in the late 1970s. John has broad experience regionally, nationally, and internationally in water resources issues and has published extensively. He received many awards throughout his career including the prestigious Donald C. Roush Excellence in Teaching Award from New Mexico State University in 1990, and the Civil Engineering building at NMSU is now named Hernandez Hall in his honor. This fall John was elevated to the rank of honorary member in the American Society of Civil Engineers.



Bobby J. Creel has been with the WRRRI since 1986. He has served as Assistant Director, Acting Director, and Associate Director at the Institute. He came to NMSU as a student in 1964 and received his bachelor's degree in agriculture in 1968, a master's degree in agricultural economics in 1971, and a Ph.D. in resource economics from UNM in 1986. He has over 150 journal articles, research reports, special reports, book chapters, and conference proceedings publications and abstracts, mainly in the areas of natural resource economics, water resource planning, allocation and use of the water resources in the various basins of the state and southwest U.S. Most of these incorporate various quantitative assessment methods such as geographic information systems, input-output analysis, cost-benefit analysis, linear programming, cost and returns analysis, assessments for water quality protection programs using geographic information systems, feasibility of developing saline water resources, geothermal water resources, large-scale irrigation projects, and energy development impacts on agriculture. In 2002 he received the Fort Bliss Federal Credit Union Research Award for his many years of research in the areas of water and natural resources.



HOMAGE TO H. RALPH STUCKY

John Hernandez and Bobby Creel
New Mexico Water Resources Research Institute
MSC 3167, Box 30001
Las Cruces, NM 88003-8001

The New Mexico Water Resources Research Institute is now 40 years old, and the annual water conference is 50 years old. Ralph Stucky would be a hundred today, if he were still with us. And in many ways, he still is. Ralph hasn't been the director of the WRRRI for over 30 years, but his organizational ideas are still very much a part of the style and format of the annual water conference, and his concepts of involvement in state and national water resources issues still provide strong direction for the Institute, an involvement in real world water problems that has lasted a half century.

What was it about Ralph Stucky—his family background, his education, his work experience—that has led to his lasting impact on water resources planning, education and research, particularly here in New Mexico? Was it his Ph.D. in Ag. Economics? I don't think so. Was it his 70+ publications? I don't think so. Was it his name on the WRRRI building—dedicated to Ralph in 1970? I don't think so. Well, what was it? Let's spend a few minutes reviewing his life and see if we can find the Stucky magic—and tell others how to prevail in the way that Stucky's ideas have. Much of what I will tell you comes from a thick, unpublished text that Ralph wrote in 1994 called *My First Ninety Years*. An interesting title. Did Ralph expect to live another ninety years? Maybe. He did live another five years, dying in 1999 at the age of 94.

This water resources pioneer came from pioneer stock—Grandfather Gottlieb Stucky, born in Switzerland, came to America in 1855 at age 10, and Grandmother Mary Hess, also Swiss, was born on a ship on the Atlantic in route here. Like many mid-1800 European emigrants, Gottlieb Stucky found himself in the Union Army during the Civil War. Ralph's grandparents were married in Denver, Missouri in 1871 and headed for Montana by wagon in 1879, but the railroad arrived in Montana soon thereafter and some of the family and their freight arrived by rail. I tell you about Gottlieb Stucky as Ralph, born December 14, 1904, near Bozeman, Montana, had the opportunity to talk to his grandfather about Gottlieb's childhood in Switzerland.

Ralph mentions his talks with his grandfather in his book; those talks were clearly important to him.

Ralph came from a large family; that is, lots of kids. His mother was Nellie and his father was John Stucky. He grew up on a farm, and at an early age, he learned all about the hard work associated with farming. He learned how to milk cows, how to feed hogs and sheep, and how to pick rocks. Yes, how to pick rocks. His father's farm was in a glacial valley, and as the land was plowed each year, more and more rocks came to the surface and someone had to pick them up. Strangely enough, Ralph liked farm life.

Ralph's childhood was not atypical from that of many of us. He learned that crime does not pay at age seven when he was caught stealing apples. He learned not to wise off at teachers in the 4th grade in a time when corporal punishment was still allowed. "Ouch!" In his book, Ralph says that once it took him two days to get over being sick from swallowing a wad of chewing tobacco. He was not a stellar high school student, but he enjoyed his ag-related classes. He was involved in livestock judging, and he learned how to cull non-laying hens. In his book he tells of how you pick up a hen and by doing something related to her bottom tell if she is a non-layer and is headed for the stew-pot. I told you, Ralph really liked that ag stuff.

He had decided to take school seriously by the time he headed for the University of Idaho. He picked Moscow, Idaho because of recommendations from a high school ag teacher who had gone there. Ralph became active in 4-H clubs, and he never looked back from a life in agricultural education. He majored in animal husbandry and got a BS degree from the University of Idaho in 1927.

His first job was as a vocational ag teacher in Filer Rural High school in rural Idaho. He had 50 students in classes, took care of the 4-H club, trained and lead the high school judging teams, was the local Scout Master, and had time to court a young woman. He had a room in the Wilson house in Filer, and when she wasn't off teaching school in another nearby rural community, Frances Wilson lived there. She was the future Mrs.

Homage to H. Ralph Stucky

Ralph Stucky, and they were married on July first 1930. They had two children Creta, now Mrs. Robert McGuire of Calgary, Canada and John now of White Bear, Minnesota.

His next job, 1929 to 1933, was as the 4-H club agent in Bannock County Idaho. From 1933 to 1935, he was County Agricultural Agent in Power County, Idaho. This was at the start of the depression and tough years to find a job and hold it. Banks closed and farm prices fell to 10 percent of 1930 levels. In a decision on who got paid to print ag reports for the county, Ralph got into trouble with a newspaper owner who called for his resignation in an editorial saying that "Ralph Stucky has ruined his usefulness here in Power County unless he is a better politician than we think." Ralph was lucky. Just prior to the Power County dust-up, he had applied for and gotten a job as the County Agent in Fergus County, Montana. When he got to Montana, he got a copy of a letter from the Power County Commissioners to the newspaper, commending Ralph for the great job he had done. Ralph was really a pretty good politician. No. He was a very good politician.

Ralph was the Ag County Extension Agent in Fergus County, Montana from 1935 to 1941, and he and Frances and their two kids lived in Lewiston, Montana. Ralph was always scheduling a meeting of some kind or traveling off into the hinterlands of Montana for a meeting. Stucky had all the thrills of trying to get somewhere in a winter blizzard and to get somewhere else in the sea of mud that followed in the spring. But Ralph stayed the course through mud and snow. He always said he liked it in Montana.

In September 1941, Ralph went off to the University of Minnesota to get an M.S. in Agricultural Economics. On graduation in 1942, Ralph had to make the choice: buy 1,000 sheep at \$10 apiece and become a rancher, or accept a job with the Soil Conservation Service in Glendive in northeastern Montana. He picked right: half the crop of new lambs from the bunch he could have bought died that winter. Ralph was with the SCS till 1947 when he was offered an associate professor's post in Ag Economics at Montana State. He stayed with his teaching, and through hard work and perseverance he managed to work on a Ph.D. at the University of Minnesota, which he received in 1954.

Shortly after that he came to NMSU as head of the Ag. Econ. Department. It was a new department and when it started there were no ag econ students, none, zero, zip, nada. Ralph persisted and soon made

the Department one of the biggest and best in the Ag College.

During the spring semester 1955, Ralph decided to teach a course in water resources economics to 15 students. He invited a number of the important water leaders in the state to talk to his class. Steve Reynolds was one. People heard about these talks and wanted to come. So Ralph asked his speakers to come back for a two-day conference, the First Annual Water Conference, and over 100 came to take part. A huge success! And the next forty-nine water conferences have been as successful: state and federal officials, legislators, governors, U.S. congressman and senators, and lots of interested folks have come together over the years to share their common interest in water. Senator Clinton Anderson attended the 1957 Water Conference. In 1962, Senator Anderson sponsored a bill to create a center for water resources research in every state. In 1965, New Mexico became the first state to have a federally funded center and Ralph Stucky became the director. He was followed by some notable successors and pioneers in New Mexico water resources: John Clark, Garrey Caruthers, Tom Bahr, Bobby Creel, and Karl Wood.

How did Stucky do it? How did he pull it off? Through the water conference, he had developed a large cadre of supporters who were concerned about New Mexico's future, its future water supply. Somehow Ralph could bring people together to listen to each other and to talk about something they would normally fight about—water! Ralph Stucky made his greatest contribution to water resources, not through his research, but through his ability to get people to come and work together, and this because of his stick-to-itiveness, or was it stucky-to-itiveness? Yes, when Ralph wanted to get some thing done, he stuck to it. Stucky's lasting impact has come about because always, "Stucky-stuck"!

Bobby and I both worked for Ralph Stucky on research teams. And while he expected a lot and got a lot, we both prize our years of being with him. A personal note: I will always be in debt to Ralph Stucky for making the last 16 years of my parents' lives better. Through typical Stucky perseverance, he created the Good Samaritan Village, a senior living center, and my folks were the beneficiaries of his good works. Thank you Ralph.

Jim Peach is Regents Professor of Economics and International Business at NMSU where he has been a member of the faculty since 1980. Jim received his Ph.D. from the University of Texas at Austin in 1978. He was appointed Regent's Professor in January 2002. His research is focused on the demography and economic development of the U.S.-Mexico border region and U.S.-Mexico economic interaction. Jim's teaching duties include mathematical economics, macroeconomics, econometrics, sports economics, and population economics. He is a former editor of the Journal of Borderlands Studies, a past-president of the Association of Borderlands Studies, the Rocky Mountain Council on Latin American Studies, and the Association for Evolutionary Economics. He is currently president of the Western Social Science Association.



LONG TERM DEMOGRAPHIC UNCERTAINTY AND WATER DEMAND IN NEW MEXICO

Jim Peach

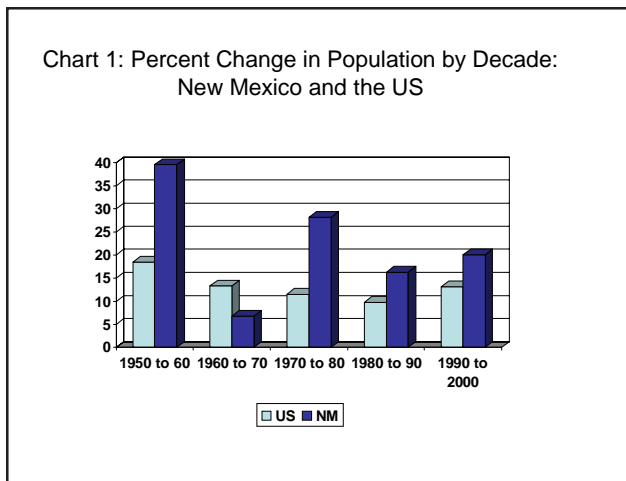
Department of Economics and International Business
New Mexico State University
MSC 3CQ
Las Cruces, NM 88003

The fiftieth anniversary of this conference is an opportune time to take a brief look at demographic trends in New Mexico over the last fifty years and to speculate on demographic trends over the next fifty years. The New Mexico population, its rate of growth, its age structure, and its geographic distribution are important determinants of water demand.¹ Examining demographic trends in New Mexico over the last fifty years is a relatively easy task. Because demographic events often last a long time, looking backwards can tell us a great deal about what might happen in the future. But there will be major demographic surprises in New Mexico during the next half century.

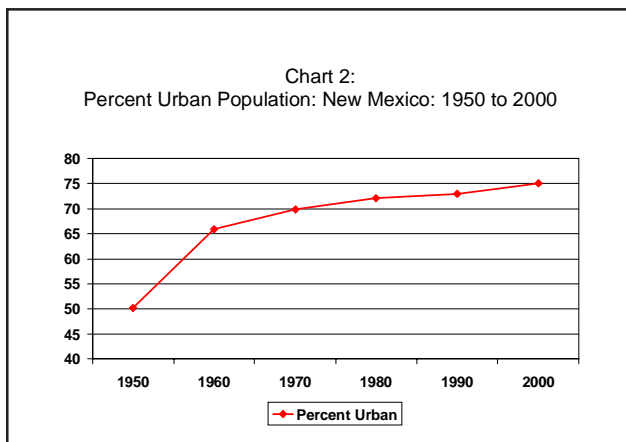
A Look Back: 1950 to 2000

Over the last half century, the population of the United States nearly doubled (an 87 percent increase) from 151 million in 1950 to 281 million in 2000.² New Mexico's population nearly tripled in the same time span, increasing from 681 thousand persons in 1950 to 1.8 million persons in 2000. As Chart 1 indicates, New Mexico's population growth rate was higher than the national growth rate in all but one of the last five decades. The single exception was from 1960 to 1970 – a decade in which economic conditions in New Mexico were particularly weak. In the 1960s, Walker Air Force Base in Roswell closed, and Roswell is just now regaining the population it lost as a result. Oil prices

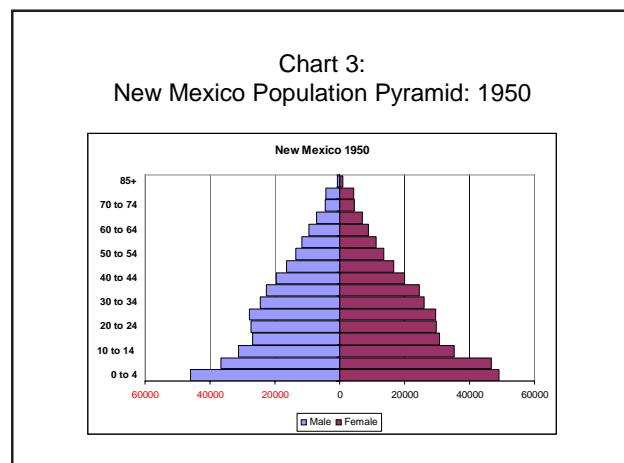
were also very low in the 1960s and the state economy suffered as a result. But the 1960s in New Mexico were a notable exception to long-term trends. During the 1950s when the nation was experiencing its most rapid population growth of the 20th century, New Mexico's population increased (39.6 percent) at more than double the national growth rate (18.5 percent). New Mexico was not unique among western states during the latter half of the century. Nearly all western states were growing rapidly.



One of the most important demographic changes over the last fifty years is often ignored. New Mexico became highly urbanized between 1950 and 2000. Chart 2 displays the percentage of the New Mexico population classified as urban for each census year. In 1950, barely half of the state's population (50.2 percent) lived in urban areas. A decade later this figure had increased to 65.4 percent, and by 2000, 75.0 percent of New Mexicans lived in urban areas.³

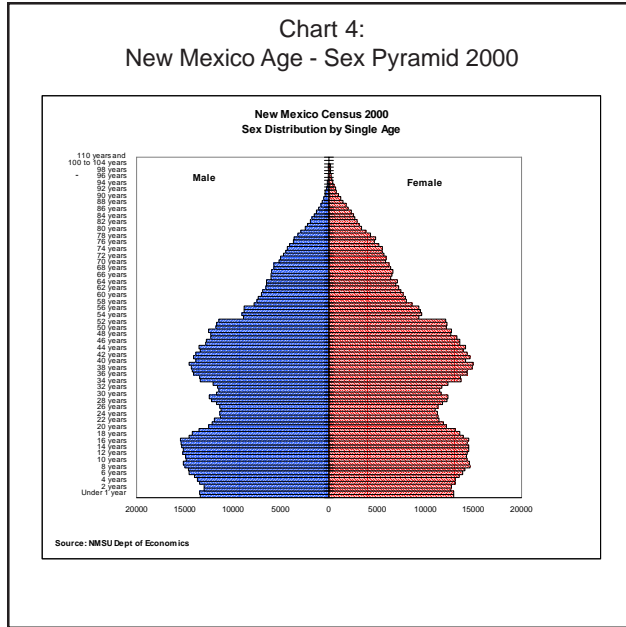


New Mexico grew rapidly during the last fifty years because: (a) the state had a relatively young population, (b) had relatively high total fertility rates, and (c) was attracting a great deal of in-migration. Chart 3 displays an age-sex pyramid for New Mexico in 1950. The shape of the chart is a classic 'pyramid' in which most of the population is relatively young. In 1950, New Mexico's population had a median age of 24.0 years, while the nation's median age was 30.2 years. New Mexico's crude birth rate (CBR) in 1950 was 34.1 per 1,000 – nearly 50 percent larger than the nation's CBR of 24.1. It is no wonder that the state's population was growing rapidly. Throughout the last half century, natural increase, the excess of births over deaths, has been an important contributor to New Mexico's rapid population growth. Between 1950 and 1960, natural increase accounted for about two-thirds of the increase in the state's population. By the 1980s and 1990s, natural increase accounted for about half of the state's population growth.

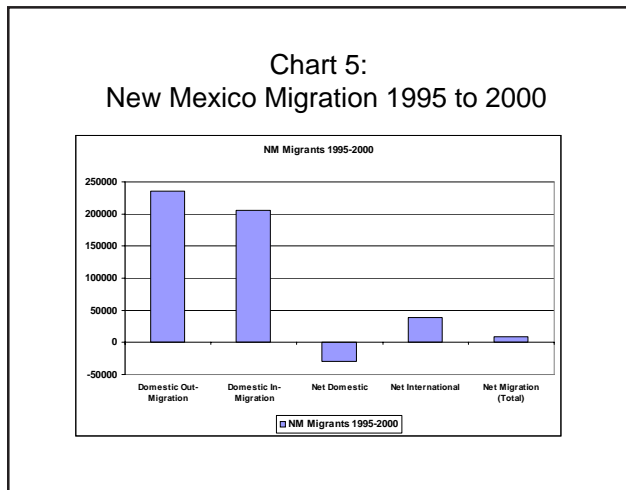


The 2000 Census reported that New Mexico's population had been aging rapidly. The aging of the state's population can be seen graphically in Chart 4, which contains a single year of age pyramid for New Mexico. The median age of New Mexico's population was 34.6 compared to the national figure of 35.3.

New Mexico's fertility rates were also falling by the end of the 20th century. The national CBR in 2000 was 14.5 just below New Mexico's CBR of 15.0. A different way of looking at New Mexico's long term decline in fertility is that in 1950, there were 23,495 births and a population of 681,000. In 2000, there were 27,223 births and a population of 1.81 million persons in the state.



The 2000 Census also reported migration patterns in and out of the state and from abroad. Between 1995 and 2000, the Census reported that more people moved out of New Mexico to other states (235,512) than moved to New Mexico from other states (205,267). Thus, net domestic migration for New Mexico was minus 29,945 people. Net domestic out-migration was offset by 38,706 people from other nations who moved into New Mexico. The 1995 to 2000 migration data are depicted in Chart 5.



The Next Fifty Years – almost

State population projections (from 2000 to 2030) released by the U.S. Bureau of the Census in April

2005 created quite a controversy in New Mexico. The Census Bureau projections were headline news across the state. A major business group in Albuquerque formed a task-force to examine the projections and to urge the Census Bureau to change them. Clearly, the business group is concerned about the possibility of a feedback loop in which the projections become a self-fulfilling prophecy. The logic of such concerns is easy to understand. If the Census Bureau (or others) predict a slowing of the rate of growth of population, then many businesses (particularly those looking for an expanding market) might find New Mexico to be a less desirable location. Consequently, the state’s population growth rate might in fact decline. Naturally, this is sensitive stuff from the perspective of those promoting the state’s virtues.

The Census Bureau’s 2005 projections are a bit surprising. According to the projections, New Mexico’s population will continue to grow, but at a much slower rate than the historical pattern. In 2000, the Census recorded a population in New Mexico of just over 1.8 million persons. The Bureau projects a state population of 2.1 million for 2030 – an increase of only 15.4 percent spread over three decades – a rate that is barely half of the national rate of 29.4 percent.

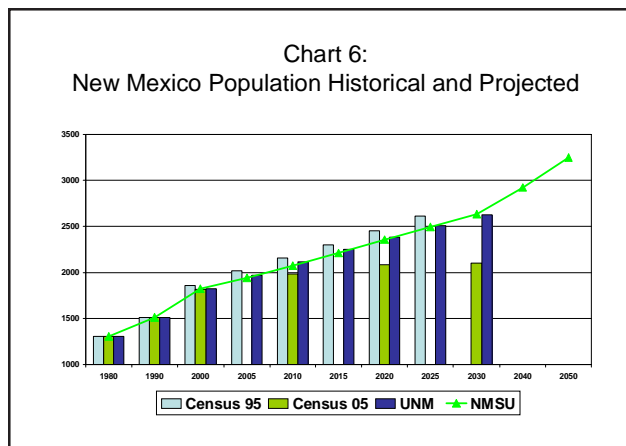
In contrast, New Mexico’s population increased by 16.3 percent in the 1980s (1.303 million to 1.515 million) and by 20.1 percent in the 1990s (1.515 million to 1.819 million). In both the 1980s and 1990s, New Mexico’s population growth rate was substantially higher than the nation’s growth rate (9.8 percent in the 1980s and 13.1 percent in the 1990s).

Young populations are often said to have what is commonly called demographic momentum – the tendency of a population to grow even if fertility rates are stable or falling. An aging population is typically a population that does not grow very fast. The Census Bureau projects that New Mexicans will be much older in 2030. Perhaps that aging population will include you and me. The Census Bureau’s projections indicate that the median age in New Mexico will reach 44.8 years in 2030 – an increase of 10.2 years from the state’s 2000 median age of 34.6. For a state traditionally known for its relatively young age distribution, the Bureau’s projections indicate that New Mexico would be the 6th oldest state. Only Florida, Maine, Montana, West Virginia, and Wyoming would have a higher median age in 2030.

But, this is not all. A previous set of Census Bureau state level projections released in 1996 indicated a

much different demographic picture of the state's population (U.S. Bureau of the Census 1996). In that set of projections, New Mexico was the second fastest growing state over the 1995 to 2025 period – trailing only California. By 2025, New Mexico's population was projected to increase to 2.612 million. In percentage terms, this would have been 40.4 percent compared to the 15.4 percent rate in the most recent projections.

Other population projections are available. Some of these are depicted in Chart 6. The most recent population projections of the University of New Mexico's Bureau of Business and Economic Research (BBER) show more rapid growth in the state than projected by the Census Bureau. BBER projects the state population to be 2.626 million in 2030 – an increase of 40.3 percent over the 2000 population. The baseline scenario of a demographic model constructed at NMSU produces a population figure for 2030 that is almost identical to the BBER projection (2.635 million persons) and a population of 3.2 million by the year 2050.



So, what's going on?

The Census Bureau and most demographers use a method called the cohort-component method to project population (U.S. Bureau of the Census, April 2005b). A cohort is a group of people with the same characteristic – usually, age, race or sex. For example, we could talk about a cohort of 60 year old males. The components of population change are births, deaths and migration. The cohort component technique involves projecting the components of change for each cohort. For the state population projections, the Census Bureau, UNM and NMSU use a single year of age model. Simple enough, but the details matter.

The population of both the state and the nation is aging. And, despite a year or two of increased fertility rates, the overall trend in fertility has been decreasing for many years. The Census Bureau estimates that the TFR for New Mexico is 2.20198 (2000-2001). In simple terms, the TFR represents the expected number of children per woman over the woman's lifetime. The New Mexico figure is not much higher than the replacement TFR of 2.08.

An aging population will also have higher crude death rates (deaths per 1,000 persons) even if we assume that age specific rates remain constant. The crude death rate for New Mexico in 2000 is 7.96 per 1,000 persons. New Mexico's crude death rate will probably increase to nearly 11 per 1,000 by 2030.

Combining the aging of the population, a long term increase in crude death rates, and a long-term decrease in TFRs suggests that New Mexico's growth due to natural increase (births over deaths) will decline. Differences in fertility and mortality account for very little of the differences in the population projections discussed above.

Differences in the assumed patterns of migration account for nearly all of the variation in the state population projections. Indeed, if net-migration is set to zero, the NMSU model calculates a 2030 state population of 2,105,749 persons – a figure that is almost identical to the Census Bureau's (2005 vintage) projection for 2030 of 2,099,708 persons. The difference of 6,041 persons is trivial. Zero net migration to New Mexico is not a likely possibility over the next two or three decades.

In reference to water demand, it makes a great deal of difference whether New Mexico's population in 2030 is 2.1 or 2.6 million persons. No one knows for certain what the state's population will be in 25 or 50 years, but we can make some tentative conclusions. First, if we examine New Mexico's demographic trends from 1950 to 2000, the state's population: (a) was relatively young, (b) had relatively high birth rates, (c) was urbanizing rapidly, and (d) was growing rapidly. Second, New Mexico's population is aging and decreasing fertility rates do suggest a slow-down in the state's future population growth rates. Third, the

In reference to water demand, it makes a great deal of difference whether New Mexico's population in 2030 is 2.1 or 2.6 million persons.

Census Bureau's (2005 vintage) projections to the year 2030 seem inconsistent with the history of population growth in the state over the last fifty years. Fourth, other projections of the state's population are higher than those of the Census Bureau. Fifth, the critical difference between the Bureau's projections and others is most likely migration. Demographers and economists are almost always less certain about future migration trends than they are about fertility and mortality trends. There will almost certainly be demographic surprises over the next fifty years that no one can predict in advance.

References

U.S. Bureau of the Census. 1996. "Population Projections for States by Age, Sex, Race, and Hispanic Origin: 1995 to 2025" (<http://www.census.gov/prod/2/pop/p25/p25-1131.pdf>)

U.S. Bureau of the Census. August 2003. "Census Bureau Special Reports: State to State Migration Flows"

U.S. Bureau of the Census. 2005. "State Projections: Methodology Summary Interim Population Projections for States by Age and Sex: 2004 to 2030" (<http://www.census.gov/population/www/projections/methodology.html>)

University of New Mexico, Bureau of Business and Economic Research (BBER). 2005. Population Projections. Projections: <http://www.unm.edu/~bber/demo/table1.htm>

Endnotes

¹ Other determinants of the demand for water include the price of water, per capita income, the structure of industry within the state, technological change, and a host of other variables.

² Unless otherwise noted, all data were obtained from the website of the U.S. Census Bureau (www.census.gov).

³ Some changes have occurred in the Census Bureau's definition of urban areas. See http://www.census.gov/geo/www/ua/ua_2k.html for an explanation.

Janie M. Chermak is an Associate Professor in the Department of Economics at UNM as well as a member of the Water Resources Program Faculty. She received her Ph.D. in mineral economics from the Colorado School of Mines in 1991, her M.S. from Mines in 1988, and her bachelor's in geology from Western State College in 1979. She specializes in applied microeconomics and natural resource economics with an emphasis in water and energy issues. Her current research in water covers a broad range of topics including consumer behavior, integrated modeling, markets for water, and the impacts of varying policy objectives on efficiency. Many of these efforts require collaborative, interdisciplinary research. Recent and forthcoming papers pertaining to water include publications in the Journal of Regulatory Economics, Journal of Environmental and Economic Management, the Natural Resource Journal, Water Resources Research, and Journal of Groundwater.



URBAN WATER PRICING: A HISTORICAL PERSPECTIVE AND THE CHALLENGES FOR THE FUTURE

Janie M. Chermak
Department of Economics
MSC 05 3060
University of New Mexico
1 University of New Mexico
Albuquerque, NM 87131-0001

The work that I am going to talk about is really a combination of efforts, and I would be remiss if I did not mention some of the people or groups who have contributed to this work. Part of this is research that I have been doing on my own. Part of this work is with SAHRA, which is an NSF funded science and technology center housed at the University of Arizona. Part of the work is by an intern sponsored by the Office of the State Engineer who is working with Anne Watkins on an infrastructure initiative. There is a whole consortium of people working on urban water pricing. For any errors I, of course, take responsibility.

There is a quote from Mellendorf in 1983, which is still fairly germane to water. The part that is most important says that water seems to almost have these sacred qualities that precludes it from economic analysis. This is important because of the history of water and water pricing. Unfortunately, water becomes scarcer as the population grows, but there haven't been drastic changes in the price of water. As can be seen from the previous talk by Jim Peach, population growth is going to occur and water issues are going to become more difficult. Perhaps economics can at least lend some analysis and some tools that might help. If water

is becoming scarcer, are pricing policies a viable tool to help manage water?

What characterizes the Southwest? I am preaching to the choir, because you know that we have had growing populations. If you look between 1990 and 2000, the South-

We must consider the historical realities of where water prices have been, how they impact where we are right now, the current trends in water prices, and what we might expect in the future.

west was part of the United States that was the fastest growing over that period of time. We have erratic precipitation. If we look at the amount of precipitation we get in the Southwest and in New

Mexico specifically, it is very, very low. All of these things are going to make this a difficult thing. If we look at the increase in competing uses, we find that not only do we have increases in demands, but we also have increases in non-market uses. We have increases across the board.

If we look at the report Water 2025, which DOI put out in 2003, we find some potential areas of conflict (Figure 1). You probably have all seen this, but if you look at the map of the Four Corners Area and New Mexico specifically, red shows the highest potential for conflicts. I think something that might actually be more frightening to me is a survey by the U.S. conference of mayors, which surveyed 414 cities. They looked at what the water concerns were. There was a top ten list. Included in the top-ten list was the age and security of infrastructure. The water supply availability, unfunded federal mandates, drought management, and regional conflict over water use were also on the list. It sounds like a shopping list for New Mexico. I think what probably caught my eye the most was that forty percent of the cities said that they did not have an

adequate water supply in twenty years. That is a fairly significant statistic.

How do water prices fit in here? We must consider the historical realities of where water prices have been, how they impact where we are right now, the current trends in water prices, and what we might expect in the future. Are we going to have to change what we are doing, and how we are doing it in order to have supply and demand be at a point where the demand does not exceed the supply available? The conventional wisdom has been that people do not respond very much to price, in fact people are very unresponsive to water price. Why do we say this is the case? Basically, it is because of the data. The empirical evidence from studies done between about 1950 and 1995 found that in every case consumers were unresponsive or were inelastic to price increases.

Why is this the case? We have to look at historic pricing in the United States (Figure 2). Across the United States from about 1955 to 2000, you see a price per gallon ranging from .0005 cents up to about .0043 cents per gallon. It does not matter what part of the United States we are in or what year we are in. There was very, very little difference in the price plotted across time and geographic area. What does that mean? It means that it was a statistically insignificant difference between 1955 and 1995 in the prices we were paying for urban water. What is the problem with that for where we are now and where we are going in the future? Historical data indicates little response to water price increases, but the historic prices may not reflect current or future reality.

Do prices matter today? They are somewhat higher than the historical prices. Look at urban prices today (Table 1) and the cost of six thousand gallons of water for May 2004 from a survey done by the NM Environmental Department. Alamogordo cost for six thousand gallons of water is about \$16.61. Aztec has the lowest cost at \$6.36. Albuquerque's price was about \$17.94. Las Cruces' price was \$14.68. These

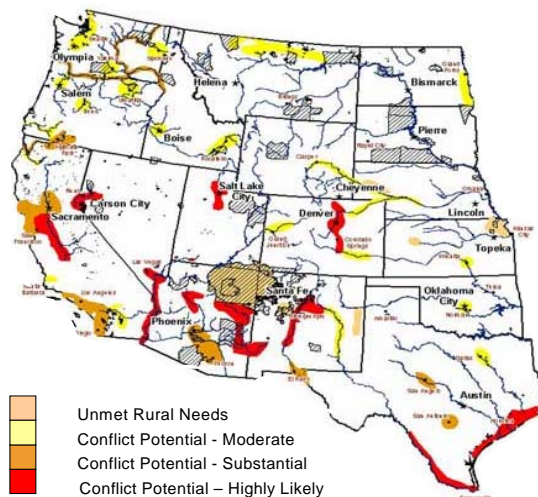


Figure 1. Potential Areas of Conflict (2003)

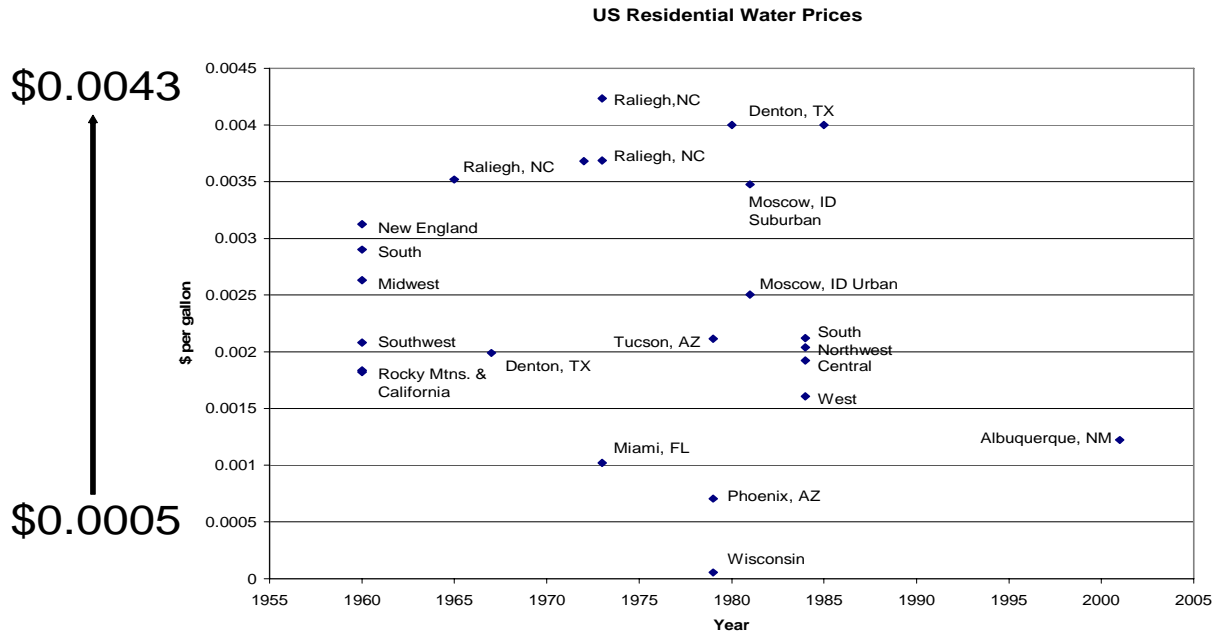


Figure 2. Historical Pricing in US

range anywhere from six dollars up to about sixty dollars. The average is about nineteen dollars. Think about what nineteen dollars buys. Nineteen dollars buys a family of four a meal at McDonald’s, or seven coffee drinks at Starbucks. It does not buy very many bottles of water. What are the prices reflecting today? What is the signal that is being given? If the prices reflect scarcity or true value, the incentive and the prices or the information being given may not be the appropriate information.

Table 1. Do Prices Play a Part Today in the SW?

Cost for 6000 gallons of water (May 2004):	
Alamogordo:	\$16.61
Albuquerque:	\$17.94
Aztec:	\$ 6.36
Bernalillo:	\$20.48
Carlsbad:	\$ 9.91
Las Cruces:	\$14.68
Avg: \$19.39, Min: \$6.36, Max: \$61.14, Med: \$18.00	
From: NM Environment Department Water and Wastewater User Charge Survey	

How important is this? For any of those of you who have read *Freakonomics*, which is one of the books on the best-seller list right now, there is an anecdote about a couple of economists who did a study on daycare. They went to Israel and looked at nineteen different daycares. The average cost per month of keeping your kid in daycare was about \$360. On average across these nineteen daycares, there were about eight late pickups per day. At that point, there was absolutely no penalty for being late to pick up your child. The economists got the daycares to implement an incentive for late pickups. Every time someone was late they were charged a three-dollar late fee. What happened to the number of late pickups? It went up to twenty across the board. A wrong signal is perhaps worse than no signal. That is the wrong signal, because now it is said that the value of the daycare’s time for picking up a child late is three dollars. They removed the three dollars and went back to just \$360 a month. What happened? They stayed at twenty late pickups per daycare. People take information from that incentive. They learn from it, and they use it.

What are the incentives we are giving? Almost everyone has a base or fixed charge. There is a commodity charge added on to that for the amount of water that is used. Some places are using block rate structures, where if you use more, you pay an increasingly higher commodity charge. Summer

surcharges are also being used. There is one thing that I will say about the base charge which makes it difficult to analyze and compare across different communities: when you have a small base that is paying that fixed charge for just the maintenance what ends up happening is these systems, in many cases, have a higher overall cost than larger places like Albuquerque. One of the things that this does not probably bode very well for small community water systems is if they need more money for infrastructure. If they increase their base charge they are going to experience difficulties because of what that will do to their consumers. Perhaps in these cases, one of the things to consider is regional water systems that spread the costs over a larger consumer base.

The trend in the United States and the trend in New Mexico is that persons per household have declined dramatically from 1970 to 2000.

What are some pricing examples in the Southwest? Table 2 shows prices from Albuquerque, Santa Fe, and a few other places. If you will notice in almost every case there is a base charge that goes anywhere from about \$3 up to \$12 in Santa Fe. They have different commodity charges, and they may have surcharges or block rates. Albuquerque has a surcharge in the summer that is equal to fifty percent of the commodity charge if you use more than three hundred percent of the city average. If you go up to four hundred percent of the city average, the surcharge goes up to one hundred percent of the commodity charge. The summer runs from April through October. Santa Fe probably has one of the most aggressive policies right now. It costs \$2.50 per thousand gallons between 12,000 and 20,000 gallons, and then it increases. Their drought policies are fairly steep and substantial. It costs up to \$25 per thousand gallons if you use over 20,000 gallons of water. They are becoming very aggressive in what they are doing. Truth or Consequences has a block rate as well as Denver, Tucson, Fort Collins, and Las Vegas. Los Angeles is interesting, and I am using this example for a reason. They actually have a tiered system that depends on where you live and the size of your household. They started to recognize that there is heterogeneity across households in Los Angeles, which is a very progressive way to price.

Table 2. Southwest Pricing Examples

Location	Base	Commodity (1000 gallons)	Comments
Albuquerque	\$4.60	\$1.65	Surcharge
Santa Fe	\$12.42	\$5.47	Surcharge
T or C	\$8.15	\$1.75	Block Rate
Denver	\$3.41	\$1.63	Block Rate
Fort Collins	\$12.72	\$1.78	Block Rate
Tucson	\$5.35	\$1.03	Block Rate
Tucson	\$11.96	\$1.98	Block Rate
Phoenix	\$5.16	\$1.93	Uniform
Las Vegas	\$3.72	\$1.05	Block Rate
Los Angeles	None	\$2.46 (tier 1) \$2.56 (tier 2)	Block Rate, by tier by month

What do we need to consider for future prices? We need to consider infrastructure needs. The EPA did a survey a couple of years ago in which they looked at the infrastructure needs and found that we had huge shortfalls in the United States across every state. Supply availability and population growth are also considerations. What we need is really to be able to look at both the supply and demand part of this. What about New Mexico? According to the EPA survey, our current, largest needs are transmission and distribution. Figure 2 depicts results of a survey of community and other water systems. The largest future need for New Mexico is treatment, according to the survey. The problem is that federal dollars are declining. We are not going to be able to pay for what we need.

Population growth is another huge concern (Table 3). The question is asked, "Where is the growth in our curve?" This is from the Bureau of Business and Economic Research at UNM. Bernalillo County and Albuquerque are going to grow. Doña Ana County is going to grow about 45%. Valencia and around Socorro are going to grow about 68%. Sandoval and Rio Rancho's projected growth is 82% between 2005 and 2030. With those increases, we have some difficulties in terms of where the water comes from and what we are going to do with that.

Table 3. Population Growth (2005-2030) BBER Projections

New Mexico: 33%
Bernalillo: 27%
Dona Ana: 45%
Santa Fe: 57%
San Juan 27%
Sierra: 50%
Valencia: 68%
Sandoval: 82%
From: http://www.unm.edu/lbber/demo/table1.htm

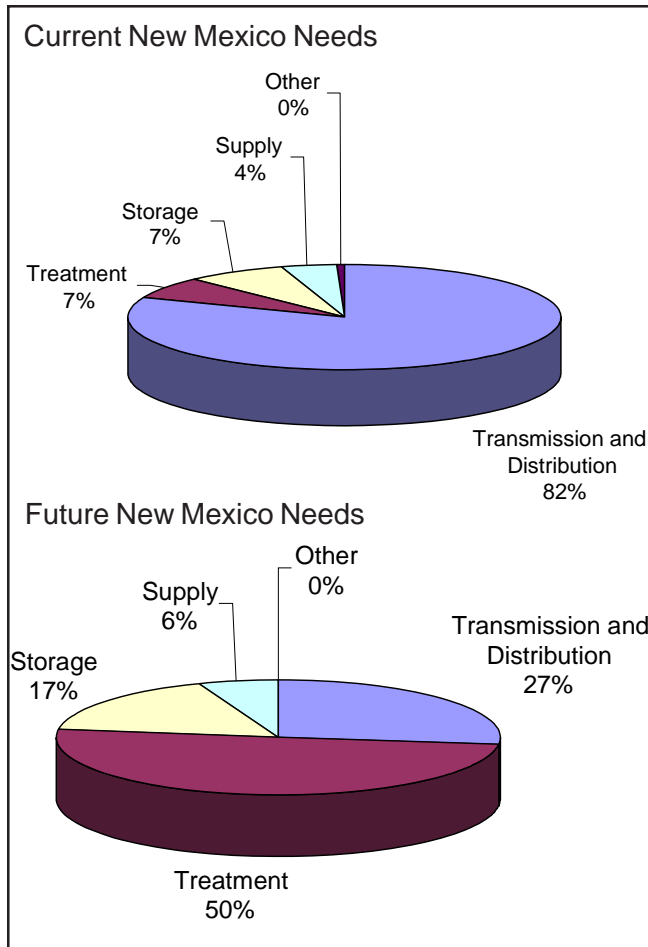


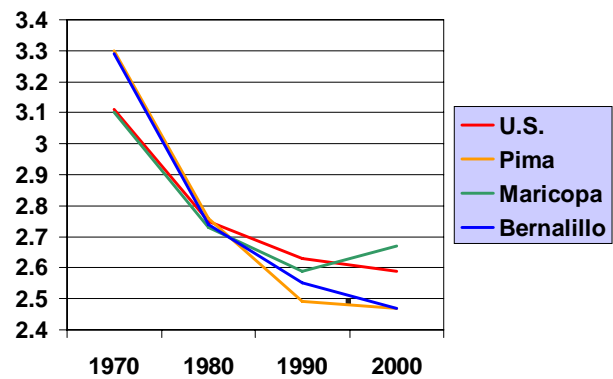
Figure 2. New Mexico Future Infrastructure Needs

One of the things that I want to talk about a little bit is industry in New Mexico. We are talking in the urban areas about economic growth. If you look at this, we can look at the macro economy and all the industry, but what is really important is where the water demand is. The demand is residential, commercial, and industrial. In Albuquerque, industrial water is less than five percent of the total water use in the city. Residential use is about 61%. Commercial is the rest of that. What is important about that? It is important because I would argue that all growth is not created equal. Table 4 is a chart that takes information from a Carnegie Mellon website that looks at the impact of a one million dollar increase in production in different sectors. I picked a couple of activities that are present in New Mexico. The fifth column over shows the impact of the dollars of gallons of water gained from the specific activity. It goes anywhere from ten cents per gallon for grain production up to about ninety-five cents per gallons for electronics. The third row over is the employment

that is required for that million dollar primary impact by the primary and secondary. For grain, the estimated employment increase is nine workers, for electronics, it is 20 workers. The employment numbers and their impact on population and the subsequent impact on residential consumption, I think, is what we really need to be considering rather than just how industry impacts water use. Economic growth and its impact on population, I would argue, is going to be very important.

All households are also not the same (Figure 3). The trend in the United States and the trend in New Mexico is that persons per household have declined dramatically from 1970 to 2000. We went from about 3.3 people per household in Bernalillo County down to less than 2.5. The impact on housing demand in Albuquerque is fairly consistent with other areas in New Mexico. These statistics are, by the way, from the work of Gary Woodard from the University of Arizona. In New Mexico during this time, 57% of housing demand is from population growth. 43% of the housing demand is because we like to live alone. The type of home ownership also matters. Single-family houses use more water than condominiums. Condominiums use more water than apartments. Owner occupied houses, we have found in some areas, tend to use greater amounts of water than non-owner occupied houses. The change in the housing stock mix impacts water demand per household.

Figure 3. Trends: Persons Per Household



from Woodard (2002)

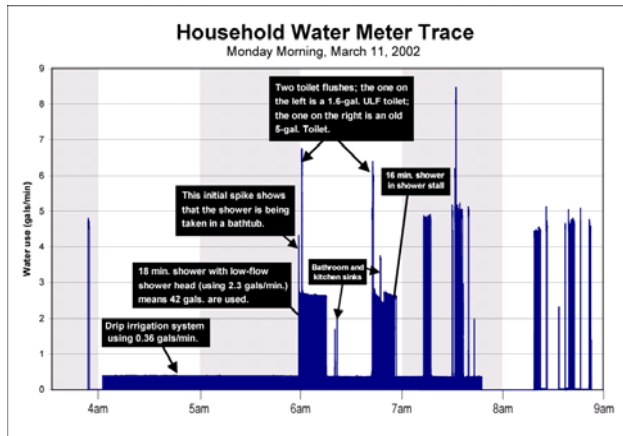
Another point to consider is whether conservation-built homes help. If you build it, will they come? If you build it, will they use it? Consider this: you have a consumer that has low flow showerheads, low flush toilets, drip irrigation systems, does this family conserve water? Using a meter monitoring their use, we can answer this, at least for a household in Tucson. Here

Table 4. For a \$1 Million Dollar Primary Impact

Activity	Econ. Impact	Employ	Water Use (Mil Gal)	\$/Gallon
Copper Mining	1.96	11	8237	0.24
Manufacturing	2.15	21	10481	0.21
Electronics	1.7	20	1790	0.95
Grains	2.02	9	20333	0.10
Golf (amusement/Rec Services)	1.54	23	2637	0.58
Electric Utility	1.67	7	2239	0.75
Dairy	2.7	13	12885	0.21
Semiconductors	1.77	13	8452	0.21
Mattresses and Bedsprings	2.28	20	11093	0.21

is some data from Tucson for March (Figure 4). What is important to look at are the irrigation systems. The irrigation system runs for three and a half hours every other morning in March. You do not need three and a half hours of drip irrigation system in Tucson even in March. Having the technology does not mean it is used.

Figure 4. Household Water Meter Trace - Tucson March 2002 (from Woodard 2002)



We also have a problem that everyone is not the same. I find in work that I have done with colleagues at the University of New Mexico that consumers do respond to price, but income, education, and gender are also important. We found in experiments and in data from the city of Albuquerque, people who are male when all else is constant use more water than women. We found that people who are native to Albuquerque all else equal use more water than those who move into the city. We find also that religious attributes are significant. There are significant differences in how people use water based on what they tell us about their religious and political preferences. We also find that the geographic location

in Albuquerque is also important. Temperature or climate fits in there also.

The point of all of this talk is that water pricing is difficult and if you really start to look at what water prices should be, a “one-size-fits-all” policy probably is going to be a very, very difficult thing to use efficiently or effectively. Incorporating consumer heterogeneity, housing sizes, and everything else we’ve touched on into pricing policies is not an easy task. I expect most future-pricing policies will be based on block rate pricing structures. Surcharges are important. I expect the way surcharges are implemented is also going to be important. How quickly price increases are implemented will also be important. If it is a small increase on an annual basis, people tend to absorb it more easily. When it is a large increase, people tend to react differently. Look at gasoline prices. Over the last two years, we have had incremental increases, but what probably got most people’s attention was the fifty to sixty-cent per gallon increase after Hurricane Katrina. The size of the incremental change is probably going to make a difference. Time of use pricing should be considered. If outdoor water is really what we need to go after, should we be charging more not only in the summer, but also for the time of day? Menu pricing should also be considered. You have to consider the fact that not all people’s water uses are created equal. Not everyone has the same ability economically to absorb price increases, and so pricing considerations must include New Mexico’s diverse population and economic means.

The important starting question may not be what the water should cost. Instead the questions may include: how does economic growth impact population growth, and how do economic growth policies coordinate with other policies? If we have economic

growth that requires a high level of education, are education policies in New Mexico also coordinated? How do community development plans fit in? Are we pushing single-family homes? Are we pushing condominium style homes? How does the type of population affect water demand? We do need to know how responsive people are to price. We need to know the economic conditions in the community. We do need to know what type of pricing schedule is going to work best for what type of community. Communities are very different in New Mexico. We have large urban areas and small regional areas that have to be considered. Are the prices necessary for the infrastructure costs economically feasible and politically feasible? If we can answer those questions then we can begin to determine appropriate future water prices.

Thank you.

In Albuquerque, industrial water is less than five percent of the total water use in the city. Residential use is about 61%. Commercial is the rest of that. What is important about that? ... all growth is not created equal.

Frank Ward is Professor of Water Policy in the Department of Agricultural Economics and Agricultural Business at NMSU. He has been a faculty member at NMSU since 1978. Frank has published extensively in the areas of water policy, resource economics, ecology, and conservation. He received bachelors, masters, and doctoral degrees in economics from Colorado State University.



INSTITUTIONAL BARRIERS TO WATER CONSERVATION IN THE RIO GRANDE BASIN: CHALLENGES AND OPPORTUNITIES¹

Frank Ward, Agricultural Economics & Business, MSC 3169
New Mexico State University, PO Box 30003, Las Cruces, NM 88003

Ari Michelsen, Agricultural Research and Extension Center
Texas A & M University, 1380 A & M Circle, El Paso, TX 79927

Leeann DeMouche, Extension Plant Sciences, MSC 3AE
New Mexico State University, PO Box 30003, Las Cruces, NM 88003

Abstract

The Rio Grande basin shares the problems faced by many arid regions of the world, in which water is over-allocated, there are growing competing demands, and river flows and uses are vulnerable to drought and climate change. Recent years have witnessed the emergence of legislation, administrative action, and other measures in the basin to encourage private investment in increased water use efficiency with the

intent of promoting agricultural water conservation. Nevertheless, several institutional barriers discourage irrigators from investing in measures to conserve water.

This talk examines institutional barriers to agricultural water conservation and identifies challenges and opportunities for emerging efforts to promote water conservation in the basin's agriculture. A water management practice is found to constitute conservation when it conserves a given supply of water through reduction in water use and it produces a net

increase in society's economic welfare. Several institutional barriers to water conservation are identified: clouded titles, water transfer restrictions, illusory on-farm water savings, insecure property rights to conserved water, an uncertain duty of water, shared carryover storage, interstate compacts, conservation attitudes, land tenure arrangements, and incomplete stream adjudications. Using data on water use and crop production costs for Elephant Butte Irrigation District, New Mexico, price is found to be a major factor influencing water conservation. Results show that a low price of water discourages water conservation even if other institutions promote it. A high price of water encourages water conservation even in the presence of other factors that discourage it. We conclude that water-conserving policies can be more effectively implemented where existing institutions that regulate the use of water are designed to be compatible with water's underlying economic scarcity.

Introduction

In most of the western United States, existing water supplies are claimed and diverted for irrigation and growing municipal and industrial demands. Remaining flows are increasingly protected for instream flows and environmental purposes. Most easily accessible groundwater is developed or is depletable. Throughout the west, drought, climate change, and emerging environmental laws and regulations intensify the competition for water. The United States federal government recently identified the Upper Rio Grande (Figure 1 map) as among river basins having the highest potential for conflict and crisis, especially in drought conditions (U.S. Department of Interior 2003). The Rio Grande exemplifies the problems faced by many arid regions of the world (e.g., Colorado, USA; Yellow, China; Jordan, Middle-East; Murray-Darling, Australia; and Nile, Africa) in which water is over-allocated, there are growing competing demands, and river flows and uses are vulnerable to drought and climate change. These factors along with the need for water policies that are sustainable have highlighted the interest by policymakers, scientists, and water managers to examine carefully water management alternatives that encourage, promote, and reward water conservation.



Figure 1. Study area

Originating in the southern Colorado Rocky Mountains, the Upper Rio Grande extends 600 miles (960 kilometers) from its headwaters and flows through New Mexico to the border cities of El Paso, Texas, USA and Ciudad Juárez, Chihuahua, Mexico (Fig. 1). Downstream of El Paso, the river forms the international border between the U.S. and Mexico on its way to the Gulf of Mexico. The Upper Basin (hereafter referred to as the basin) supports a rapidly growing population of more than three million², extensive irrigated agriculture, and fish and wildlife habitat in Colorado, New Mexico, Texas, and the Mexican state of Chihuahua. Some 80 to 90 percent of the water in the basin is used for irrigated agriculture.

Yet, the basin's population is expected to double in the next 50 years, potentially doubling urban water demands. This rapid population growth in conjunction with increased demands by all users, will further intensify the competition for limited water resources. Recent years have witnessed the emergence of legislation, administrative action, and other measures to encourage private investment in increased efficiency with the intent of promoting agricultural water conservation. Nevertheless, several institutional barriers may discourage irrigators from investing in measures or otherwise taking actions designed to conserve water. In the basin, more than a century of

federal water development programs and policies have attached great importance to providing plentiful and reliable supplies at a low price. Because of the widespread successes of these programs, a large number of institutions have arisen that promote, reward, and support heavy water use, especially in agriculture.

Factors that influence water conservation, both inside and outside agriculture, have seen recent attention in the literature. Schaible (1997) found that major water price reforms are required to compensate for institutional barriers to conservation for irrigators in the U.S. Pacific Northwest. Moore and Negri (1992) found that reducing the supply of water to western irrigators by 10 percent would increase the national price of three of ten major crops produced by Bureau of Reclamation farms. Yang, Zhang, and Zehnder (2003) found that rapid increases in irrigation costs in northern China since 1993 have failed to generate a sufficient force for water conservation, and that more generally water pricing reform by itself is not an effective measure for promoting water conservation. In an analysis of municipal water use in Ontario, Canada, DeLoe and others (2001) found that limited finances, lack of political will, and public resistance all constrain the effectiveness of municipal conservation programs. Jenkins and Lund (2000) found that the high economic cost of dealing with water shortages can be reduced by jointly expanding infrastructure as well as eliminating institutional constraints.

Winter-Nelson and Amegbeto (1998) developed an economic model of optimal investment under uncertainty to analyze the effects of both the level and variability of water's price on the decision to conserve. Loaiciga and Renehan (1997) examined the effects of pricing and drought on water conservation in Santa Barbara California during the 1986-1996 period when per capita supplies fluctuated considerably. DoMonte, Angelakis, and Asano (1996) analyzed how water use guidelines could be designed to deal with similar problems in Europe's Mediterranean region.

Michelsen, McGuckin, and Stumpf (1999) found that non-price programs could be an effective instrument for achieving water conservation for seven cities in the southwestern U.S. Huffaker and Whittlesey (2000, 2003), Stonehouse (1996), and Huffaker and others (1998) found that increasing the price of water, possibly through greater water marketing opportunities, is more effective than subsidizing the cost of improved on-farm irrigation efficiency at promoting water conservation in irrigated agriculture. Anton (1995)

summarized the Seattle Water Department's experience with water use curtailment measures for promoting water conservation during the 1987 and 1992 droughts. Mulwafu and others (2003) found that irrigators in Malawi Africa made the fewest water conservation investments when the price of water was lowest. Michelsen and others (1999) confirmed a long history of research findings showing that a low price of water charged by the U.S. Bureau of Reclamation for irrigation water strongly discourages water conservation in agriculture. Peterson and Ding (2005), in their analysis of the U.S. High Plains area, found that the presence of water-saving irrigation systems do not guarantee water conservation in irrigated agriculture, as long as water's price remains low.

Pender and Kerr (1998) found that water conservation investments by irrigators in the semi-arid lands of India are significantly lower on leased land and on lands subject to sales restrictions than on deeded lands. Their results suggest considerable potential for land market reforms as a way to increase water conservation investments. Sokolov (1999) found that various water saving methods in Uzbekistan, when combined with price incentives, could secure a path of sustainable development for agriculture. Zougmore, Mando, and Stroosnijder (2004) found that efficient combinations of organic resources and fertilizers will improve water use efficiency and productivity of agriculture in Burkina Faso, Africa. Cuthbert and Lemoine (1996) found that increasing numbers of U.S. water utilities practice seasonal rates, inverted block rates, and excess use rates to provide pricing signals that promote water conservation.

Despite these above contributions, little research has examined institutional barriers to water conservation and identified institutional innovations that could circumvent those barriers. The goal of this talk is to help fill those gaps by examining institutional barriers to agricultural water conservation and identifying challenges and opportunities for emerging efforts to promote water conservation in the basin's agriculture. It accomplishes these aims by briefly examining selected organizations, laws, and system operating procedures that act as institutional barriers to agricultural water conservation. It also examines how those barriers have influenced irrigation water use in the basin. Finally it identifies some challenges and opportunities presented by attempts to deal with these barriers in the search for increased water use efficiency in the basin's irrigated agriculture.

What is Water Conservation?

Water conservation could be defined as any action that promotes a reduction in its use. In the Rio Grande Basin, various actions could be taken that encourage or require irrigators to substitute additional land, labor, capital, or money for reduced use of water. Under that definition, all water use reductions are conservation. While this is a precise and clear definition, it is economically naive and politically impractical: water is only one of many scarce resources required for agricultural production. For example, regulations could be enacted requiring all irrigators to reduce their water use by changing from flood irrigation to drip irrigation if drip irrigation is not already being practiced. Drip irrigation does reduce water applied in agriculture, and it typically increases crop yields as well. However, that particular reduced use of water applied in agriculture will usually be accompanied by increased use of other scarce resources, most notably labor, capital, and money. Unless crop yields increase considerably under drip irrigation and unless water is much more expensive than normally seen in the irrigated west, changing from flood to drip irrigation typically reduces net farm income under typical economic conditions. These economic conditions usually include a comparatively low price of water, especially for the use of water provided under federal reclamation projects. Irrigators are typically in business to increase their income or to meet other personal or farming goals, not to conserve water.

Only actions that reduce the use of water without disproportionately increasing the use of other resources can be labeled as water-conserving in the economic sense. So an acceptable definition of water conservation requires that the beneficial effects of the reduced water use must be greater than the adverse effects associated with the use of other resources required to support conservation. Where all beneficial and adverse effects are measurable in monetary units, this test amounts to the requirement that the benefits of reduced water use exceed its costs. What this means is that the essence of conservation is reduced use, but more must occur. A water management practice constitutes conservation in the economic sense when it meets two tests: (1) it conserves a given supply of water through reduction in water use; (2) it produces in a net increase in society's economic welfare, that is, the additional resources used to support the water conservation (e.g., increased labor and greater capital

to support drip irrigation) have a lower economic cost than the value of the water saved.

The first test insures that the practice results in a reduction in use, while the second establishes that overall benefits exceed costs. This definition of water conservation is simply a specified subset of those practices that comprise economically efficient management of water resources. When conservation is thus differentiated from other desirable water management measures, it becomes possible to formulate policies and propose practices that are directed to promote conservation, and it becomes possible to evaluate their success on economic grounds.

Barriers to Conservation

This section identifies several institutional barriers that can limit the effectiveness of future water conservation programs in the Rio Grande Basin. Removing or alleviating any of these barriers could promote conservation, thus freeing up water for alternative uses or providing more water for future use in agriculture, cities, or the environment.

Clouded Titles

In both New Mexico and Texas, a person or organization must apply to a state administrative agency to obtain a valid water right, either through a new appropriation or a water transfer from another user. In both states, there is a constitutional requirement that the appropriator must show to the state's satisfaction that the water will be applied to beneficial use. In both states, within the Rio Grande Project, downstream of Elephant Butte Reservoir (Fig. 1), the water right permit is granted in perpetuity or until the land and/or water has been transferred to another user. After the permit is granted, the appropriator is required to put the water to beneficial use. Nevertheless, producers often express the fear that investments made in water conservation, such as changing irrigation technologies that reduce water applied or adopting new management techniques like irrigation scheduling, will result in the saved water being lost to the state or to the irrigation district, because of the presumption that the saved water was not used beneficially.

Water Transfer Restrictions

Short-term water transfers through mechanisms like water banks could provide an economic incentive for agriculture to save water, especially in periods of drought or other shortages. Temporary water transfers,

such as a one-season water rental or leasing arrangement, possibly through an arrangement similar to banking, could provide agricultural producers an incentive to reduce water use in agriculture.³ The advantage of such a short-term transfer is the immediate infusion of cash into agriculture when the transfer takes place.

A water bank is a special form of a spot market organized and operated by a central banker, such as the state, a state-appointed water broker, irrigation districts or private companies. The bank, if established, is a mechanism for willing water right owners to lease water to the bank or renters, such as cities or an environmental group, on a short term basis. A bank can typically acquire water in at least three ways: by paying farmers for water they would have used to irrigate their fields; by purchasing surplus water from local irrigation districts; or by paying farmers to use groundwater instead of surface water. A successful water bank experiment in California in the early 1990s taught several lessons: water markets, even when they are severely constrained and controlled, will work; water has a very high value for city and environmental buyers, and at a suitably high price there are likely to be many sellers; very large amounts of water can be found for the bank if money is put on the table; and third-party interests in water market transactions can be protected (Dziegielewski et al. 1993; California Department of Water Resources 1992; Pratt 1994).

Nevertheless, some Rio Grande Basin producers have expressed concern that these short-term transfers may be interpreted by water administrators or by the public as evidence of a nonbeneficial use of water. Furthermore, some producers may fear that the water right will be lost through a temporary transfer into a bank. This could occur because of unclear or unenforced legislation or poor communication by water administrators to producers. As a result, this important potential source of conservable water for use by others currently is unavailable.

Illusory On-Farm Water Savings

Agricultural producers continue to adopt more technically efficient irrigation methods to produce higher net incomes through increased crop yields, increased efficiency in nutrient and chemical use, reduced labor costs and more efficient water use. One definition of on-farm irrigation efficiency is the ratio of water stored and depleted in the crop root zone for crop consumption to the total water diverted from the

stream for irrigation. One method to increase on-farm efficiency, defined in this way, would be to encourage producers to apply water more consistently across fields, which enables crops to maintain or increase their consumptive water use from reduced stream diversions.

Many policy makers believe that reduced diversions resulting from increased on-farm efficiency produce water savings that become available to meet other growing demands. Some states across the West are passing or are considering passing legislation that encourages producers to invest in improved on-farm irrigation technologies. However, this kind of legislation should be approached carefully, because many of these on-farm investments in greater irrigation efficiency can reduce the available water that would have been otherwise supplied through return flows to downstream appropriators (Huffaker and Whittlesey 2000; Huffaker et al. 1998).

An on-farm investment that reduces water applied from the individual producer's view by X acre-feet can reduce downstream supplies by as much or more than X.⁴ A policy measure that guards against this false water savings would encourage only those private investments in on-farm irrigation efficiency that do not decrease return flows relied on by downstream appropriators and instream users (Huffaker and Whittlesey 2000). Return flows are not impaired only if the on-farm investment leads to reductions in the water consumed or irretrievably lost to the basin.

Insecure Rights to Conserved Water

One definition of water conservation is when the appropriator saves water otherwise irretrievably lost to the system.⁵ Water is irretrievably lost to the system when it is depleted through uptake by plants, evaporation, runoff to saline groundwater basins or to aquifers too deep for economic use. Conserved water, according to this definition, is that use of a particular stream or other watercourse or supply source that is saved from loss and made available for current or future beneficial use. For water to be conserved, the potential conserver must show that the conservation efforts will not damage other appropriators on the same watercourse, typically by reducing return flows (Glickstein et al. 1981). For example, a producer who intercepts his return flows from a field that would otherwise flow unimpeded to a downstream user fails to conserve water. This water saved would not

otherwise be lost, since it takes water from another downstream appropriator.

There are many ways to conserve water. Concrete-lined canals or ditches, for example, prevent water from seeping to uneconomical depths or to saline aquifers. Other ways include removing water-using weeds (phreatophytes) to decrease water lost to nonbeneficial uses or substituting water stored in surface reservoirs to shallow groundwater basins. Institutions that block producers from securing a water right to the water conserved in this way discourage investments in conservation.

Uncertain Duty of Water

Many Western states, including New Mexico, are in the process of adjudicating their streams, that is, defining clear titles to the right to use water. A completely adjudicated stream system clearly defines all owners' rights to use water under all possible future hydrological conditions. Adjudication began in earnest in New Mexico's Lower Rio Grande in the late 1990s, with the first offers of adjudicated water rights sent to landowners in 2000.

Despite the considerable progress made on these adjudications, the "duty of water," that is the amount of water right assigned per acre, has yet to be established. There is considerable uncertainty over what the duty of water will be or how it will be established. Will all irrigators receive an equal amount of adjudicated water per acre, for example, 3 acre-feet per acre for every irrigator? Or will the offer vary with type of crop? For example, pecan growers could receive more water rights per acre than cotton growers because of the greater water applied historically per acre to pecan trees.⁶ This uncertain duty of water prior to the completed adjudications may establish perverse incentives for water conservation: If there is widespread belief that producers who plant more water-using crops will secure a larger adjudicated offer per acre, growers have an incentive to plant crops or trees that use larger amounts of water solely to receive more water in the future.

Shared Carryover Storage

Producers sometimes express an interest in seeing a policy that permits or encourages them to carry over and keep track of this year's unused water, which can be kept in a storage reservoir for use in a subsequent year. Rio Grande Project water users in southern New Mexico and West Texas are discouraged from saving

water in any given year and storing it at Elephant Butte Reservoir for later use.⁷ Three preventable losses occur when water is released from a reservoir and used for irrigation: part of the water is consumed by evaporation; a portion percolates to the aquifer; and the drainage water is sometimes damaged by salts or chemicals. If a system of carryover storage credits could be enacted with property rights assigned to those who reduce their current water use by fallowing land, adopting water-conserving irrigation technology or shifting to lower water-using crops, these losses could be reduced. In drought years, this saved water would be especially valuable.

The common property nature of an irrigator's saved water in Rio Grande Project lands combined with the historical 57 percent water allocation to New Mexico users and 43 percent to Texas users means that any water carried over this year is shared by everybody the next year. For example, suppose a Texas user reduces current use by 1,000 acre-feet and stores it behind Elephant Butte in hopes of receiving extra water the following year. The unevaporated part of the 1,000 acre-feet saved by the Texas user will accrue as 43 percent to the Texas user and 57 percent to New Mexico users. The fact that a well-defined, transferable and enforceable private property right fails to be earned in water carried over discourages irrigators from conserving water.

Interstate Compacts

The Rio Grande Compact and the 1906 U.S.-Mexico Treaty are the overriding mechanisms for allocating water to Colorado, New Mexico, Texas and the Republic of Mexico. The quantity of water allocated to each is set out clearly within the compact and treaty allocations with little opportunity to trade water surpluses or shortfalls for cash or other considerations. The Rio Grande Compact⁸ currently has no institution in place that would permit water users in Colorado or New Mexico to sell or rent surplus water to users below Elephant Butte Reservoir or to buy deficit water from these same users. If, for example, the Rio Grande Compact were amended to allow Colorado or New Mexico users to under deliver to Elephant Butte in exchange for cash (buy water) or over deliver to Elephant Butte Reservoir in exchange for cash (sell water), agricultural users in all three states may be encouraged by cash incentives to conserve water. Mexico is allocated 60,000 acre-feet per year under the 1906 U.S.-Mexico treaty, an amount of water that

is not normally subject to negotiation. If irrigators in southern New Mexico or West Texas could sell or rent some of their unused water to Mexico in exchange for cash, the associated financial incentive may encourage all users to invest in water conservation measures.

Conservation Attitudes

Negative attitudes toward water conservation can represent a major barrier to its practice, despite the fact that people who conserve water are generally respected and admired. To understand more about these attitudes, a survey of water management practices administered in 2002-03 to members of the Elephant Butte Irrigation District (EBID), New Mexico on drought conditions during this irrigation season were comparable to other drought season conditions observed in New Mexico. The survey was designed to identify the attitudes that discourage irrigators from conserving water. Table 1 shows irrigated acreage for the producers sampled by the survey for both 2002 and 2003 by crop and by irrigation technology used. Table 2 shows that a strong majority of producers identified several barriers to water conservation:

conservation is too expensive, the basin’s stream adjudications are not yet complete, additional labor required to implement conservation, inadequate financial incentives for reducing water use, an inadequate water distribution system, and increased soil salts resulting from reduced water use.

Land Tenure

Additional results from the survey showed that those farmers renting acreage were more sensitive to reasons for not reducing current water use compared to farmland owners. Most farm rentals in the area were based on a crop sharing arrangement, but renters paid a flat fee for the right to farm the acreage in the production season. Any additional water usage over the District allotment became part of the renters production cost. During the survey several renters described the considerable lack of financial incentives for owners to invest in water conservation when their farmland is rental property. Not surprisingly, both owners and renters respond strongly to needing all of the water they receive.

Table 1: Irrigated Acreage by Crop and Irrigation Method, Lower Rio Grande Basin, New Mexico								
Year	2002				2003			
Crop / method	Flood		Drip		Flood		Drip	
	acres	pct total	acres	pct total	acres	pct total	acres	pct total
Alfalfa	6302	16.02	220	0.56	5683	15.53	270	0.74
Cabbage	3110	7.90	310	0.79	2670	7.30	360	0.98
Chile	6855	17.42	690	1.75	5841	15.96	690	1.89
Corn	2729	6.94	70	0.18	2544	6.95	120	.33
Cotton	5979	15.20	480	1.22	5206	14.23	530	1.45
Lettuce	3007	7.64	310	0.79	2582	7.06	360	0.98
Onion	4755	12.09	310	0.79	5250	14.35	620	1.69
Pecans	3077	7.82	210	0.53	2699	7.38	262	0.72
Wheat	880	2.24	50	0.13	800	2.19	100	.27
Total Acres	36694	93.26	2650	6.74	33275	90.95	3312	9.05

Land Tenure Arrangement	Own Land N=67	Rent Land N=20
Reasons for not reducing water use		
Water conservation costs too much	69 ⁹	60
Incomplete stream adjudications	88	75
Water conservation requires additional labor	76	70
No buyers for saved water	96	100
No financial incentive to reduce water use	85	65
Water distribution system restricts conserving	90	93
Reduced water use builds up salts in soil	79	67

⁹Entry reflects percentage of all respondents indicating agreement with statement

Incomplete Stream Adjudications

General stream adjudications fulfill three functions: (1) public recording and validation of all water claims and rights; (2) facilitating the fair distribution of water; and (3) enabling improved and more planning and management of future water allocations. Stream adjudications give certainty to water rights, provide the basis for water right administration, reduce conflict over water allocation and water usage, and facilitate important market transfers for water rights. Most of the stream segments in the Rio Grande basin are still not adjudicated, which means that there is considerable uncertainty over who currently has the right to use how much water in what water supply conditions. One problem presented by this legal uncertainty over who owns what water rights is that water authorities have a difficult time administering water rights (e.g., locking gates of junior users) to guarantee sufficient downstream flow to meet interstate compact obligations, for it is unclear who the junior users are.

Despite all these advantages of completed stream adjudications, the question of how water administrators should assign the initial property rights to support as part remains a major unresolved challenge. Where most use is for agriculture, adjudication of a stream based

on irrigated acreage requires establishing the duty of water per irrigated acre. That duty of water in the Rio Grande basin is currently unknown. Assigning a higher duty of water per acre based on historical crop water requirements effectively assigns greater amounts of real economic wealth to people who can demonstrate the highest historical use. This widespread recognition of real wealth created by the higher potential duty produces incentives discouraging current water conservation in an effort by irrigators to show higher historical use and to begin carrying out that higher use in anticipation of that favorable higher duty of water.

Despite the ultimate greater certainty targeted by the ongoing adjudications in the basin their current incomplete status creates its own significant institutional barrier to incentives for conserving water, a hypothesis borne out by Table 3. The table presents results of the survey organized by major crop cultivated. Crops listed are onion, pecans, alfalfa, and cotton. Onion farmers were especially sensitive to the incomplete status of the ongoing adjudication process; 67 percent stated that the adjudication process discourages them from conserving water. Producers of other crops were somewhat less sensitive to uncertainties caused by the ongoing adjudications.

Price and Conservation

The price of water as well as the price of water-conserving technologies are important indicators of economic scarcity. Economic theory suggests that producers will pay close attention to both sets of prices. These prices can be expected to exert a major influence on the intensity and duration of producers' search for water saving substitutes.

Effective Price

Various institutions set both the price of water and establish the rules governing how water can be traded both within and outside agriculture. These institutions potentially have an important influence on water conservation. For example, each EBID member is charged \$50 per acre per year for the right to use up to 2 acre-feet per acre, if there is enough water available at the reservoir. Any water user who conserves that 2 foot allotment still pays the \$50. For this reason, the \$50 charge is a district membership charge and not a price of water. Because any increase or decrease in water use between 0 and 2 acre-feet per acre results in the producers paying the same \$50 price, the first 2 acre-feet per acre are effectively priced at zero.

Most Important Crop	Onions N=3	Pecans N=35	Alfalfa N=38	Cotton N=19
Reasons for not reducing water use				
Water conservation costs too much	67 ¹⁰	69	74	63
Incomplete stream adjudications	33	91	89	68
Water conservation requires additional labor	67	83	76	68
No buyers for saved water	67	100	97	95
No financial incentive to reduce water use	67	86	87	63
Water distribution system restricts conserving	100	82	94	94
Reduced water use builds up salts in soil	50	71	81	82

¹⁰Entry reflects percentage of all respondents indicating agreement with statement

EBID members also have the right to purchase additional water at \$18 per acre-foot if the water is available, so the incremental price after two acre-feet is \$18. If policies were instituted that allowed members to buy each acre-foot after two at \$18, then rent any unused portion of it out at \$100 or even \$200 per acre-foot to a city or recreational or industrial buyer, there would be considerable financial incentive to invest in on-farm water conservation measures. However, current water transfer practices do not permit trading of water outside agriculture. Thus, water is effectively locked into agriculture, which discourages investments in water conservation and raises the price of water to city or environmental users.

Price and Use

The scarcity of water itself as well as the price of various irrigation technologies both influence water conservation decisions in agriculture. Economic conditions for irrigated agriculture in the basin are shown in Table 4. As of 2005, virtually all EBID producers use flood irrigation, as shown in Table 1. So the question of what changes it would take to promote investments in water conservation, defined here as allocating some acreage into drip irrigation, takes on considerable economic and political importance. As is typical in much of the irrigated west, drip irrigation in the Lower Rio Grande Basin is considerably more expensive than flood irrigation, but it also uses less water per acre and produces greater crop yields.

Water supply	300 acre feet
Crop	Onions
Farm size	100 acres
Crop price	\$6.38 per sack
Flood irrigation	
Production cost	\$4120 per acre
Crop yield	675 sacks/acre
Water use	4 acre feet/acre
Drip irrigation	
Production cost	\$5320 per acre
Crop yield	845 sacks/acre
Water use	2 acre feet/acre

The answer to the question turns on what combination of economic conditions and water supplies makes it profitable to favor drip over flood irrigation. Table 5 shows the impact of changes in water scarcity and adjustments in water institutions that affect water conservation in agriculture. The table shows four sets of future production cost and crop prices. Rows 1-4 show current conditions, consisting of high production

costs (\$4120 / acre for flood irrigation) and low crop prices (\$6.38); Rows 5-8 show conditions of high production costs and high crop prices (\$7.38); Rows 9-12 show low production costs (\$3820/ acre for flood irrigation) and low crop prices (\$6.38). Rows 13-16 show low production costs and high crop prices. Drip irrigation is priced at a constant \$5320 per acre except where reduced through a conservation subsidy.

For each set of these three future economic conditions described above, the table shows three possible irrigator responses to a water supply reduction from 300 to 200 acre feet for the 100 acres. In all cases the producer is presumed to maximize net income subject to constraints of water supply and available land. The first possible response is continued income maximization while facing any institutional constraint that blocks the producer from adopting added drip irrigation acreage than occurs under the base water supply of 300 acre feet. The second response is continued income maximization with no institutional constraint to investing in drip irrigation. The third response assumes the that government water conservation program is enacted. Under the program,

the cost per acre of drip irrigation is reduced through a subsidy by the minimum amount per acre needed to maintain equal farm income that was earned with a 300 acre feet supply, but after the 100 acre foot shortfall occurs. Results of the income maximization provide insights into factors that most influence farmers' water conservation investments.

Table 5 shows that net farm income is lowest under current conditions where production costs are high and crop prices are low (row 1). Under these 2005 conditions, abundant water (300 acre feet) and low crop prices make it economically attractive to substitute water for land and for other inputs. Some drip irrigation could be put onto the 25 acres of idled land, shown in row 1. But at \$6.38 the crop price is too low for the value of the additional yield to pay for the additional costs of drip technology. Row 1 shows that income maximization requires idling 25 of the 100 available acres, and that all 75 acres production occurs under flood irrigation, which actually occurred in 2005. The value of one additional acre foot of water to the 100 acre farm is \$47, and the farm produces a total net income just under \$14,000. When water supply falls to

Table 5: Factors Affecting Water Use in Irrigated Agriculture, Lower Rio Grande Basin, New Mexico, 2005

Supply (a-f)	Institutions		Input costs		Price Onions (\$/sack)	Land Allocation			Water Allocation		Economic Impact		
	Subsidy	Barrier ¹¹	Flood ¹² (\$/ac)	Drip ¹³ (\$/ac)		Flood (ac)	Drip (ac)	Idled (ac)	Average Use (a-f/ ac)	Idled (a-f)	Water Value (\$/a-f)	Net Income (\$)	Program Cost (\$)
300 ¹⁴	no	no	4,120	5,320	6.38	75	0	25	4.00	0	47	13,988	0
200	no	yes	4,120	5,320	6.38	50	0	50	4.00	0	47	9,325	0
200	no	no		5,320		50	0	50	4.00	0	47	9,325	0
200	yes	no		5,205		25	50	25	2.67	0	47	13,988	5,770
300	no	no		4,120		5,320	7.38	0	100	0	2.00	100	0
200	no	yes	5,320		0	100		0	2.00	0	0	91,610	0
200	no	no	5,320		0	100		0	2.00	0	0	91,610	0
200	yes	no	5,320		0	100		0	2.00	0	0	91,610	0
300	no	no	3,820	5,320	6.38	75	0	25	4.00	0	122	36,487	0
200	no	yes		5,320		50	0	50	4.00	0	122	24,325	0
200	no	no		5,320		50	0	50	4.00	0	122	24,325	0
200	yes	no		4,905		25	50	25	2.67	0	122	36,487	20,770
300	no	no	3,820	5,320	7.38	50	50	0	3.00	0	123	103,880	0
200	no	yes		5,320		25	50	25	2.67	0	290	74,842	0
200	no	no		5,320		0	100	0	2.00	0	123	91,610	0
200	yes	no		5,197		0	100	0	2.00	0	61	103,880	12,270

¹¹Institutional barrier prevents producer from investing in water conservation even if it increases net income.

¹²Equals cost per acre of crop production under flood irrigation technology; crop yield is 675 sacks per acre; water use is 4 a-f/ac. Data source is (<http://costsandreturns.nmsu.edu/2005Projected.htm>).

¹³Equals cost per acre of crop production under drip irrigation technology; crop yield is 845 sacks per acre; water use is 2 a-f/ac.

¹⁴The top row of numbers reflect 2005 conditions

200 acre feet, irrigators simply reduce the scale of farming from 75 to 50 acres. No investments in drip irrigation are made because the added economic value of the higher yields are too small to pay for drip's added costs of production (rows 2-3). Row 4 shows that a subsidy for drip irrigation of \$115 per acre is enough to maintain original income through the producer's investment in the drip technology while having 100 acre feet less water to apply to the land.

Irrigators' highest willingness to invest in water conservation occurs when flood irrigation is expensive and crop prices are high, shown in row 5. The increased crop price shown by comparing row 1 and row 5 produces a dramatic increase in the producers' willingness to invest in drip irrigation. The higher crop price enables the yield increment produced by drip irrigation to pay for its higher production costs. By contrast, under low crop prices, the economic value of the added yield produced by drip is insufficient to pay for its added production costs. Under conditions shown in row 5, drip irrigation becomes so profitable that all 100 acres are produced under drip even without reducing the water supply. Furthermore drip conserves so much water that its adoption results in 100 acre feet of unused water in agriculture. This water becomes available for uses outside agriculture. For this reason, when agricultural water supply falls from 300 to 200 acre feet, there is no economic loss whatsoever to agriculture. In these conditions the cost of a water-conservation program subsidy is zero, since maximum conservation already occurs. These results are shown in rows 5-8.

The highest cost to the taxpayer of implementing a program to subsidize water conservation occurs when flood irrigation is cheap and crop prices are low, as shown in row 12's \$20,770 total program cost. Producer responses to these conditions are shown in rows 9-12. In this situation, an on-farm water supply reduction from 300 to 200 acre feet encourages no water conservation investments whatsoever by irrigators, as shown by comparing rows 9 and 10. A low crop price means that the added cost of drip irrigation is larger than the economic value produced by drip's increased crop yield, so the irrigator reduces water use by the required 100 acre feet by simply reducing the scale of the farm's operation and idling 25 more acres of land (compare rows 9 and 10). These economic conditions, while weak at encouraging drip irrigation investments, are precisely the same conditions that cause the conservation program subsidy required of the taxpayer

to be so high. When farm income falls from \$36,487 to \$24,325 after the water supply reduction, the cost-minimizing drip irrigation subsidy needed to maintain farm income at the \$36,487 base after the 100 acre foot water loss is a high \$415 per acre.

Institutional barriers to water conservation have the largest negative effect on net farm income after water supply is reduced when flood irrigation is cheap and crop prices are high. Rows 13-16 show that the economic value of access to drip irrigation about \$17,000 (\$91,610 - \$74,842). That is, removing the institutional constraint to water conservation saves the irrigator about \$17,000. In the face of institutional barriers to water conservation (row 14) in these most attractive economic conditions, the economic value lost by suffering a water supply shortfall of 100 acre feet produces the highest of all losses, about \$29,000. This very large economic loss produced by institutional rigidities blocking conservation, not surprisingly also produces the highest economic value of water at \$290 per acre foot. Remarkably the economic cost of a water conservation program subsidy is comparatively small (\$12,270 shown in row 16) compared to conditions described in rows 12 (\$20,770). It is smaller because the most flexible producers already discover they can afford to invest in drip irrigation thanks to a high crop price. Therefore the drip irrigation subsidy required to restore their base income (\$103,880) is only about \$123 per acre or a total of \$12,270 for the 100 acres that the subsidy induces.

Price and Substitution

Groundwater substitution occurs when irrigators respond to surface water price increases or shortages by reducing surface water demand and tapping instead into groundwater. An unfortunate side effect of this is that groundwater substitution can lead to actions that conserve one water resource at the expense of another to which it is hydrologically connected. As a result of the interdependence between ground and surface water use, it is difficult to determine if a surface water pricing or conservation program promotes saved water from the view of the system. One water source is potentially conserved at the expense of the other. For this reason, the hydrologic and economic ease with which groundwater is substituted for surface water is important to understand and measure when discussing, designing or enacting policies that promote water conservation by agricultural producers. What all this means for policy analysis is that the net result of surface

water pricing, including marketing and conservation legislation or incentives, is an uncertain conservation policy tool when groundwater is available as a close substitute for surface water. An effective conservation policy will account for the interaction between the two water sources and will attempt to encourage irrigators to manage the two water sources jointly (Schuck 2001).

Conclusions

The ability for an irrigator to realize an economic gain by reducing current water use in agriculture is an important incentive to promote conservation. Several barriers to water conservation were identified. These include lack of clear titles to water rights, barriers to water transfers, on-farm water savings that fail to save water for the basin, and barriers to securing rights to conserve water. Other barriers include the ease with which greater groundwater use can be substituted for reduced surface water, water's uncertain duty, the common property nature of carryover storage, interstate compact constraints, and water's low price, which locks water into agriculture.

One constructive measure to promote water-conserving decisions is to design institutions that remove barriers to informing water users about the opportunity cost of current water uses. Another is to enact laws and policies that guarantee that reduced upstream water use does not simply come at the expense of water taken from a downstream appropriator. Considerable differences in the value of water used in agriculture versus urban and environmental use create an opportunity for designing legal and pricing institutions that reduce barriers to market transfers and incentives that discourage conservation. Water that could be saved in agriculture is typically quite responsive to price changes. Owners or users of agricultural water rights could use this price sensitivity to their advantage by renting or leasing their water to cities or environmental users in periods of drought or other shortages with no change in water rights ownership. Without legislative action, perceptions by many farmers that all unused water may be lost pose a barrier to water conservation. Many water users in the basin avoid conservation because of incomplete stream adjudications that throw into doubt the security of their water right. Higher current use is believed by some to be an indication of beneficial use of a larger quantity of water than is currently needed, although that water might be needed for the future, particularly when severe drought reduces all quantities. Where there is water infrastructure to

store and move traded water, legislation that defines water trading to be a beneficial water use could remove this barrier to conservation.

References

- Anton, W.F. 1995. Implementing ASCE Water-Conservation Policy. *Journal of Water Resources Planning and Management-ASCE*. 121:1:80-89.
- California Department of Water Resources. 1992. *The 1992 Drought Water Bank*. Sacramento, CA.
- Cuthbert, R.W. and P.R. Lemoine. 1996. Conservation-oriented water rates. *Journal American Water Works Association*. 88:11:68-78.
- De Loe, R., L. Moraru, R. Kreutzwiser, K. Schaefer, and B. Mills. 2001. Demand side management of water in Ontario municipalities: Status, progress, and opportunities. *Journal of the American Water Resources Association*. 37:1:57-72.
- Do Monte, M.H.F.M., A.N. Angelakis, and T. Asano. 1996. Necessity and basis for establishment of European guidelines for reclaimed wastewater in the Mediterranean region. *Water Science and Technology*. 33:10-11:303-316.
- Dziegielewski, B., H.P. Garbharran, and J.F. Langowski. 1993. *Lessons learned from the California Drought (1987-1992): National study of water management during drought*. IWR Report 93. Washington, D.C. U.S. Army Corps of Engineers.
- Glickstein, R.J., R. Heimlichner, S. Rosenbaum, and D. Downing. 1981. *Assessment of Selected Legal/Institutional Constraints to Water Conservation in the Western States*. Department of the Interior, Office of Water Research and Technology, April 1981.
- Huffaker, R., N. Whittlesey, A. Michelsen, R. Taylor, and T. McGuckin. 1998. Evaluating the effectiveness of conservation water-pricing programs. *Journal of Agricultural and Resource Economics*. 23:1:12-19.
- Huffaker, R. and N. Whittlesey. 2000. The allocative efficiency and conservation potential of water laws encouraging investments in on-farm irrigation technology. *Agricultural Economics*. 24:1:47-60.
- . 2003. A theoretical analysis of economic incentive policies encouraging agricultural water conservation. *International Journal of Water Resources Development*. 19:1:37-53.
- Jenkins, M.W. and J.R. Lund. 2000. Integrating yield and shortage management under multiple

- uncertainties. *Journal of Water Resources Planning and Management-ASCE*. 126:5:288-297.
- Loaiciga, H.A. and S. Renehan. 1997. Municipal water use and water rates driven by severe drought: A case study. *Journal of the American Water Resources Association*. 33:6:1313-1326.
- Michelsen, A.M., J.T. McGuckin, and D. Stumpf. 1999. Nonprice water conservation programs as a demand management tool. *Journal of the American Water Resources Association*. 35:3:593-602.
- Michelsen, A.M., R.G. Taylor, R.G. Huffaker, and J.T. McGuckin. 1999. Emerging agricultural water conservation price incentives. *Journal of Agricultural and Resource Economics*. 24:1:222-238.
- Moore, M.R., and D.H. Negri. 1992. A Multicrop Production-Model of Irrigated Agriculture, Applied Policy of the Bureau-of-Reclamation. *Journal of Agricultural and Resource Economics*. 17:1:29-43.
- Mulwafu, W., C. Chipeta, G. Chavula, A. Ferguson, B.G. Nkhoma, and G. Chilima. 2003. Water demand management in Malawi: problems and prospects for its promotion. *Physics and Chemistry of the Earth*. 28:20-27:787-796.
- Pender, J.L. and J.M. Kerr. 1998. Determinants of farmers' indigenous soil and water conservation investments in semi-arid India. *Agricultural Economics*. 19:1-2:113-125.
- Peterson, J.M. and Y. Ding. 2005. Economic adjustments to groundwater depletion in the high plains: Do water-saving irrigation systems save water? *American Journal of Agricultural Economics*. 87: 1:147-159.
- Pratt, K.B. 1994. Water banking: A new tool for water management. *The Colorado Lane*. 23:3:595-597.
- Schaible, G.D. 1997. Water conservation policy analysis: An interregional, multi-output, primal-dual optimization approach. *American Journal of Agricultural Economics*. 79:1:163-177.
- Schuck, E. and G.P. Green. 2003. Conserving one water source at the expense of another: The role of surface water price in adoption of wells in a conjunctive use system. *International Journal of Water Resources Development*. 19:1:55-66.
- Sokolov, V.I. 1999. Integrated water resources management in the Republic of Uzbekistan. *Water International*. 24:2:104-115.
- Stonehouse, D.P. 1996. A targeted policy approach to inducing improved rates of conservation compliance in agriculture. *Canadian Journal of Agricultural Economics-Revue Canadienne D Economie Rurale*. 44:2:105-119.
- U.S. Department of Interior. 2003. *Water 2025: Preventing Crises and Conflict*. Washington, DC. Bureau of Reclamation.
- Winter-Nelson, A. and K. Amegbeto. 1998. Option values to conservation and agricultural price policy: Application to terrace construction in Kenya. *American Journal of Agricultural Economics*. 80:2:409-418.
- Yang, H., X.H. Zhang, and A.J.B. Zehnder. 2003. Water scarcity, pricing mechanism and institutional reform in northern China irrigated agriculture. *Agricultural Water Management*. 61:2:143-161.
- Zougmore, R., A. Mando, and L. Stroosnijder. 2004. Effect of soil and water conservation and nutrient management on the soil-plant water balance in semi-arid Burkina Faso. *Agricultural Water Management*. 65:2:103-120.

Endnotes

¹The authors gratefully acknowledge support for this research by the New Mexico Agricultural Experiment Station; Texas Agricultural Experiment Station; and Rio Grande Basin Initiative Project, U.S. Department of Agriculture, Agreement Numbers 2005-34461-15661 and 2005-45049-03209. An expanded version of this paper is to be published by the *Journal of the American Water Resources Association*.

²In 1900 the population of El Paso, Las Cruces and Ciudad Juárez was 44,000. By 1950 it had grown to 357,000 and in 2000 the population was over two million, almost a 50 fold increase over the century. The population is projected to nearly double again by 2020.

³Permanent transfers are even more attractive to municipal and industrial users, such as the city of El Paso; surface water treatment plants need a predictable and continuous water supply.

⁴This counterintuitive result occurs because of reduced return flows. For example, a producer who switches from flood to drip irrigation, applies the crop's needed water by diverting X acre-feet less from the stream. However, this change in technology, while appearing to save water from the adopter's view, may reduce return flows by X, producing zero net water savings to the basin.

⁵Some states refer to this as "salvaged" water, that is, water saved that takes no wet water from anybody else either currently or in the foreseeable future.

⁶Tied to this is uncertainty of groundwater adjudication. The question centers on whether or not water rights offers will be defined on combined rights to surface and groundwater use. For New Mexico producers, groundwater is an important source of water during drought, but it also is used widely in normal years.

⁷High evaporation, which causes considerable losses to water carried over, and limited reservoir storage space at Elephant Butte (stored water may displace future inflows to the reservoir) are two reasons why little carryover storage is seen.

⁸In the Rio Grande Basin above El Paso, Texas, water is managed to comply with the Rio Grande Compact. Colorado's water deliveries to New Mexico at the Colorado-New Mexico state line are a function of headwater flows produced by Colorado's snowpack runoff. All water not delivered to New Mexico is available for use by Colorado. Water that New Mexico delivers to Texas at Elephant Butte, measured at the gauging station below Elephant Butte, is a function of annual flows at the Otowi gauge above Santa Fe, excluding San Juan-Chama flows. So flows in New Mexico are delivered to the Elephant Butte gauge based on native flows at the Otowi gauge. In very wet years, when New Mexico does not have the capacity to use its full compact allocation, New Mexico may receive an annual credit of up to 200,000 acre-feet for its over delivery to Texas. In dry years, New Mexico may underdeliver to Texas by an amount not to exceed 150,000 acre-feet, and an annual debit is incurred in such cases. New Mexico, under the compact, may accrue total debits, offset by wet year credits, of up to a total of 200,000 acre-feet.

PANEL DISCUSSION

ECONOMIC DEVELOPMENT AND LAND USE: HOW DO WE CONTINUE TO GROW WHILE LIVING WITHIN OUR “WATER MEANS”?

Moderator

Bill Hume was born in Albuquerque and moved to Socorro prior to fourth grade in school. He graduated from Socorro High School, attended the University of New Mexico, with a three-year vacation from 1960-63 spent in the U.S. Army, mostly in southern Germany. Bill started with the Albuquerque Journal in November 1966. He graduated from UNM in the spring of 1967 with a degree in journalism and minors in German language and economics. At the Journal, Bill served as police reporter, general assignment reporter, science and military reporter, state editor, investigative reporter, editorial writer, and for the last 18 years of his tenure there, editorial page editor. On January 1, 2003, he joined the staff of Governor Bill Richardson as director of policy and strategic planning. Bill is married to Elizabeth G. Hume and has two children, a son age 26 and a daughter age 21.



Bill Hume
Director of Policy and Strategic Planning
Office of the Governor, State Capitol Building,
Suite 400, Santa Fe, NM 87501

Panel Discussion

Janet Jarratt is a native New Mexican living and working on the family farm where she grew up, finding her education in electrical engineering and computer science useful. She has become very involved in water issues, particularly along the agricultural/urban interface. Janet is currently vice-chair of the Middle Rio Grande ESA Collaborative Program, Executive Board member of the New Mexico Farm and Livestock Bureau, board member of the New Mexico Water Dialogue, board member of the Assessment Payers Association of the MRGCD, and past president of the MRG Water Assembly. She actively participated in state and regional water planning and is helping the process move toward implementation. Janet has been a guest lecturer at UNM as well as on a variety of panels around the state.



Janet Jarratt
MRGCD, Farmer, 2520 Los Lentos Rd SE,
Los Lunas, NM 87031

Tom Phillips is currently the Land Use Planner for the Las Cruces District Office (LCDO) of the Bureau of Land Management. He is the Team Leader for the Resource Management Plan Amendment and Revision for public lands in Sierra, Otero, and Doña Ana Counties (TriCounty RMPs). Tom graduated from NMSU with a B.S. degree in rangeland management and as an undergraduate worked for Dr. Karl Wood conducting runoff and erosion studies at Fort Stanton. He was a Rangeland Management Specialist for 15 years, before taking on the role of Land Use Planner and Team Leader for the Otero Mesa RMPA in 1999. Tom's current responsibilities for the TriCounty RMPs planning effort includes coordination and discussions with various cooperating agencies, interest groups/organizations, the general public, and BLM team members. It is important to gain their involvement and assistance in the development of appropriate public land use decisions that will guide the LCDO in managing public lands in Sierra, Otero, and Doña Ana Counties over the next 15-20 years.



Tom Phillips
Las Cruces District Office
U.S. Bureau of Land Management
1800 Marquess Street, Las Cruces, NM 88005

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

James Rivera is a tribal council member of the Pueblo of Pojoaque. Currently he is the Director of Community Development. James serves on several boards for the Pueblo, including Vice-President for the Pueblo of Pojoaque Enterprise Corporation, the Pueblo of Pojoaque Development Corporation, and the Boy’s and Girl’s Club. James also does community relations with the New Mexico Legislature. He is the Chairman of North Central Regional Transit System, which includes the cities of Española and Santa Fe, the counties of Santa Fe, Rio Arriba, Los Alamos, and five tribal governments in the tri-county area. James owns his own company, Cornerstone Government and Public Relations.



James Rivera
Pueblo of Pojoaque
78 City of Gold Road, Santa Fe, NM 87506

David Steinborn is the owner of the largest real estate company outside of the Albuquerque/Santa Fe area in New Mexico. He is also a partner in the largest subdivision outside of Albuquerque and Santa Fe. David has been honored as Las Cruces Citizen of the Year. He was a three-term mayor of Las Cruces, is past president of Hospice, past chair of the Mountain View Regional Medical Center, and current president of the New Mexico Real Estate Commission. David is the father of six, all of whom drink water as their drink of choice.



David Steinborn
Steinborn Inc., Realty
PO Box 936, Las Cruces, NM 88004

Panel Discussion

Karyn Stockdale works for *The Trust for Public Land (TPL)*, a national nonprofit organization that conserves land for people to enjoy as parks, playgrounds, community gardens, farms, historic places, and wilderness areas. As Project Manager, Karyn is responsible for all aspects of TPL-New Mexico's land conservation work including working with landowners, public agencies, and communities to preserve important lands and to assist with the strategic planning and development of conservation goals for the state of New Mexico. She also helps communities analyze their conservation financing options. Before joining TPL, Karyn worked for the University of New Mexico in recreational planning and as a wilderness guide. She holds a B.A. from the University of Texas at Austin and an M.A. from UNM. Karyn lives in Santa Fe with her husband, Justin Stockdale, and daughter, Keely.



Karyn Stockdale
Western Region-Santa Fe Office
The Trust for Public Land
418 Montezuma Avenue, Santa Fe, NM 87501

John Stomp, III was born and raised in Albuquerque and graduated with bachelors and masters degrees in civil engineering from UNM. John is the Water Resources Manager for the City working as an agent to the Albuquerque Bernalillo County Water Utility Authority. The Water Authority provides water and wastewater services to more than 475,000 residents in the metropolitan area. John's responsibilities as Water Resources Manager include water conservation, water resources, groundwater protection, and arsenic investigations. His primary responsibility is to implement the City Council adopted Water Resources Management Strategy to provide a safe and sustainable water supply for the City. The strategy includes transitioning from sole reliance on groundwater to renewable surface water supplies, namely the City's San Juan-Chama water. The project includes the construction of more than \$375 million in facilities consisting of a new surface diversion, water treatment plant, and distribution pipelines. He is also responsible for evaluating issues related to compliance with the new drinking water standard for arsenic. John has more than 17 years of experience dealing with water and wastewater issues in New Mexico and throughout the southwestern U.S.



John Stomp
Albuquerque Public Works Department
PO Box 1293
Albuquerque, NM 87103

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

Moderator Bill Hume

Good afternoon. My name is Bill Hume. I am in the office of Governor Bill Richardson, but before that I was with the Albuquerque Journal and have a long standing interest in water matters. In most things having to do with water I know enough not to come to a good conclusion, but at least enough to get myself in trouble.

Whoever thinks up provocative titles for WRR panels deserves a gold star for: “Economic Development and Land Use: How Do We Continue to Grow While Living within Our Water Means?”, which is of course the topic I am going to address today. That is the dilemma facing every municipal government from mighty Albuquerque to the tiniest mutual domestic water users association. But rest assured it is with absolute certainty that all will succeed. How can I say that? Government can ignore burgeoning populations of young families filling schools to bursting. Urban life and growth goes on. Government can ignore road building needs forcing citizens to crowd up on roadways carrying far beyond their capacity of traffic, but urban life and growth goes on. Government can shortchange needed public safety facilities leaving the community under-policed and the officers overworked, but urban life and growth goes on. But no government anywhere on God’s green earth can deliver one ounce more water than it has available. A government can refuse new connections; it can impose rationing; it can curtail large users, but it cannot create water. No government can accommodate growth beyond its ability to deliver water.

Back in the 1960s and ‘70s when I first became aware of these issues, the pace and location of urban growth was left largely to the developing community. Developers platted; municipalities and utilities extended service; customers bought; and the community prospered. Questions of water availability were pretty much left exclusively to the municipalities. Of course Albuquerque in those days was fat and sassy in the erroneous belief that it sat on top of an aquifer the size of Lake Superior. Water quantity questions in those days were a problem for less well-endowed communities.

It is not from selfish cynicism that the development community is reluctant to assume any responsibility for water availability. That was the way it was for a long time. And regardless of what government wrings out of the developers, the ultimate responsibility will remain with government. Why? Because the water needs of the neighborhood will remain long after the

developer has sold his last lot, built his last house, and moved on.

There’s been a seen change in perception of the requirements since those happy days in the ‘60s and ‘70s. Albuquerque ratepayers have absorbed a steady diet of annual rate increases to put together the money to do our San Juan–Chama Diversion Project. Santa Fe imposes ever stricter requirements on developers to bring water to the table or to finance water conservation retrofits to cover the water needs of new development there. Rio Rancho and the customers of New Mexico Utilities, that’s Paradise Hills and Ventana Ranch on Albuquerque’s west mesa, face onerous requirements to acquire water rights to offset ground water pumping.

There’s the village of Cloudcroft. Its tank ran almost completely dry last summer; they were hauling water up to the municipal tank in a tank truck and dumping it into the tank. They are on the highest drought restrictions that they could have, and they are currently involved in putting in a system where they will take the effluent from their wastewater system and place it back in the front end of the system again. That’s when you’re really short of water.

We are going to explore the ins-and-outs of whether and how our communities can continue to grow while living within our water means as considered from a rich variety of view points represented by our panel here today. Our views will be further supplemented by the variety of questions I am sure we will receive from you all. We will explore how land use planning can help position development where there is sufficient water to support it.

With me today is Karyn Stockdale with The Trust for Public Land. The Trust for Public Land is involved in many land and natural resource preservation projects around the state and the nation. One element that stretches our water means that I am familiar with is the water reuse and recycling technology being built in the Santa Fe Rail Yard.

Tom Phillips, Bureau of Land Management. BLM has come a long way from the days of being primarily the collector of fees from the users of federal lands to being a proactive land use planning agency.

John Stomp, City of Albuquerque. John has been intimately involved in the design and implementation of the Albuquerque Drinking Water Project and has hands on experience in how New Mexico’s largest city is coping with the dilemma of water and growth.

James Rivera, Governor of the Pueblo of Pojoaque. Pojoaque Pueblo has earned the attention of the outside world by converting some of its water resources to the development of golf courses and resorts that are used to cater to the outside world. At the same time, Pojoaque has some ambitious plans for the use of wastewater to stretch its scarce resources.

Janet Jarrett, Middle Rio Grande Conservancy District. While Janet is very much a water user of the Middle Rio Grande Conservancy District, I doubt the

...the reality of it is you can make water. The problem is you need an average relative humidity of about 7 percent to make it economical. In Albuquerque the average relative humidity is 5 percent. From an energy perspective that makes absolutely no sense...

John Stomp

Las Cruces in the late 1970s and early '80s and through his business as a residential developer, he knows the inner action of development and water from both sides of the equation.

So let's hear from each of our panelists following which we will entertain questions from you all. John do you want to start out?

John Stomp: Sure, I'll be glad to Bill. As I always do, I would like to thank the WRRI for the opportunity to be here today, and it is a privilege and an honor to be here and also on this distinguished panel. Of course being an engineer I looked at the question, and I said, "Let's answer the question: What are you going to do? How are you going to live within your water means?" So my presentation today, with no slides I might add, is going to focus on how to answer that question.

The first issue I think I am going to focus on is the kind of planning and technical issues related to answering this question of how we live within our water means. First and foremost, I think the state law

planning horizon for municipalities and water suppliers is too short. By state law we are required to have a 40-year plan and a 40-year planning horizon, and I think that is way too short. It is even inconsistent with the state engineer's policy that requires when they do their own subdivision review on a 70-year planning horizon and for some counties even a 100-year planning horizon. From my perspective, that is one part of state law that must be looked at and addressed in terms of how municipalities and water providers look beyond 40 years. Forty years is a short time frame with which to deal. I don't know if the answer is 70 years. I don't know if the answer is a 100 years or even beyond that, but still the planning horizon of 40 years is just way too short.

I believe from a technical standpoint that entities like WRRI, USGS, Bureau of Reclamation, all the federal entities, and all the state entities with respect to water planning are significantly under funded. It's really a sad sight to see. As our water challenges become more and more complex, and we face more and more protests, and legal challenges, we don't have the technical information necessary to help make decisions. For the City of Albuquerque and the Albuquerque-Bernalillo County water utility authority, we are making decisions in the future to look out in this planning horizon. You have to analyze and set up some sort of decision matrix.

In fact, from a water resources perspective, we are going to start looking at water resources much like municipalities and other entities look at managing their utilities, as asset management. We are going to put together a profile of your assets called your water resources and evaluate the cost, the benefit, the risk, the security issues, all the environmental issues, the legal issues, all those challenges in that portfolio of options. It will determine whether or not you are going to pursue a potential alternative for a new supply or even use the existing supply that you might have, because cost and environmental wise it may not make any sense. So I think asset management from a water resources perspective is something that is on the horizon for water managers and water users.

I can't tell you how many times we have been approached by somebody who has an alternative water supply from Amarillo or from someplace in Lubbock. Somebody came to Albuquerque about four years ago and said, "We can make water." Bill said, "You can't make water," but the reality of it is you can make water. The problem is you need an average relative humidity

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

of about 7 percent to make it economical. In Albuquerque the average relative humidity is 5 percent. From an energy perspective that makes absolutely no sense, but you can imagine the actual traction that got when somebody said to a city council or city policy maker, ‘Hey, we can make water.’ Yet from an economical or environmental perspective, it was just ludicrous. Yet we don’t have the tools and abilities to actually set the foundation for our policy makers to understand the impacts basin-wide or statewide. I’m advocating that for the planning agencies and the entities, we really need to seek additional funding.

When we talk about existing water resources, conservation obviously is your first defense when you talk about water resources. Frank was up here earlier talking about whether people should conserve. Well sometimes you get mandates to conserve. You say, “Well here’s the cost. Here’s the price.” You have mandates, and now the state engineer is actually placing conservation requirements in permits. For our new permit that the City received the 4830 for the drinking water project, there are actually two conservation mandates in there. The first one is that we have to reach 175 gallons per person per day before we can divert a single drop of native water, and we must reach a goal of 155 gallons per person per day within 20 years. So how do you make people conserve? How do you do those kinds of things? Sometimes you don’t have a choice as a municipality or water provider, because we are the ones out there actually transferring water rights. We are the ones actually in the process of trying to get new water or even use our existing supplies. We are being held to a higher standard. You could argue whether that’s right or wrong. But the fact is we are held to a higher standard. I believe obviously municipalities and water providers like the city aren’t necessarily the only ones that should conserve. Rather than start a fight on that, I’m just saying that conservation needs to be practiced by all segments in one way or another whether there is an economical incentive or not. We must find a way to conserve.

Reuse and recycling obviously is your next step. But even in reuse and recycling there is going to be a cost benefit in which some things work and some things don’t work. In Albuquerque we have the benefit of contaminated aquifers, which I’m sure nobody here has ever heard of. We have plumes of TCE sitting around different places in Albuquerque. Downtown for example, the Fruit Avenue plume, is a potential

source of reuse water, non-potable water that could be used to fill up the lakes at Tingley Beach or used for non-potable supplies at Caballo Park or whatever. The point is that when you do reuse and recycle, you must look at all available supplies. It’s not just reusing your effluent. Cloudcroft is really doing the reuse, the ‘toilet to tap’ concept, which by the way in California did not go over very well, and they are pretty proactive in water resource management. Toilet to tap didn’t work there, but maybe it will work in Cloudcroft, maybe it will not.

We all are trying to transition to renewable supplies because obviously we are on an unsustainable aquifer, and Bill talked a little bit about that. I would be fired if I didn’t bring up the San Juan–Chama Drinking Water Project. Just to give you an update on where we are on that project: the project is scheduled to come online. Even though we still have existing legal challenges that are ongoing, we are proceeding with the project. It is estimated to cost about \$375 million of which about \$300 million is already under construction right now. We are hoping to have the project online by 2008. But even in using our existing supplies, there is a perfect example of where we still have challenges. We have challenges that we must meet and people are still fighting us in court over the use of that water.

I see some opportunities for the future. By the way, Bill told me I had seven minutes. I’ve probably already gone way past that. I think one of our key issues is planning during wet years. We have spent a lot of time and effort in drought management, and we have to. Obviously we live in a place where there are droughts. But we also live in a place where sometimes we actually get water. And I think sometimes our water managers are so tired and so worn out from drought management because of all the pressures and stresses that are put on them during a drought, the first time we get an average year or wet year all they want to do is relax and be able to go home at 5 o’clock and not have to think about what the release rate is going to be next day or whatever. I think we sometimes lose focus on being able to save during those wet times, because it would be amazing to see how much you might be able to save during a wet period to offset a use during a dry time.

I presented an alternative called The Rio Grande Interstate Water Bank back in 2003 at the Law of Rio Grande Conference. Some people said, “You are insane John, you’re psycho,” and I am. But the reality of it is I still believe that the Rio Grande Compact is an

interstate tool for water banking with flexibility in its debits and the credits for trading water among Colorado, Texas, and New Mexico. I still think this might be years and years away. Like all good ideas, maybe this will never work, but the reality of it is we have to start thinking and trying to find a way to do it. This state has been very successful working with Texas and Colorado in the conservation water agreement where we are able to use credit water in Elephant Butte to take it upstream for other instream purposes. Why can't we take that one step further and find a way to trade water on that same sort of accounting methodology? I still think it is something worth looking at.

Desalinization is obviously something that is important and people have already talked about it. Other people at this conference will be speaking about it. We are even looking at it on the west side of Albuquerque. We are looking at using our methane gas from the Cerro Colorado landfill to generate power to utilize reverse osmosis to clean up the water. We are trying to balance all kinds of environmental considerations and use methane gas where it's possible to generate power and use that power to take the salt out of the water.

Concerning aquifer storage and recovery, we worked so hard back in 1999 to get legislation approved. Some people would say that given the history of water bills in the legislature in the last five years, just getting that bill approved was an accomplishment, but still to this day I don't think there has been a single aquifer and storage recovery permit approved by the state engineer. I'm not even sure one's actually been submitted. So here we are five, six years later and although this is going to be a tremendous management tool for all of us, we still haven't been able to take the next step. Now the New Mexico Environment Department is looking to establish a committee to evaluate the potential for using wastewater effluent for aquifer storage and recovery. That's another potential alternative water supply that could be used.

Water banking is an important concept that we have talked about before. I think that water banking doesn't necessarily have to be water. For the City of Albuquerque, we have some space up in Abiquiu and working with the Corps of Engineers, there is a possibility to actually leverage that space to create more water for the authority or for other purposes like conservation of water, and for example, for the minnow. Can Abiquiu become an asset of which you

can use and leverage space for water banking as opposed to the water itself? I think that is something worth looking at.

Regarding transbasin projects, I know the City of Santa Fe went out on a limb and suggested that they might actually try to get some water from the Estancia Basin. I don't know how you guys view that, but it was certainly very politically motivated. The media got a hold of it, and it was huge. Yet those are the kind of projects that we get approached with every single day. How do you figure out a way to make that work if you can even make that work at all? How do you find a way to increase your supplies without burdening other communities? I think that is going to be a tremendous opportunity for us and others. But they are going to have to come over and figure out what to do about the institutional, environmental, and all those other constraints. Wrapping up my talk, I would say asset management, evaluating and using your water resources, and looking at the entire picture is going to be the key for water resource management for water providers in the future. Thanks Bill.

Bill Hume: I should have said we'll go through everybody, and then we will open it up for questions and comments at the end of this. Karyn, why don't you go.

Karyn Stockdale: As Bill said, I work for The Trust for Public Land (TPL), a national non-profit land conservation organization. We were established in 1972. We have been working in New Mexico for about 25 years, although we just opened our state office in Santa Fe in 2001. Our mission is to conserve land for people to enjoy as parks, gardens, and other natural places ensuring livable communities for generations to come.

Across the country TPL is one of the leaders in land conservation. We have helped to conserve more than 2 million acres in the United States. In the past year alone we completed about 250 projects worth over 400 million dollars. We also work on conservation funding. We have helped communities raise 2.3 billion dollars in new funding.

TPL is also a leader in using land conservation to protect drinking water supplies. We protect municipal water supplies, rural acequia systems, mountain streams, and as Bill mentioned, we also work on innovative water harvesting in some of our parks for people projects like the Railyard Park and Plaza in

Santa Fe. Other examples around the country: in San Antonio, Texas they just opened the Government Canyon Natural Recreation Area. It is part of a greater effort to protect the Edwards aquifer and surrounding areas and to create greenways along sensitive creeks to protect about 16,000 acres of aquifer recharge land. In Cleveland, Ohio, we assisted the regional water district in acquiring a lake preserve at the headwaters of the Chagrin River to protect water quality. We have worked on demonstration sites in conjunction with the EPA in looking at source water protection activities that result in cleaner water. We have also looked at some GIS/computer mapping systems working with the University of Massachusetts in ranking priority lands in order to have that source water protection. I did put a couple of booklets out front, and I didn't bring nearly enough, but hopefully a couple of you that were interested picked those up. You can always order them on our web page if that is something that is more interesting.

But specifically in New Mexico TPL has been working on several projects that protect water resources in connection with land conservation. Along the Rio Grande we focus quite a bit on the federally designated wild and scenic stretch of the Rio Grande up by the Colorado border and south towards Pilar. We protected about 2,600 acres just south of Taos called the Taos Valley Overlook and over 14,000 acres of Ute Mountain on the Colorado border. We also work on projects that prohibit the conversion of lands to subdivision development by purchasing conservation easements. And just in the last month we completed two different projects using federal Farm and Ranchland Protection money as well as local funding sources in both the village of Corrales and in the town of Mesilla just outside of Las Cruces. In Mesilla, our efforts to protect the Harris farm have added benefits to the adjacent Mesilla Valley Bosque State Park including securing that scenic entrance, providing educational opportunities about the historic uses of the Mesilla Valley, and protecting additional wildlife habitat.

We have also worked to bring a federal program called Forest Legacy to New Mexico that provides funding for the purchase of conservation easements and in some cases outright acquisition to ensure that private landowners continue to use their land, conserve their forests, and protect their water resources. The State's first Forest Legacy success was this summer, and we helped them work on the Vallecitos Mountain Refuge up in Rio Arriba County. It is bordered on all

sides by the Carson National Forest. It had an old growth Ponderosa Pine forest with some mixed conifer, numerous ponds, and flowing water with the Vallecitos River and Rock Creek and that helps protect some of the downstream acequias by preventing any kind of future water diversions and keeping that live water in those systems. And then one other example in Santa Fe is along the Santa Fe River, which most folks don't recognize as a river.

It's more of an arroyo, because it is without water most of the year, and it is pretty heavily eroded. We have been collaborating with public agencies and citizens groups to protect, restore, and create some recreational opportunities along that corridor. We have mainly focused on the village of Agua Fria which is just west of the City of Santa Fe or surrounded by the City of Santa Fe, in working with Santa Fe County and acquiring land and easements to create these pocket parks and trails. These kinds of acquisitions even though they are for land conservation they allow restoration projects to stabilize the banks, restore native plants, assist in efforts to slow down the water in storm events to continue to hopefully reduce erosion and recharge the aquifer.

So despite all these examples what in the heck does land conservation have to do with our water resources? Professor Hall noted earlier today that water and land are linked and you can't separate the two. The quality of the water that we drink and the health of our ecosystems are directly linked to the health of our land. Across the country and we have been talking about here in New Mexico, population growth and development threaten our natural lands to protect our regional and local water supplies. The fastest growing threat to our water quality is pollution from non-point sources related to development, urban runoff from roads and parking lots and houses and big subdivisions. Also the development increases storm water runoff and erosion, whereas undeveloped land serves as a natural water filter and buffers our water

The fastest growing threat to our water quality is pollution from non-point sources related to development, urban runoff from roads and parking lots and houses and big subdivisions.

Karyn Stockdale

supplies. So my work with TPL emphasizes the permanent protection of land around both the ground water sources and the surface water sources. It's a means for watershed protection. And watersheds by definition are that interaction between the land and the water drainage of that river basin. Land conservation can create groundwater recharge areas that can actually increase water quantity, and in general source protection including this land conservation is much less costly than cleanup.

The impact of development and the loss of forest land and water quality happens over time but as some water suppliers can note the increase in capital investment on our water treatment facilities and the new treatment technology can be very expensive and these upgrades of treatment systems can cost anywhere from, we have seen statistics here in the Southwest of 5 million up to 35 million dollars or more, and municipalities are having to invest in these systems. One of our studies showed for every 4 percent increase in raw water turbidity, water treatment costs increase 1 percent. So that increased turbidity, which is the presence of sediments and algae and other microorganisms in the water, is a direct result of increased development whether residential or commercial and erosion and contaminants in that watershed. And then when water quality causes an unusual taste or maybe even an illness in the community the public quickly loses confidence in the safety of its supply. Businesses or individuals may even choose not to live in a certain area, and I'm not going to let the word out too much about Cloudcroft because they might perceive it has a poor water quality. Protected land provides clean water sources and will only require minimal treatment and serves as a natural filter for contaminants that might get into the water supply, and it's considered one of the key approaches in providing safe drinking water by water suppliers and municipalities.

Protecting land for water also has other benefits. I know we were thinking about economic benefits primarily. So that alternative to costly cleanup could enhance surrounding property values. It also has the recharge opportunities and can prevent or control erosion and floods. But it can also have the added benefits of improving air quality, sometimes providing recreational opportunities, maintaining scenic views, or protecting historical, environmental, or cultural resources. I'm looking forward to maybe a lively debate. Thank you for allowing me to be on this panel.

Hume: Thank you Karyn. Tom?

Tom Phillips: Bill, this panel discussion has an intriguing title to me, how do we continue to grow while living within our water means? I think the answer lies in constant communication among all interested parties. As I think about that I'd like to explain what BLM's role in this is. I see the BLM as having a variety of roles. Three come to the top of the list for me. They are: facilitator, consultant, and mediator. I'll explain those a little bit.

As a facilitator, BLM's role is tied to our land use planning process which follows the mandates of both the National Environmental Policy Act and the Federal Land Policy and Management Act. NEPA was enacted to establish a national policy for the environment that encourages productive and enjoyable harmony between man and his environment. FLPMA requires the BLM, with public involvement, to develop, maintain, and when appropriate, revise land use plans which provide for the use of those lands. FLPMA also states that a track of public land may be sold, where as a result of the land use plan the BLM determines that disposal of such a tract will serve important public objectives, including expansion of communities and economic development so long as that outweighs other public objectives and values such as recreation and scenic values. BLM incorporates the policies of NEPA and FLPMA in its land use planning process, and in the Las Cruces area, we are currently doing just that.

Earlier this year we started the revision to the White Sands Resource Management Plan which covers public lands in Sierra and Otero Counties and the amendment to the Mimbres Resource Management Plan which covers lands in Doña Ana County. This started with a public scoping phase where BLM identifies the areas we are developing the plan for and the anticipated issues or concerns that we felt needed to be addressed. We recognize the area around Las Cruces has seen tremendous growth, and we knew that our decisions in Mimbres RMP were likely outdated as far as addressing this growth. During the public scoping we heard very clearly that the public was interested in how we may consider subjects, such as what lands would be made available for sale and what lands would be retained in federal ownership. I believe that this is a reflection of how people want to see growth managed.

As a facilitator BLM will use the planning process to bring special interest groups, local and state agencies,

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

and the general public together to look at the current situation of land ownership patterns and land uses. Through this dialogue we will openly discuss opportunities and options for adjusting those current decisions in ways that will address the needs and desires of all involved. Very clearly this is a huge task and in the end not everyone will get everything they wanted. But our primary purpose is to involve all interests in the process and allow that involvement to help formulate appropriate decisions to direct decisions and management of public lands over the next 10 to 20 years.

Now for the consultant role. The BLM’s recently revised planning handbook describes a number of program areas that must be addressed in the plan with decisions that address desired outcomes and allowable uses and also actions to achieve those outcomes. These eventually impact how communities adjacent to public lands grow. The decisions that must be addressed include managing for watershed health; identifying measures to meet local, state, and tribal water quality requirements; ensuring water availability for multiple use and functioning healthy riparian and upland systems; identifying special recreation areas; delineating travel management areas; and also identifying lands for retention, disposal, or acquisition. This list obviously does not include all of the land use plan requirements, but should give you a flavor for the real challenge facing us as we proceed with the revision and amendment of these two plans. Within BLM we have a team of resource specialists that participate in the planning process, and they serve a role as a consultant in the various resources and uses that they represent.

Finally regarding the BLM’s mediator role. Over a year ago when the Las Cruces District was looking at how we would initiate and develop our land use plans, we envisioned a very involved public, and we anticipated the desire of local and state agencies and governments to participate. We were certainly not disappointed, as we have had extensive input from the public regarding their desires, and we have also had numerous discussions with state and local agencies and governments regarding issues they would like to have addressed. BLM has recently issued guidance on collaborative planning that recognizes that individuals, communities, and governments working together toward commonly understood objectives yields a significant improvement in the stewardship of public lands. Also we have invited many state and local entities to participate with us as cooperating agencies,

and to date we have agreements with Sierra and Doña Ana Counties, the City of Las Cruces, and New Mexico Department of Agriculture. This grants those entities a special level of involvement that we believe will help them clearly offer guidance on how they would like the BLM to manage public land in order to help them deal with their issues.

Although BLM is a participant in the process we recognize our mediator role of bringing parties together to assist us in the development of appropriate decisions for the management of public lands. Even though BLM does not make decisions directly towards where and how our communities grow, our decisions can affect that. Without input from local entities and the public, we could make inappropriate decisions regarding what lands will be available for that growth.

As a facilitator BLM will use the planning process to bring special interest groups, local and state agencies, and the general public together to look at the current situation of land ownership patterns and land uses.

Tom Phillips

Through BLM’s various roles, including facilitator, consultant, and mediator we can improve the outcome of our land use planning. This will ensure that our management direction will work in concert with the local desires for community growth. I have been working in the Las Cruces District for over 20 years, and in that time I’ve had the chance to meet and work with individuals, special interest groups, and with government entities who have specific requirements. One thing I have learned is that listening is usually more important than talking. And anything I can do to help bring people together and help them voice their concerns is one of the most important actions I can take. With that I would like to quit talking and continue listening.

David Steinborn: Good afternoon. How many people in this room are elected policy makers? Please raise your hands. Four of you. How many run public parks? None of you. How many of you run public or private golf courses? One. [One of the panel members, James Rivera, Pueblo of Pojoaque raises his hand.] How many developers are there in the room? Two. [Both panel

members James Rivera and David Steinborn raise their hands]. We may be talking to the wrong publics. And I say that seriously, because during the time I was Mayor of Las Cruces we had occasion to have a day that was called the Las Cruces Day at Santa Fe. We invited all of the elected officials in Santa Fe. Many cabinet people came.

I think public policy needs to be proactive. I think you need to have 100 year water plans and not 40. I think you need a plan for the future...

David Steinborn

One of the things I said six years running, was the State of New Mexico does not have a growth policy. That was 1981 through 1987. Las Cruces isn't any different now than it was then except for being bigger. New Mexico still doesn't have an urban policy. I would suggest to you that the policy that it doesn't have also is the same policy it doesn't have dealing with water.

There is no real incentive to conserve.

As a matter of fact, I was Mayor of Las Cruces during the time that El Paso was trying to get water out of New Mexico, and I became familiar with the Nebraska-Vorhees case, and I learned all the language that you all in the water business use. I found it very interesting that as a matter of public policy the decision we made is that the more water during that period of time we used, the more we insulated ourselves in the event that later on we were told that we had to go to a historic place and that was what we were going to get. I'm getting enough head shaking; I think you all understand exactly what I am saying.

So now we've got this issue in 1985 of the conversion rate from farm land to urban—it took 9/10 of an acre-foot in 1985 in Las Cruces to supply water to one acre that was urbanized. If you took a piece of land out of the valley and took away its water, in other words, they sold or gave away or turned over to the city the water rights, the city used those water rights for urbanization. For every acre you converted in the valley you could grow houses on that acre or you could grow houses on two acres of the mesa.

After I left office, I had four years of no public policy work and then I got to chair the State Environment Board, which was very interesting. I found, for example, the area in downtown Albuquerque that is contaminated originally had a dry cleaners on it.

When Sunwest Bank sold to Bank of America, Bank of America asked for an environmental impact statement. When that was done, it was discovered that they had the problem. I would suggest to you that up and down the valleys of this state there is a lot of contamination nobody knows about yet, because those farms have never sold, and the farmers have for years changed their oil and dumped the stuff into our earth. We've gotten smarter, but the reality is we have dumped a lot of bad stuff into our earth.

Now as a policy maker I understand those things, and I understand that what we really need to do is to get the stakeholders together. Our friend from BLM is exactly right; the stakeholders need to sit down over a period of a long time, maybe two or three years and really talk about where we are. We have a finite amount of water. We don't know if we are mining water in Doña Ana County today. We would like to think we are not. But we don't know until we go through the adjudication process and somebody comes up with a model that everybody salutes at. I don't think we really know the answer to the question.

I can tell you that five years ago as one of the three developers of Sonoma Ranch Golf Course, we spent \$1.5 million extra developing our water system so that we could be good shepherds of water. Our water doesn't go on when the wind is blowing; we have meters everywhere, our water doesn't go on in zones that don't need the water. We have meters all through the golf course that are electronic on our GPS system; so our man in charge on our irrigation system actually drives around and turns on and off systems to make sure the only areas that get water get it when they need it. But the reality is, it's still water isn't it? And no matter how much you conserve someone else thinks that your ox could be gored because your ox is different than theirs.

Let me give you something different to think about. My in-laws are in the agriculture business. How many of you own farms that you make a living off of that's your livelihood? Not many of you, we've got a few people but not very many. Isn't it interesting we have major stakeholders here at the table with us? In our valley it takes 5-6 acre-feet to really run an alfalfa field. The real question is: Where does the alfalfa go? We all know where it goes. It goes to cows and horses. I am not a vegetarian; I am a carnivore. Two of my adult kids are not only vegetarian, but they eat raw food, nothing cooked over 120 degrees. They don't eat any meat. So from their point of view alfalfa is

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

what a golf course is to someone else. They don't ride horses; they don't eat cows, so they don't understand why we would use 5 acre-feet of water to grow alfalfa when you can convert that into 6 ½ acres of houses, which converts to 30 families. When you start looking at water in terms of the economics of water, everybody sits around the table understanding everybody wants a piece of the action.

I saw something on the news this morning that maybe all of you saw. Gas production right now is at the lowest it has been since 1941. We know we have a lot more people since 1941. We have a lot more vehicles. SUVs' are today's target for people that think that people shouldn't drive cars. SUVs mileage is not a whole lot better than cars in 1939-47. Oddly enough we have a comparison. If you are looking at somebody that made \$5,000 a year, that was making a living in 1950. Here it is 55 years later, and the question is in New Mexico if they were making \$55,000 a year as a family, how would they be doing? If you convert that to housing, that is about \$190,000. That's what that buys about \$190,000 worth of house. Look at Albuquerque, Santa Fe, and Taos, you can't buy a house for that amount. If you do, it is way on the bottom end, and you are lucky to be able to find one. If you start multiplying and looking at the value economically of water and what that buys, convert that to gasoline, or interest rates, or housing costs, or car costs. A 1957 Chevy was \$1,800; today can you get a brand new car for \$18,000? Yes. In 1957 if you were making \$5,700 a year, you were making a living, so today if you make \$57,000 a year, are you making a living?

In the 1980s in Las Cruces when I was in office we created an inverted block rate. We said if people keep using water, the next 10,000 gallons of water they use is going to cost more than the last 10,000. We figured out about how many gallons a family needed that we called a life-gallon-per-month number. We said you go beyond that, you pay more per 10,000 than you did on previous ones. The other thing we did then in 1985 is we actually created a public policy that said that if somebody wanted to annex land into the city of Las Cruces, they either had to bring money to pay for water rights, or they had to bring water rights. The City Council got rid of that unfortunately about 8 years ago. I think it is a good public policy. If we are going to have growth in New Mexico, the people that are enjoying the growth ought to help pay for it. Having said that, I have a few more things I want to say.

I am trying to be provocative. I am hoping that this will tweak some of you to ask questions. I think the development business is a reactive business. If there's no activity, there's no development. If there aren't people knocking on the door wanting to come to your town, there is no reason to do development. If you can't get the financing, can't get the builders, you can't sell the lots, there's no development. Conversely, I think public policy needs to be proactive. I think you need to have 100 year water plans and not 40. I think you need a plan for the future instead of just planting rice that's good for a year. The Chinese were smart. They said if you plan for a year, plant rice, if you plan for 20, plant trees; if you plan for 100, educate people. I don't think we are educating people. We are educating each other, but the reality is I doubt that we will leave here and come up with a concise 3-page executive summary and try to get face time with elected officials. Do not send it to them in the mail. But get face time with them, go over the executive summary, and ask what they are going to do about it.

But I think you also need to get a consortium of people who are sitting there with face time, and they just can't be people that are labeled as 'concerned about the environment,' 'concerned about water.' It has to be all of the stakeholders. It has to be a big broad list. It has to include the developer community, the realtor community, the builder community, because every one of them has a stake in the process.

The last thing I would like to cover is this. In 1972, I was State President of the Realtors Association of New Mexico, and I attended a meeting in Santa Fe of 25 different presidents of large and broadly membered organizations in the state. The meeting was sponsored by the Director of Tourism for the state. He asked this question, he said, "In your views, (there were 12 of us at the table) what is the single biggest thing that we could do to change New Mexico to cause more people to come here?" Now I know that some of you don't want any more people to come here. I know that. But I grew up in Tucson, and Arizona is not a whole lot different than New Mexico. And the question that begged an answer was – it's a marketing question isn't it? – what would you do here to cause people to come here? And everybody went around the table. One person said "Well, we need to have a right-to-work state." Somebody else said we need to have a big zoo, or whatever, but I said we needed to change the name of the state. I believe that. I am now 33 years older, but I would still say exactly the same thing. When I

travel around the United States talking about Sonoma Ranch subdivision or the City of Las Cruces or anything else, and I tell them I'm from New Mexico they start talking slowly, because their immediate assumption is that I'm translating as they're talking.

Janet Jarratt: I did bring a PowerPoint. I like to know who I'm talking to, and the best way to let people know who they are listening to if I'm talking is in pictures. I am part of the three generations that live on a family farm south of Los Lunas. This is where my mindset comes from. I don't know if anyone else in the room raised their hand when he asked who is making a living in agriculture, but I did. So I feel kind of in the minority. I too found the questions here fairly provocative.

What I hear a lot not just here but everywhere is about water markets, and economics, and how to expedite transfers, and reallocation to produce economic development. And it's always about reallocating from agriculture. So when I saw the title of this; 'economic development and land use' the first thing I thought of was that we need to define economic development and not just make assumptions about what economic development means.

In response to what was said earlier today, I want to point out that all of our fields whether we lease them or own them are all laser-leveled. Most have concrete ditches and the reason is because time is money. The higher level of production you get off of an even distribution of water across the field is also an economic benefit. So it isn't necessarily about governmental mandates or tax incentives or any of that other kind of business. Don't get me wrong, that'd be great. But it is because time is money and this is a business. If we have a proper head of water we have 137 acres that are together that we lease that are laser-leveled and have a dirt ditch, and if we have a proper head of water we can irrigate it in less than 36 hours. That's pretty efficient. It doesn't have anything to do with the cost of water. I just wanted to mention that.

I want to show some information that was generated here at New Mexico State University (Table 1). What I find most interesting is the fact that the full economic value of agriculture is not represented as output value. That means to me that there is a significant opportunity to increase economic development within this current resource use. You don't have to necessarily reallocate that water to enhance the economic development of that resource. We don't have to be doing all the value added services out of state. We can

do it here; we can employ our own people and keep it within our use sector. These numbers don't reflect the fact that Petsmart in Albuquerque has about one-third of the store devoted to equine. but that goes down as retail sales, not agricultural sales. There are many spin-off businesses that are not part of the state's economic development that don't ever go to the proper sector, which would be agriculture.

Table 1.

<ul style="list-style-type: none"> •Considering the forward linkage industries, the value increases to \$4.74 billion. •Currently, raw product is grown in NM, then shipped out of state for value added processing, then shipped back for consumption. •Agriculture is a raw material industry. Agriculture is not the final product that is purchased directly by the consumer and therefore the full value is not represented in its output value. All other industries in the top 15 (other than oil and gas) are final product businesses that sell directly to the consumer. •The farmer's share of grocery store price averages 22%. •Value of agriculture is \$3.24 billion <p><i>From "Total Economic Value of Agriculture in New Mexico" by Nick Ashcroft, NMSU</i></p>
--

Another interesting thing is the cost of community services. Figure 1 was put together based on over 102 studies nationwide that demonstrates that agricultural land has a similar return value on your tax-basis as other commercial and industrial uses have. In other words, the cost of community services is extremely low for the amount of money that you get back, and I think this flies in the face of conventional wisdom that agricultural land is not taxed high enough, that it's kind of a "loser" for a county for instance for doing a tax-basis. That doesn't actually work out to be true, because when you look at the cost of services, agricultural lands are supporting those residential uses as well.

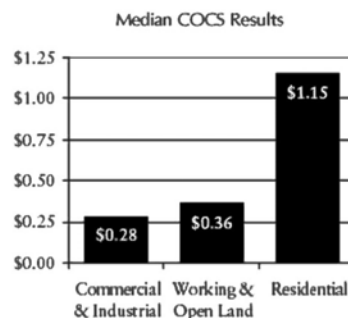


Figure 1. Median cost per dollar of revenue raised to provide public services to different land uses. *from Farmland Information Center, Aug. 2004*

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

Figures 2 through 7 are photos taken on our family farm.



Figure 2. Winter wheat harvest in late spring



Figure 5. Snow geese and Canada geese during the winter



Figure 3. Snow geese and Canada geese during the winter



Figure 6. The last whooping crane in New Mexico



Figure 4. The fall season



Figure 7. Snow geese and Canada geese during the winter

Panel Discussion

Let's look at what changing land use has looked like historically in the valley. Figures 8-11 depict the Albuquerque area in 1935, 1951, 1973, 1991. These slides do not include Mesa del Sol, which is 20 square

miles that was subsequently added to the south of the illustrated boundaries. This is what happens when you shift those uses.

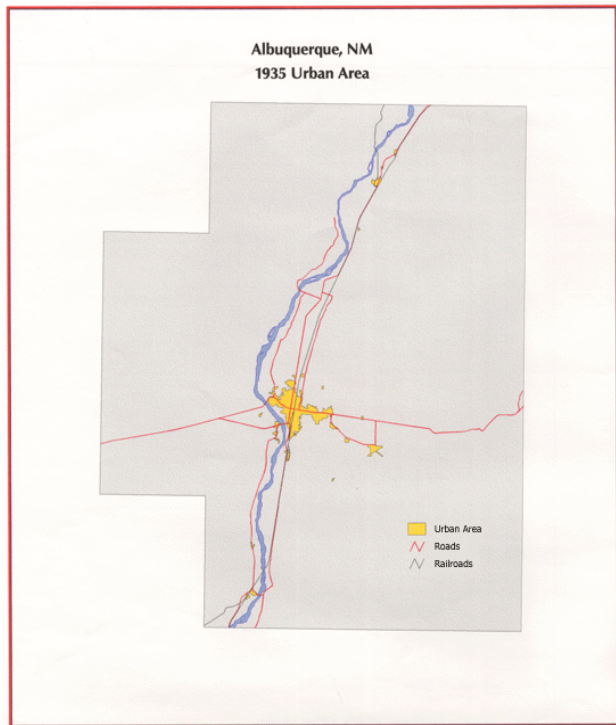


Figure 8. Albuquerque, NM urban area in 1935

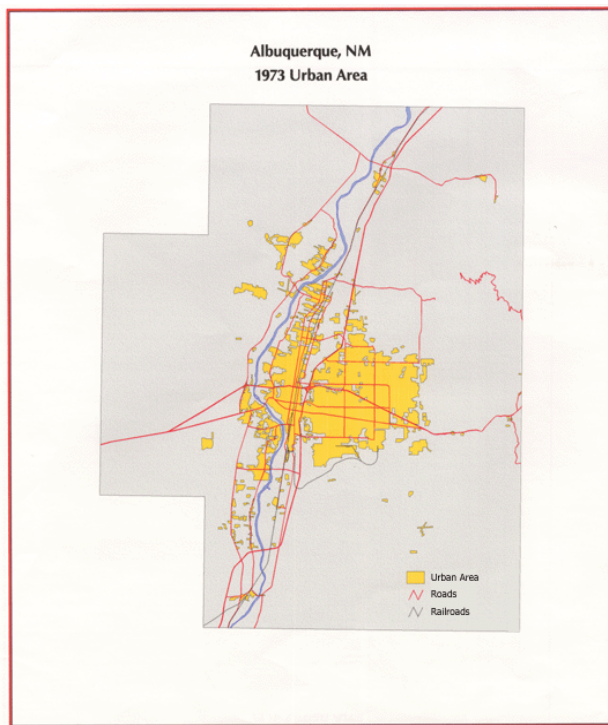


Figure 10. Albuquerque, NM urban area in 1973

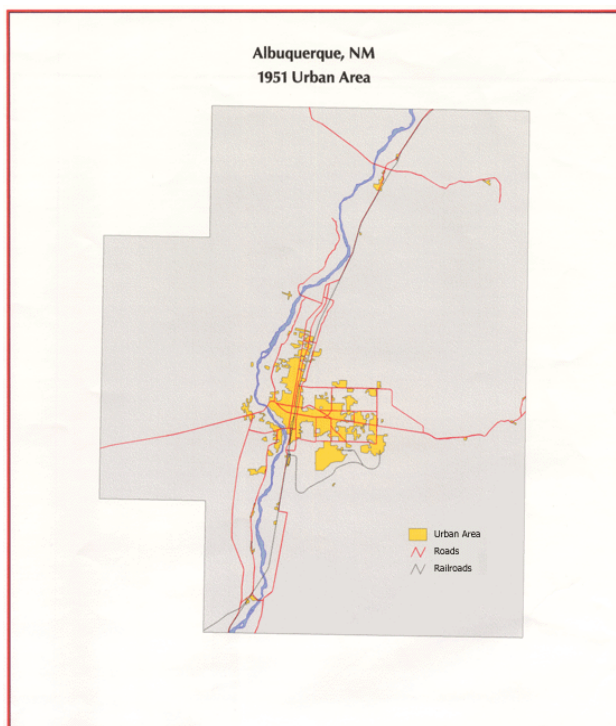


Figure 9. Albuquerque, NM urban area in 1951

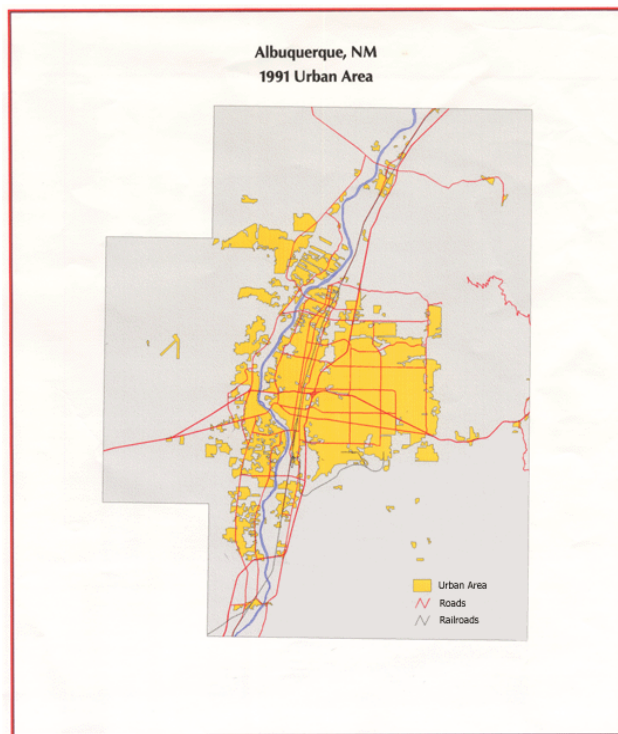


Figure 11. Albuquerque, NM urban area in 1991

Economic Development and Land Use:
How Do We Continue to Grow While Living within Our “Water Means”?

Figure 12 comes from a study that came out a couple of years ago showing the flow of groundwater is no longer toward the river, but is away from the river toward the pumping centers. To me that is pretty darn scary, because you are not recharging the aquifer anymore. In fact, the Papadopolous study that was funded with the interstate stream commission shows that in the Middle Rio Grande Basin, there is a 70-110,000 acre-foot a year depletion to the aquifer, every year. It is cumulative, so this is what happens when you continue to change land uses and you don't have that recharge.

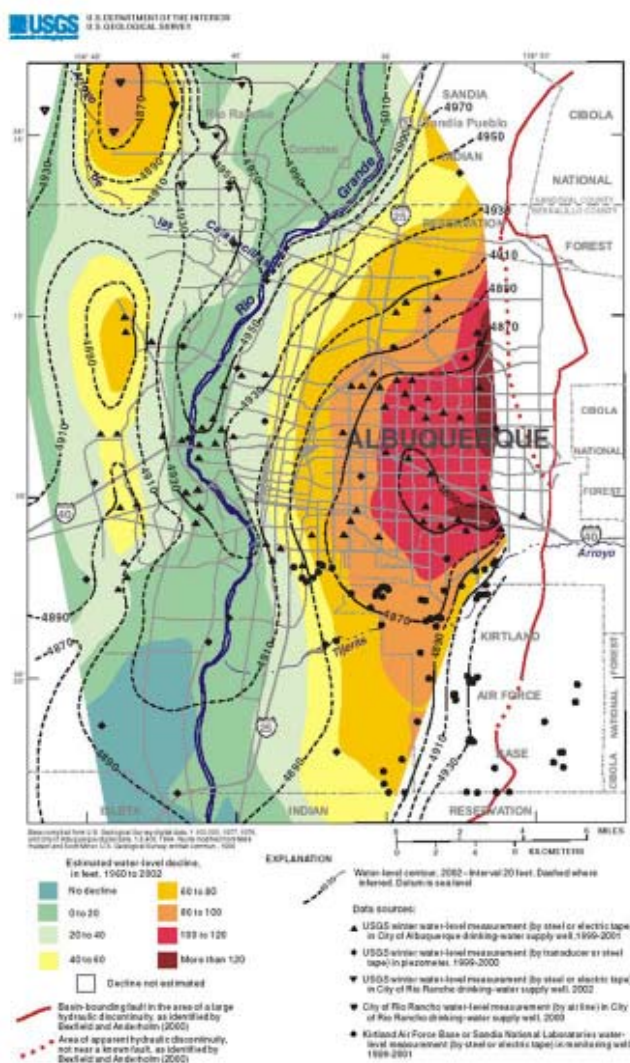


Figure 12. Implications for groundwater flow and response of the aquifer system to pumping stress; USGS report 02-4233

Figure 13 is a map of the Belen Quadrangle. There is an area between Los Lunas and Belen that is platted. It's an antiquated subdivision, but they are in the process of developing it. They have several hundred homes out there. They are extending the water lines, and moving on it, so it's looking like it might go forward after all. It is platted with over 100,000 lots. Well what does that mean on a localized basis? The bottom line of what that means is that about 40 percent of the privately held agricultural land in the Middle Rio Grande Basin would have to be retired to support this one subdivision. What that doesn't tell you is that there are several more in Valencia County, one 2,200 acres, another 6,000 acres. This doesn't include the other developments in the basin in Sandoval County around Rio Rancho, City of Albuquerque and the west mesa, all of which are going to require retirement of water rights.



Figure 13. Belen Quadrangle

I found out something particularly interesting in June of 2005 at the Middle Rio Grande Water Assembly annual meeting where their topic was water allocation. Former State Engineer, Tom Turner spoke. One of the topics he spoke about was dedications. One of the funny things he said was that he didn't know they existed until about a year before he was State Engineer. To quote him in defining dedications, "basically you have got to pump water out of storage and only acquire the water right when the flows in the river began to diminish." Later he said, "I tried to get a handle on the extent of these dedications, and we came up with two or three different values. I can tell you that the number is so large it is probably going to require the majority of agriculture in the middle valley to change its purpose of use." That's on dedications. That has very little to do with these developments that I'm talking about except to the extent that they relied on dedications to get their permits. Table 2 shows the trend for developed land and irrigating cropland in New Mexico between 1982 and 1997. We have a shift. It is not necessarily happening in the same place, but overall we're having a shift.

Table 2. Developed Land and Irrigated Cropland in New Mexico, 1982 and 1997.

NRCS 1997 New Mexico Data Tables (in thousands of acres)		
	Developed Land	Irrigated Cultivated Cropland
1982	781.0	998.0
1997	1152.7	635.6
48% increase in developed land 36% decrease in irrigated cultivated cropland		

So we hear a lot about how much water agriculture uses. Of course we spent the capital investment to make it viable to where we are and own the water rights, and I think that has a lot of validity. But nevertheless, you hear a lot – "if agriculture would only reduce their use by some small percentage, we would have plenty to grow." If you look at where the irrigated agriculture is in this state and where the growth areas are, how does that break down in a localized decision? In your community what does the reallocation really mean for the percentage of agricultural land you are going to lose in your community? I think that it's a mistake to generalize broadly across a wide area rather than really looking

at localized decisions and observations about the impacts to your area.

I think we have to talk about what it really costs when you start reallocating. What you've lost is the economic development that is already in place and is prepared to grow without a whole lot of investment and without reallocating water resources by having the value-added process done to the agricultural products in our state rather than shipping them out. So we have the loss of the agricultural economy. We have a loss of food security, which I think is going to get even more important as time goes on. Right now there is the avian flu. There are a lot of issues about food security that I think we are going to

We have a loss of habitat for a lot of really cool stuff, like the last whooping crane. She's gone now, but she stopped on our farm every single year, and so did the rest of them that came through until she was finally the last one. What is that worth as a value and a place to live?

Janet Jarratt

come to grips with it, and it is going to be scary. We must prepare to become somewhat self-sufficient and not assume that we are always going to be able to buy our food from Chile or somewhere else. Otherwise, I think we are going to find ourselves with a lot of problems down the road.

We also have a loss of aquifer recharge. We have a loss of habitat for a lot of really cool stuff, like the last whooping crane. She's gone now, but she stopped on our farm every single year, and so did the rest of them that came through until she was finally the last one. What is that worth as a value and a place to live? What is that worth to people to have that maintained? That's an unaccounted for value of agriculture that never shows up in any of the economic analyses. The other thing that never shows up in any of the economic analyses is the environmental gains that you reap from agriculture. For example, nitrate removal. Alfalfa is really great at this, because it not only removes a lot of nitrogen because it has a very high protein content, but it is a really lazy plant, so it will take the nitrogen out of the soil if its there or out of the groundwater because it has the roots to penetrate to the shallow aquifer. It

will clean up the nitrates. So you are talking about septic tanks, you are talking about a lot of those issues.

In Canada, they are using alfalfa in 29 locations to apply wastewater treatment effluent in order to get the nitrogen uptake. They have developed alfalfas that do no fixation of nitrogen out of the air to do brownfield cleanup in some of the military ammunition dump sites to clean up the nitrates there. When the alfalfa turns yellow, it's a clean site, and it is happening within maybe three years. Much cheaper, way better deal.

Certainly in the middle valley where we have a lot of alfalfa, we are getting a lot of benefit from it. We don't have a lot of Clean Water Act issues with the

We figure by the year 2040, we plan to serve about 18,000 people. The new appropriations are going to ensure we supply quality water resources and provide for the health and wealth of the Pojoaque valley.

James Rivera

there are a lot of alfalfa fields along the river intercepting that groundwater flow and cleaning it up?

The other thing we are not thinking about that we could lose in these things is the carbon sequestration potential. Greenhouse gases are a big deal. Globally there are reports where they are looking at going to methodologies, which I guess we consider in my family as being just normal stuff, which is to till manure into the soil. That puts biomass back into the soils that enhances its ability to sequester carbon in the soil. And you plant legumes like alfalfa, because it also has a lot of plant mass to take off and you have some of the carbon sequestered there. They are looking globally at having those kind of practices done in order to alleviate some of the greenhouse gas emissions long enough to catch up the emissions end of it. In Oklahoma, the state legislature passed legislation to pay farmers for carbon sequestration techniques. I really think when you have urban centers like Albuquerque where you already have air quality issues, you are looking at environmental issues. I think the day will come when farmers are going to be paid to farm for the environmental gains that you get out of agriculture.

I guess for me what this really boils down to is that my dad is the best farmer in the world. It's not what he started to do, but he ended up doing it, and he's great at it. He always taught us stewardship of the land and the water together. One is worth nothing without the other. And I think that's the thing we really need to be looking at as a society. You can't make quick fixes like quickly reallocating water from here to there without some consequences. What are the long-term economic costs of having to undo a short-term solution that turned out to be a long-term problem?

And with that, thank you very much.

James Rivera: I would like to tell you about a project that we started back in the late 1980s to do with a regional wastewater project in the Española-Pojoaque Valley area. There was a study done, and the book was about 2 inches thick. There was a committee set up. The committee pretty much just went away. There were several, different committees that helped in this project. Our late Governor Jacob Viarrial was one of the leaders that took the first initiative to bring these points together nationally, and he really pushed for environmental issues.

Going back to the project, I want to steal from the gentleman from Albuquerque about trying to alleviate problems by going to 'toilet-to-the-tap' projects. We have started getting funding for a wastewater treatment facility in the Pojoaque area. The treatment facility will cost about \$10.4 million. Right now we have somewhere in the neighborhood of 20 percent of that. The growth in New Mexico was mentioned earlier, and with the Pojoaque wastewater facility that we have right now, we need to service about 3,500 people a day, which includes our businesses and our housing areas. We figure by the year 2040, we plan to serve about 18,000 people. The new appropriations are going to ensure we supply quality water resources and provide for the health and wealth of the Pojoaque valley. We will have the capacity to expand to serve other growing populations in the area, which would include possibly Tesuque Village, the city of Española, and the towns of Santa Cruz and Chimayo. The pueblo has been working with the local governments of Santa Fe County, Las Alamos, and other pueblos. There is a regional wastewater advisory committee that oversees the project, and there is also another Española basin water committee that manages that type of activity.

The pueblo is proactive in the community, being very conservative with water usage. The water system

is probably the most up-to-date in the Southwest. It does a good job. Right now in the valley in Northern Santa Fe County and Southern Rio Arriba County, a lot of the houses are old. Most of them, if not all of them, are on septic tanks. Those septic tanks are starting to seep into the ground and into the aquifers and contaminating the water. Our approach is to help with the quality of the water and to help the communities that surround us.

In the past, every time that we started a new project, there was always a huge outcry about how Pojoaque Pueblo was doing it again. We get bad press, and we get some funky phone calls. When it is all said and done, the people will come to grips with it and say, "Alright. That worked." Working with different governments around Pojoaque, Santa Fe, and Los Alamos, I see that the government understands our privilege to become developed. They see the need for the types of things that we are doing in the valley. It shows that we can do it based on income. With those revenues, we are giving back to the community by providing jobs, furnishing housing, and things like that.

We are very active in the legislature. We monitor a lot of different issues, water, air quality, environmental quality being some of them. We all here have an interest in them. Last year I worked with this group. We had about six different groups that were part of the committee. They were environmentalists, conservationists, tribes, and agriculturalists. We blocked a lot of bad bills that would have had a huge impact on New Mexico ground and surface water. We got a couple of good ones passed. However, we will not be doing it again this year. Working with the legislature will educate us on so many things besides this, and with that I think I am done.

QUESTIONS

Q: I have a couple of questions for John. You mentioned in the last permit you got from the Office of the State Engineer that some gpd (gallons per day) mandates were part of it. I was curious, did you get to participate in that with the OSE in terms of establishing numbers or where did it come from?

A: **(John Stomp)** We had our own water conservation goals that were set by our own policy makers. That was kind of the process of where we started in terms of our water use for our planning. As you project what the water use is going to be for the future, you obviously need some projection, and

projection was the policy goal set. With respect to how the state engineer came about it, I can't tell you. I wasn't part of that process but we were actually submitting a lot of technical information throughout the process. It took the State Engineer's Office a year and a half to decide. So where he came up with those numbers I don't know. You might want to ask him.

Q: The other question is where are you now in terms of average gpd?

A: **(John Stomp)** At the end of 2004, we were at 177 gallons per person per day, and this year we are about 1½ percent less than where we were last year. Last year we pumped less than we did over 20 years ago. So even though our population has increased over 40,000 counts in the last 10 years, we have reduced our pumping by about 16,000 acre-feet per year. Last year we pumped about 104,000 acre-feet.

Q: The last question is; any thoughts on how to get to 155?

A: **(John Stomp)** I have lots of thoughts and it's going to take a lot of actions. I think we have peeled off a lot of the low-hanging fruit. The rest of it is going to be more difficult. I think there will be a lot more mandatory measures. It will be interesting to see how the public reacts, because conservation from an education standpoint is working out here. We will have

At the end of 2004, we were at 177 gallons per person per day, and this year we are about 1½ percent less than where we were last year.

John Stomp

to take that next step past the education, past the voluntary measures, and move on to the mandatory measures and see how that works. Policy makers are going to have to make some tough decisions.

Q: My question is for David Steinborn. I am interested in the remark you made about changing the name of the state. I would be interested in knowing what you would name it.

A: **(David Steinborn)** That is a great question. I would like to answer the question that was asked of John. As housing stock gets smaller and lots get smaller, the gallons per day per person will naturally change too. It is a function of a moving target. If you look at the housing stock in Albuquerque, there is a greater and greater percentage of smaller and smaller houses that are being built in Albuquerque and Rio Rancho on smaller sized lots. If you go back to the 1990s, there

were a lot of lots that were a quarter or a half acre. That is relatively variable now in the same market.

Now to answer your question about what I would call New Mexico. That is an interesting question. I do not know that it really makes a difference. I remember that one of the other eleven people sitting around the table took umbrage at that, because he thought I was talking about the culture of the state. I absolutely was not talking about that at all. You can call it anything.

The biggest single factor that dictated where the growth patterns in the central part of the state went was the building of interstate freeways. They were intended to be an interstate transportation hub, but they in fact became feeders into the city of Albuquerque and the growth of Albuquerque...

Bill Hume

As a matter of fact, there has been a joke going on in the news, because there is somebody that is trying to deal with the crosses in our tradition and wanting to get rid of the crosses. Some people are suggesting to get rid of the name.

Why don't we just call it Fred? I guess you could call it Fred. I have no serious substitute for a name. I just think that it is a serious subject. When I attended mayor conference meetings in the 1980s, I remember being on an elevator with a guy from Ohio. He did the slow talk with me and said, “It is very nice to have a mayor from your state.” I replied, “It is nice to have a mayor from your state.”

Q: I am surprised with what you just said. I understand, living in Albuquerque, that lots are getting smaller, but everything that I have ever read says that houses are getting bigger. What am I missing?

A: **(David Steinborn)** Well, the houses are getting bigger, but the family unit is getting smaller. The number of times toilets get flushed is really based on people rather than square footage. I may have misstated that. Houses may be getting bigger, but that is a consequence of interest rates. The places that get water (showers, toilets, sinks) are being used less; there are fewer hands getting washed, because there are fewer people per household. The square footage of the lot, where it used to be 8,000, 9,000, 12,000, and 15,000 is now 5,000 to 6,500.

Q: There is tremendous growth in Las Cruces and Albuquerque. Going back to what you were saying

about lot size, if we were to have made a policy to combat urban sprawl by providing smaller lot sizes, it sounds like that would help conservation. What are your thoughts on that?

A: **(David Steinborn)** This first part of that is a public policy thing. If it was a public policy incentive for the development of infill areas, which is what you are talking about, then there would be more infill. Your postulation is not correct. First of all, Las Cruces is not sprawling in the sense that it is growing north, south, west, and east. It is not. Eighty percent of Las Cruces's growth is to the east. People follow intersecting lines. So if you put lines in the east, that is where the people will go. If you go north and south as a matter of public policy, Las Cruces has never tried to urbanize the valley. If you go to the west then you run into the airport. I see that pattern continuing.

Q: The name of this panel seems to imply that economic development is necessarily predicated on growth. Why are we asking if economic growth and development are possible within our water means instead of whether or not we can have economic well being within this state within our water means. Economic well being, seems to me, to be tied not necessarily to growth and development, because if you consider the history of this state, we have been a developing state for one hundred and fifty years. We have the second highest poverty rate in the country. Growth does not translate into economic development and well being for the people of the state.

A: **(Bill Hume)** I would neither agree nor disagree with where you went. I would observe where you take that vastly expands the scope of what we were discussing beyond what was given to us. There are those who say that economic growth and development in a community and this country is dynamic only so long as it is growing and you cannot stop the growth. Colorado is an example of that. I remember Albuquerque when it was a lot smaller than it is now, but with some nostalgia. The biggest single factor that dictated where the growth patterns in the central part of the state went was the building of interstate freeways. They were intended to be an interstate transportation hub, but they in fact became feeders into the city of Albuquerque and the growth of Albuquerque or sprawl, depending on which term you choose to use for it, followed the interstates because that was the path that got you from where you were to where you wanted to be. I think when we get our Belen to Bernalillo train going that will stimulate growth

in some of the outlying communities in different areas than it is now. When we get all the way to Santa Fe, it will also change people's living and travel and working patterns. So many of these things are easier to analyze and form theories around after you have something happen in a community or in a state and you study what happened and why it went that way. Frequently when you derive lessons from this and try to change in the future, you will find out later that you were pushing on the wrong variable. I do not know the long answer to your question. Does anyone else want to address that?

A: **(Janet Jarratt)** I actually think you make a really good point. I tried to go after the fact that we need to define economic growth and development. One of the things that Bill just observed that is true is that the land or real estate development goes along where the transportation corridors are. The problem with that is it becomes bedroom community development, not economic development in those outlying areas. That is a very different thing. I would be much happier if instead of just looking at population growth as an end in itself, we would look at the growth of disposable income in this state and see what it takes to have economic health. In my mind, economic health is about how much disposable income you have, not about how many people you have at a certain level. I can certainly tell you that as Valencia County grows, the poverty level has definitely increased there. It is a big difference. The number of undocumented people has increased as well, the number of people not on the tax rolls or in the census. It is a very big economic problem to all the governmental entities. It is a drain to have a very low level of disposable income and to always be looking at bedroom communities and not any kind of self-supporting communities that can go together. I have some concerns that the transportation is not linked to water and land use and the ability for Valencia County, for instance, to pursue its own economic development. Everything seems to be focused on shipping people to Albuquerque, not about letting it have its own economic development. I think that is a really important question that we need to look at as citizens in this state. We need to impress on some elected officials about what it is that we really want for a standard of living in this state and how to get there.

A: **(David Steinborn)** I am going to take a shot at your question. I have been very blessed to do a lot of things in my life. Five years ago, I was on the state school board. Let me give you a state school

perspective in New Mexico, this very rural state. Of all of the fifty states, we are the second highest state that is giving the second highest percentage of our general budget to education. We are the fourth lowest when it comes to dollars per student. We have a very low average tax per person in a very rural, very difficult state to deploy education. The question is: if you want to give the same quality of education to the child in Abiquiu as you do in Albuquerque, how do you do that? It is really complicated when your provider of internet cannot give Abiquiu the same level of speed as the kid in Albuquerque takes for granted. We had major companies willing to put computers in every classroom in the state five years ago, but we did not have internet available in 50 percent of the state to be able to connect. The question is: where do you get more money? The conventional wisdom has been that you get more money by bringing in more people.

Twenty years ago somebody come up with the idea that people who move here as retirees was actually economic development. At the time that they said that, I thought that it was silly. The more I have thought about it, the more I realized that in their way of thinking that was economic development. The question that you bring up is a great question. If we did what Oregon tried, which was putting up a wall and saying, "We don't want any more growth. We don't want any more people. We are going to try doing this by bringing up the bar." They tried to do that. Twenty years later they put the bar down again and said, "Come on in." It took about ten years before people were willing to trust that process. I do not know how to answer your question, other than to tell you this. I went to the General Motors Company in 1986 with a delegation from the state of New Mexico in trying to get the Saturn plant centered in New Mexico. I got a phone call from their head of government relations in Dallas a week later. He said, "Your presentation for Santa Teresa was the best presentation in the country, and we are not going to give it to you." Why not? They did not trust the state of New Mexico's long term governmental decisions regarding whether or not they will do what they have been saying they would do. They went to Tennessee. We have a lot of things in the state of New

In my mind, economic health is about how much disposable income you have, not about how many people you have...

Janet Jarratt

Mexico to work on. One of them is our public policy process. I thank you, because you are exactly right. More people does not mean more economic development, but no more people does not mean it either. We have a real task, and water is just part of it.

Q: Mr. Steinborn spoke about subdivisions and tourism. (To Janet Jarratt) Thank you for those beautiful slides that you were showing. People come here, spend their money, and leave to see things like that. There was no question there, but thank you for that.

A: (**Bill Hume**) You are right, but the fact of subdivisions though, as David pointed out, is that they are a service industry. If nobody is buying the houses, the subdivisions go away. With regard to Valencia County, it is not Bernalillo economic leaders that are encouraging the development of bedroom communities in Valencia County or in Sandoval County. It is the developers and the local governments seeing this as development that they love. This is the dynamic of our

One of the amazing statistics that we have seen...is that people are increasingly willing to tax themselves or allow governments to increase public funding measures to protect farmland, to preserve natural lands and views that people have taken for granted.

Karyn Stockdale

free enterprise system. We have some controls and planning in place. I think we undoubtedly need more. I talked about the roads and the r a i l r o a d . Virtually all of the development is reactive, rather than proactive. We do not build roads because we want people to be here or there. We build roads because there are a whole lot of people there, and they have to get from there to here. We build a road, and then they build many more houses at the end of the road. We are then right back to where we were before. The long term answers to these things are not easy.

Q: If you take a look at Las Vegas, Nevada, they only have 300,000 acre-feet out of the Colorado River Compact. Arizona has 2.8 million acre-feet. Las Vegas was a city that was not supposed to be there, but the Colorado River Compact gave it the rights to be there. I have heard Patricia Mulroy speak a number of times, and she said, “I do not worry about the building going on. My job is to get water. If they put up a house, by

god, we will provide water for it. I am not involved in public policy.” They have a go get ‘em attitude. This state, when there is a plan to develop water, to bring water to communities that need it, you have to convince the legislature, you have to convince the administration. They will not do it. They stand in the way, and they block efforts to bring water from point a to point b. The plan to draw water from the Estancia Basin to Santa Fe was a good idea, but look at the opposition. Any time some one comes up with a positive idea for solving a water problem, thousands come out in opposition. What if I were to suggest a nuclear power plant in New Mexico? We would mine uranium here, dispose of it in Hobbs, and we have the water to cool the uranium power plant. A thousand people will come out of the woodwork and say, “No. We cannot do that.” There is not a go get ‘em attitude. In other states, if you come out with a good idea, there are a hundred people who will finance it. If you come up with a good idea in this state, there are a hundred people who will oppose it. If we were to become proactive, we would not have the same problems that we have been talking about for several years.

A: (**Karyn Stockdale**) This sort of ties in to some of the conversations that have been going on. It is one of the things that New Mexico and people across the country are doing that is proactive. One of the amazing statistics that we have seen, mainly in the west which is experiencing such intense growth, across the nation whether it was a red state or a blue state or what the demographics might be is that people are increasingly willing to tax themselves or allow governments to increase public funding measures to protect farmland, to preserve natural lands and views that people have taken for granted. I think as people see the rise in development, people say, “Wait a minute. This is changing before my very eyes. Five years ago, this town did not look the same way.” It is not an answer to everything. It is sort of in the mix of everything else that is going on. It has been a really interesting tide. We are seeing it increasingly in New Mexico as well. Bernalillo was one of the first counties to pass an open space and parks measure. Santa Fe County followed. Taos County and Doña Ana County are considering something right now. We are working with the state legislature in hoping to get some kind of state permanent or revolving fund on an annual basis that provides communities with alternatives. It is a different kind of economic development related to tourism or related to

the natural landscape that we sort of identify with New Mexico, the places that are the icons of the state when people think about New Mexico. I just wanted to add that little bit.

Q: Now that the geo-libertarian has spoken, I feel like I should say something. The beauty and awesomeness of this state is that even with all of the population growth, we are only going to be about 2.6 million people, which is great to me. We have this awesome resource. We have the Water Resources Research Institute. We have the universities. John Stomp hit it. We need to sit back and assess a plan for a number of years. We have all of the resources here. Some people might say, “Don’t build a pipeline. We have 250,000 acre feet of rechargeable water down south. Let’s move part of Albuquerque down there.” I do not necessarily endorse that idea, but I think we can get back to the panel. We can grow in this state. The thing is that we have to grow slowly. We have got to use our science, technology, and resources. This state geographically and geologically is totally different from Colorado, Texas, Arizona, and certainly culturally. My biggest joy this year was helping the Santo Domingo Pueblo. We helped them locate their first good water well ever.

A: (**Bill Hume**) All of these things about planning, thinking big, and going in different places in water policy implementation are points well taken. They are things we are trying to address in the administration. The problem with water projects is that you can tend to be vigorous and tend to be statewide and cost is quite local in effect. We are working on it.

Q: I would just like to add a comment on what you are saying right now. I would like to give my support to the last speaker. In particular, I would like to say to the woman at the end of the table, Janet Jarratt, that in thirty-five years of going to these things that was probably the most eloquent, best prepared, and best scientifically grounded advance of the economic value of the family farm that I have heard. I think that anywhere around this state, no matter where you go — Representative Stell and I have talked about this for some length of time — that you will find that the culture of this state is bound up in agriculture, everywhere you go no matter if the culture is Hispanic or Indian. I have lived on reservations for many, many years, and there may or may not be farms, but there is a culture of the land. I have friends who would full heartedly join you in saying that. It seems to me that in the matter of economic analysis what we need to do is

to look beyond the slapping out every few acres, which is going to go on anyway in Rio Rancho forever. We also need to look at the real value of the farms, which are our cultural lifeline, and how we can grow as interconnected societies in the future. I think this has been a really enlightening discussion.

Q: (To Janet Jarratt) Can you tell us your father’s name?

A: (**Janet Jarratt**) Yes. It is Raymond Jarratt.

Q: Raymond Jarratt is one of the best farmers there is.

A: (**Janet Jarratt**) That’s my opinion for sure.

Q: I had a question for Ms. Jarratt. One of the panelists was ripping farmers pretty badly. I finished high school here and went to college here. When we came here, there were about 12,500 people living in this region. There are now over 70,000 people, I understand, living in this region. Over that period of time, there has been a significant increase in the population here. I do not recognize Las Cruces anymore because of the growth and expansion. I have been talking with some farmers in the valleys up and down this state. I have noticed that their land is going out of production and being turned into residences. Isn’t there some way that this state can have the realtors and land developers leave the agricultural and farm lands, which are extremely productive, alone and go build their houses someplace else?

A: (**Janet Jarratt**) That is always the problem. Over the past we have heard a lot about transfer of development rights and those kinds of things, but the fundamental issue is the water. You cannot build anywhere. It does not matter if you are trying to build on the mesas or any where else. You still have to retire agricultural land to get the water, because that is the new use of water — urban usage. You have to get the water from somewhere, and the only place to get it is senior water rights. That is the ultimate problem right there, water. Transfer and development rights have worked in other states where they do not have the same kind of water issues that we do, when they are trying to preserve a land use. For us, it is imperative that we keep the water and the land hooked together, because they are hooked together. You cannot separate them.

A: (**Bill Hume**) I agree with that, but I would like to point out the other side of this particular issue also. I have listened to farmers from the Elephant Butte Irrigation District say that their farm is their 401K. Their kids have gone to college, and they are off doing

something else. This guy is getting old, and no one wants to buy that farm for anything like he can sell it for if he separates the water and the land from one another. He needs to live the rest of his life on what he can get for it.

I have listened to farmers from the Elephant Butte Irrigation District say that their farm is their 401K. Their kids have gone to college, and they are off doing something else. This guy is getting old, and no one wants to buy that farm for anything like he can sell it for if he separates the water and the land from one another. He needs to live the rest of his life on what he can get for it. That is the decision he faces.

Bill Hume

That is the decision he faces. I think we do need to build mechanisms to deal with this. We have started this program of buying the development rights off the top of the farm and giving the property that way the development value of its property so that it can stay in agriculture. I do not know

what the broad-reaching, long term solution to that is.

Q: I have been told by farmers that these residences that are moving in next to them are raising cane to them when they go out in the morning to do their harvesting, to do their watering. Why can't they leave the farmers alone and go build their houses somewhere else?

A: **(Bill Hume)** I live about half a mile from the Albuquerque International Airport. The airplanes have been there for as long as I have been there, and I have been there for an awfully long time. It is the same related thing. It bemuses the heck out of me for people to move in there and sit down and then complain about the noise of the airplane. The airplanes were there first. The problem you address is true.

Q: I live in Edgewood, which is close to Estancia Valley. Our major concern is that a lot of the water in the valley is being used for municipal purposes. The whole valley was drained to serve Los Lunas. We who live there did not support the economic development

plans. We did not want that plan or any other development plan.

A: **(Bill Hume)** I remember when you all came to Santa Fe, and we ultimately swung our support behind you opposing that particular plan. However, I will confess to you I was as careful as I could be to make that specific to that plan rather than interbasin transfers in general. Overall, that is something that is going to happen in this state if we are going to address these problems regionally. We need to come up with a way to do it more in terms of public policy and in terms of economic questions that exist.

Q: Are we going to use and advance our technological institutes as a way of finding new water or bringing new water resources to the table? When is the state of New Mexico going to begin to link land use and water?

A: **(John Stomp)** My answer is simple. I agree with you on the technology issue. I think that what Janet and others bring about is that you can solve some of these issues with technology advances. We should be supporting that and promoting that. That is the kind of thing that we are trying to do. I do not know when the state will begin to link land and water use. I am not a policy maker. I think a lot of people recognize that land use is tied to water. I am one of those people that believe that land use and water use go together. You cannot separate the two, even though our laws actually separate the two and make each a separate private property that can be moved and sold and transferred. I am saying I do not know.

A: **(David Steinborn)** The answer for me and your question is that I think your question has a bias with it, unfortunately. I think you are making the supposition that developers fall on one side of the world, and everybody else falls on the other side of the world. Let's start this way. I am a guy that has done probably as much public service as anybody in the room and has been a public policy maker longer than probably anybody else in the room. I will tell you that I still believe in laissez-faire government. I still believe that the government that governs least governs best. I still believe that the United States was founded on some principles that still work. I still believe in the free market. For me to represent the development community is difficult, because it is a real heterogeneous group. The group in Albuquerque differs from the group in Roswell. In Hobbs, they built two houses last year. The mayor of Hobbs, Monty Newman, called me a few days ago. I have the largest subdivision in the state outside of

Santa Fe and Albuquerque right here in Las Cruces. He called me and said, “I’ve got a guy in my market who wants to build a subdivision. Is there any good reason not to build a subdivision in Hobbs?” I guess somebody would say, “No. We have plenty of lots.” The reality is that I believe in the free market. I guess the question that I would throw back at all of you is this: If you were going to build a home today, and it was going to be half a million dollars, would you want to build it in a neighborhood that was forty years old where the average cost of the homes was \$170,000? I will throw the question the other way: If you were going to build a house today that was \$125,000, would you want to build it in the middle of a neighborhood that was decaying, in the city center in a rough school neighborhood, where the police ride two in a car and people are afraid to walk at night? I am generalizing, aren’t I? But the question really gets to be: How many stakeholders are willing to sit at the table and listen to what the other person is saying? This man back here said that somebody here bashed agriculture. It is funny. The only person here that talked about agriculture other than the lady in the business was me, and I am absolutely not bashing agriculture. I know what I said, but I know what you heard. The thing that is interesting about hearing and listening is that sometimes people do not hear what the other person is saying. Sitting around the table and having this dialogue is going to take a long time. Step number one is that people need to feel safe to talk about what their fears are, because fear motivates people. People need to talk about their fears, and people like this gentleman who is really a laissez-faire guy needs not be afraid, because the geologist over here knows what he knows the difference between s—t and shinola. Everybody comes to these discussions with a different frame of reference.

Q: I would like to make one comment about the free market. I pretty much support free market ideas also, but I think if you really are going to do it right, you have to account for all of the costs. There is a lot of externality involved, in say, development that does not get into the equation when they are doing a cost-benefit analysis. I think a lot of the free market and market transfers for water do not mention the externality such as costs to farmers, third party effects, other communities, and so on. I want to make that comment. I think that caveat has to be included when you say free market.

A: **(Bill Hume)** I think we have spent about all the time we were allotted for this. I would add just one more comment. It is my belief that everybody in New Mexico fits into two camps in water situations. There are the rural people and the people that run big water systems that understand or tear out their hair or love our system of water rights and prior appropriation. There is the other, the vast majority of the state, the people who live in the cities and know that water comes because you send a check to the water department every month and to get the water when you twist a tap. The people in the latter group need to know and understand much more than they do today

about how the natural water system and the ecosystem work to be meaningful participants in this conversation. An illustration of this was during the silvery minnow discussion a couple of years ago. There were a couple of environmentalists who were saying, “Make Albuquerque use less water, so there will be more water in the Rio Grande.” In fact, the outflow of the water treatment plant in the city of Albuquerque is the sixth largest tributary of the Rio Grande in New Mexico. If they wanted to help the silvery minnow, they would have said, “Run your bathtub on cold for a half hour every afternoon to put more water in the river,” which of course would not be good policy. We all need to understand the other person’s point of view in this to better understand how their needs and wants dovetail with our own. Thank you all.

The thing that is interesting about hearing and listening is that sometimes people do not hear what the other person is saying. Sitting around the table and having this dialogue is going to take a long time. Step number one is that people need to feel safe to talk about what their fears are, because fear motivates people.

David Steinborn

Ron Curry has served as Secretary of the New Mexico Environment Department for Governor Bill Richardson since January 2003. Ron developed the first environmental strategic plan for the Public Service Company of New Mexico (PNM), worked on an Environmental Impact Statement for Los Alamos National Laboratory, and represented both the New Mexico Environmental Law Center and the Coalition for Clean and Affordable Energy before the State Legislature. In the early 1990s, he served as the Environment Department's first Deputy Secretary. Born in Hobbs and raised in Albuquerque, Ron is also an avid balloonist. He has flown KKOB Radio's flagship hot air balloon at rallies around the state for 22 years. Ron has two grown children and lives in Albuquerque.



THE TWO Q'S: THE CONNECTION BETWEEN WATER QUALITY AND WATER QUANTITY

Ron Curry
NM Environment Department
1190 St. Francis Drive, RM-N405
Santa Fe, NM 87502

It was the jet's fault. John D'Antonio and Esteban are with me, and they will vouch for the fact that it was the jet's fault. The only thing that made me a little later was that I was in the very back of the plane. It's a hell of a lot faster than the balloon that I fly in. Thank you for being patient. I see Matt in the audience. Matt is a very knowledgeable person. We have the opportunity to work together on a lot of different occasions. The Rural Water Association and the Environment Department—I do not know if we have forged a partnership, but we certainly do a lot of things together. I like coming to New Mexico State. The last time I was here I had the chance to visit with Craig

Runyan from the NMSU Cooperative Extension Service, which has 33 offices around the state of New Mexico. Of course, I think the university here is honored by the fact that President Martin is in North Korea with Governor Richardson, Jeff Sterba, and others. I think that is a great accomplishment for New Mexico State University. I think one of the other things that I am always pleased to come down here and visit about is that I did actually fly my balloon down here about three weeks ago over Las Cruces. I am familiar with this town and this part of the state in ways that a lot of people would be surprised, aside from the fact that both of my children are graduates from New

Mexico State. I feel like I have an investment here; in fact, I know I do. In fact, I am still paying for it.

One of the things that I do not know if John will mention when he talks later in the day, is the idea of Q Two, water quantity and water quality, which is

...the largest source of groundwater pollution in the state of New Mexico, [is] our septic tanks. We estimate that there are over 220,000 septic tanks in the state of New Mexico. We estimate also that as many as 110,000 of those septic tanks were put in at midnight or on weekends or at some time when they should not have been.

something that we have pushed very aggressively in this state since the Richardson administration came in. I see Anne Watkins sitting out here, and she knows and has been part of that, working with the State Engineer's office. We have talked a lot about water quantity through the drought task force and things like that. One of the things that is stressed is that if you do not

have good water quality, then the drought is effectively extended. One of the things that the State Engineer's office has done working with the Environment Department, the Environment Department working with the State Engineer's Office is bringing up and continuing to promote the idea of Q Two. We have a nice video that is available for free, narrated by Ally McGraw. John D'Antonio is in it. I am in it. Others, including the governor, are in it. We talk about the concept of Q Two, because people when they think of water in New Mexico often times only think of quantity. You drive past Elephant Butte and see that it is down. You look at the Rio Grande and see that it is down. You hear about the drought, and you hear about the piñons. It is all thinking about water quantity.

In the Richardson administration, the term quality has come to the forefront as often or almost as often as the word quantity. One of the things that we have talked about in New Mexico and in the New Mexico Environment Department is the largest source of groundwater pollution in the state of New Mexico, our septic tanks. We estimate that there are over 220,000 septic tanks in the state of New Mexico. We estimate

also that as many as 110,000 of those septic tanks were put in at midnight or on weekends or at some time when they should not have been. Some of those septic tanks do not even qualify as septic tanks. I am sorry to say that some of them qualify as cesspools. Some of them are as near as ten miles from where we are right now. I could say the same thing if I was standing in Santa Fe, or if I was standing in my home town of Hobbs. When you consider that we get 90% of our drinking water from groundwater, and then you start talking about septic tanks and what needs to be done about them, it becomes a big source of concern in the state of New Mexico.

Think about septic tanks, and then you think about the runoff from the Cerro Grande Fire up in Los Alamos where the largest amount of plutonium in the history of the United States was washed down toward the Buckman well field and toward the Rio Grande. It was still not as large of a contamination as septic tanks. You think about all of the superfund sites throughout all the state of New Mexico, whether they are the Fruit Avenue plume in Albuquerque or whether they are near Griggs Avenue here in Las Cruces or whether they are in Española. All the superfund sites in the state of New Mexico do not equal the amount of groundwater contamination that you find because of septic tanks. You think about the nitrates that you find often times associated with dairies. New Mexico is either the sixth or seventh largest dairy state in the United States. You think about the type of groundwater pollution that is potentially caused by dairies. It is still not as big as septic tanks.

Septic tanks, however, are personal obviously. I would venture to say that there are probably people in this room that have septic tanks that maybe are not permitted. Or maybe they have septic tanks that need to be overhauled and looked at under the new regulations. When we talk about septic tanks and groundwater pollution and water quality, we acted on it in the Environment Department within the last two years. It is a very daunting challenge, but we did it working with a variety of people building a consensus, whether it was the home builders, whether it was the realtors, whether it was some of the people who install septic tanks.

There had been an effort going back to the late 1980s to rewrite the liquid waste rules in the state of New Mexico. When you say you are going to rewrite the liquid waste rules for septic tanks and other forms of liquid waste disposal, you talk to someone in the

middle of Albuquerque, and they just say, "Well, who cares?" It is a subject that a lot of people do not think of, because they take it for granted, quite frankly especially those in the metropolitan area. The people who do care about it are very, very, very passionate about it for a lot of different reasons. I can tell you that a lot of folks who work for the Environment Department—when you go out onto a property and you want to look at someone's septic tank, it is almost like inviting them to come in and look at the medicine cabinet in your bathroom. Most people are not too anxious to do that. The first liquid waste citation that was issued in the state of New Mexico was done on a septic tank just in the last year and a half up near Taos. You stop and think about our state, which has a lot of rural areas, and that becomes an amazing fact to me. When we started to rewrite the liquid waste rules, one of the things that happened is that we found out that there had been about five attempts to do so since the late 1980s. People would just throw their hands up in the air and say, "This is too contentious. This is too nasty. This is too personal. We will never come to any sort of conclusion." Matt has seen some of that through the years. When I talked to our division director in March of 2003 and set a deadline for November of 2003, they were approved and went into effect September 1st of this year, but we got them done. We got them done in a way that I think will intend to improve the water quality as a result of it. It is a uniform regulation that has provisions to fit various parts of New Mexico that are different from one another. That is the best and most outstanding example that I can talk to you about water quality and how it matches up to water quantity.

I know the Office of the State Engineer has been working diligently over the last few years trying to get the legislature to pass certain laws regarding wells and the ability for the State Engineer to permit wells based upon the water quality and the water quantity in the parts of the state. I know John has run into lots of legislative opposition to these areas, but I also know that he is finding ways to get that done, so that the governor can say that water quality will be protected at every level throughout the state of New Mexico. It is a difficult issue. I am fascinated by it, because I have never had a septic tank.

One of the members of the cabinet that John and I sat in with is James Jimenez, the secretary of the Department of Finance and Administration. He used to be city manager at Rio Rancho. Rio Rancho has up

to 40 percent% of its residential homes on septic tanks. Rio Rancho likes to think of itself as a metropolitan area. The problem with the septic tanks is because of the way that particular city was developed, septic tanks were there first, and they are still there today. You will hear us talking about septic tanks a lot as it relates to water quality. It becomes something that I have to admit that I dream about. I do not know if I have a good enough life or not.

I want to emphasize again that in the Richardson administration, if you look back at the State Engineer's Office over time and if you look back at the Environment Department over the years, then you look at the Richardson administration with John D'Antonio as State Engineer, then you look at the Environment Department, I believe, and I think John would agree with me, is that the sort of cooperation we have between

When we started to rewrite the liquid waste rules, one of the things ... that we found out [was] that there had been about five attempts to do so since the late 1980s. People would just throw their hands up in the air and say, "This is too contentious...."

the two agencies is really benefiting the citizens of New Mexico. That is what we are about. It does not hurt that John acted as interim secretary of the Environment Department from August through December of 2002. I think that is also a benefit to the state of New Mexico. I commit, and John will commit later on, to continue to have this sort of relationship between the State Engineer's Office and the Environment Department, so that the citizens of New Mexico can have the best possible service when it comes to water quantity and water quality.

One of the things that NMED and the Interstate Stream Commission have done is initiate a monitoring program in collaboration with the Elephant Butte Irrigation District in response to concerns about the quality of water in the Lower Rio Grande, especially in regard to salinity. This is another example of how we are working together to improve the service to the citizens of New Mexico. The Lower Rio Grande from the Caballo Reservoir to the international border is an area of heavy agricultural, commercial, and industrial use which is experiencing rapid population growth. It

is a continuing challenge for communities in this region to find a balance that promotes a healthy river, while continuing to provide a sustainable water supply. This project provides an opportunity to develop a regional salinity control forum and the vehicle to evaluate potential mechanisms for mitigating salinity issues in this critical border region.

When we talk about a critical border region, we are talking about as far south as you can get in New

The thing I want to emphasize today is that we believe New Mexico will eventually have primacy...[to operate the National Pollution Discharge Elimination System]. We believe it will benefit the municipalities...the private home builders...[and] the environment of New Mexico.

Mexico on the Rio Grande as it relates to the river. You are talking about Anthony. You are talking about Sunland Park. You are talking about Anapra, when you are talking about the critical border region. This project is an excellent model for the Environment Department and the State Engineer on the collaboration of water quantity and quality issues in the future and an

opportunity for regional collaboration as we look to solutions to protect and restore this critical resource.

Let me ask a question. It becomes of interest for some of us who deal with the environment, like a lot of you do every day. How many of you have ever spent much time in Sunland Park or in Anapra? I have had the opportunity to go door to door in Sunland Park a number of times for different reasons. I think when you look at Sunland Park and you look at Anapra, it calls out for the state of New Mexico to work as closely as we can to improve the environment, the water quality, and the air quality. The people of those two communities often times feel completely ignored. They feel sometimes like they are a step-child to El Paso, and they feel they are ignored by Santa Fe. I spent a number of days and hours since this administration in Sunland Park and in Anapra and on up the Mesilla Valley back toward Las Cruces. We have initiated several colonias meetings, one of which will begin in the middle of November. We are working with some folks down there not only to identify the problems which is easy to do, but also to do something about it, so that

when this administration is over, we at least leave a legacy of trying to change things in some of these most critical areas around the border, whether it is water quality or water quantity or other aspects of the environment. For those of you who have not spent much time in the areas of Sunland Park, Santa Teresa, or Anapra, I encourage you to do so. I know it is one of the most dynamic parts of the state. It is one of the most challenging parts of the state, because it is a border area, not just with Mexico but with Texas. It is one of the fastest growing areas. There are concerns throughout the entire area that encompass water quality on a daily basis.

There is a landfill that the Environment Department permits right on the border—the Camino Real Landfill. It is privately owned. On an occasion earlier this year, we sent teams into the landfill unannounced at 4:30 in the morning to inspect the sort of waste that was coming into the landfill. Most of the waste that comes into the Camino Real Landfill comes from El Paso. What we found was a lot of medical waste that was being illegally shipped by hospitals in El Paso. We issued a number of violations and penalties. We ordered a number of the hospitals in El Paso to work with Camino Real to educate one another and the other hospitals in El Paso to make sure that New Mexico was not feeling the brunt of illegal waste coming into the Camino Real landfill. Why is that important when we are talking about water quality and water quantity? Simply because no matter how well you operate a landfill, no matter what kind of liners you have, at some time or another, the landfill will leak. Period. We want to maintain a relationship with the state of Texas that tells them that if New Mexico is going to be here for their use, we expect everyone to be good citizens in the process. That is a message that we want to send also when we are addressing some of the water concerns and environmental concerns in the areas of Sunland Park, Anapra, Santa Theresa, and otherwise. We will continue to make a strong dedicated effort in this part of the state in the critical border region to make sure that water quality and all aspects of the environment are protected. Again, I will emphasize one more time the strong working relationship which we continue to build to provide better service to the citizens of New Mexico between the State Engineer's Office and the New Mexico Environment Department. It is critical to all of us in the state of New Mexico. It is also critical to John and I, because Governor Richardson loves for

all of his cabinet secretaries to work together. So it is very critical for John and I. It is very important.

One last thing that I want to touch on very briefly is something called NPDES. I am sure most of you are aware of that. The state of New Mexico is looking at the possibility of gaining primacy from the Environmental Protection Agency to operate the National Pollution Discharge Elimination System. The New Mexico Environment Department has every other aspect of environmental regulatory issues delegated to it, except for surface water protection, permitting, and enforcement. Surface water includes such things as stormwater runoff, building permits when you are distributing more than an acre if you are a contractor. It also includes things as far as federal facilities, and it also includes things relating to municipalities as far as their wet wastewater permits. New Mexico has been looking at this since last April. It tends to be a controversial subject, and we will continue to look at it.

The thing I want to emphasize today is that we believe New Mexico will eventually have primacy in this area. We believe it will benefit the municipalities. It will benefit the private home builders around the state. It will benefit the environment of New Mexico. We want to continue doing education on it. We want to continue to ensure that everyone understands the program. One of the most important aspects of this primacy issue is that it is good for economic development. New Mexico is in EPA region six, which includes New Mexico, Texas, Oklahoma, Louisiana, and Arkansas. New Mexico is the only state that does not have this primacy of surface water delegation given to it in region six. Out of the 50 states in the United States, we are one of four that does not have this delegation given to us. There are a number of reasons, but it is the long term belief that if New Mexico is going to put its arms around much of its water quality and water quantity concerns that we should have this delegation given to us. We have everything from hazardous waste, to drinking water, to solid waste, to air quality that has been delegated and been run successfully from the EPA. This is an area we will continue to investigate, continue to look at, and try to build a consensus.

The arguments are fun and challenging. There has been a lot of misinformation put out. For some people it is a complex issue. For others, it does not seem to be as complex. There is a lot of legal wrangling at the federal level over standards and over definitions. A lot of people have said that there is just a legal quagmire

out there when it comes to surface water quality throughout the United States. The state of New Mexico through NPDES and through the Water Quality Control Commission strives to continue to protect our surface waters the same way they have been protected for the last three decades. That is the goal of the Environment Department, the Water Quality Control Commission, and eventually if we get primacy, that will be part of it as well.

This is last thing I want to leave you with, and some of you may have heard me tell this story before. I think it is important in organizations like this. It is important to people working hard at the ground level trying to make a difference in whatever they do. It is a true story, and it shows you how responsibility can flow one way or another. It happened back in the early 90s. It had to do with Senator Bill Bradley at the time.

Senator Bradley was from New Jersey and was a former NBA basketball star. He had been called to give a presentation at a luncheon engagement. He got there early for his luncheon speaking engagement, and the people were not there yet. He was sitting at the head table making his notes out and trying to eat a little bite while he was preparing his notes for his presentation. One of the waiters that was preparing the rest of the hall came by. Senator Bradley said, "Sir, could I have some butter? I am going to eat before I speak, and I need some butter for my roll." The gentleman acknowledged his request and went on about his work. About 10 or 15 minutes later, the gentleman came back by and did not have the butter. The Senator was still working, but was a little perplexed. He asked for his butter again. The waiter replied that he had not yet got it. The Senator said, "Do you know who I am?" The waiter said, "No. I don't." The Senator said, "I am Senator Bill Bradley, and I have to give a presentation here shortly." The waiter said, "Senator, do you know who I am?" The Senator said, "No." The waiter replied, "Sir, I am the guy with the butter." I think as we go about our business, it depends on whether you have got the water or you have got the quality. We all have to remember to respect one another.

Thank you all very much.

Matthew Holmes is the Executive Director for the New Mexico Rural Water Association, a nonprofit technical assistance provider for water and wastewater systems. He holds an M.A. in environmental and natural resource economics from UNM and a B.S.B.A. in business economics from the University of Arizona. Matt frequently provides testimony to the New Mexico State Legislature regarding small drinking water systems issues and travels several times each year to Washington, D.C. to represent Rural Water. His other duties include overseeing federal and state grant programs, managing the Association budget, interacting with the Board of Directors and the membership, helping rural communities, and managing sixteen employees. He currently serves on the Drinking Water Workgroup of the New Mexico Drought Task Force and the Technical Team of the Water Infrastructure Investment Team.



CREATING EFFECTIVE SOURCE WATER PROTECTION THROUGH REGIONAL COLLABORATION

Matt Holmes
New Mexico Rural Water Association
3413 Carlisle Blvd. NE
Albuquerque, NM 87110

Thank you and good morning!

I understand it's not the jet that has slowed (Secretary of the Environment) Ron Curry down; he decided to fly his hot air balloon down here and it took him a little bit longer than he expected. The winds weren't blowing in the right direction.

I would just like to say that the dinner last night was fantastic. Thanks to NMSU for providing us not only great entertainment but an excellent dinner.

I know what you're all thinking: 'Oh, no, another economist.' Karl said something yesterday about economists, that Dr. Lowell Catlett was given all the personality for all economists. That really hurt, but it's true. So I won't try to compete with him this morning. I'm doing the best I can here, however. Dr. Catlett also said something interesting. I am 33 years old, so I was a little confused by his talk yesterday because I

don't know if I need to watch less TV and play more video games, or leave 30 minutes early to get my Starbucks coffee... That's it, that's as good as I can do for humor.

For those who are not familiar with our organization, The New Mexico Rural Water Association is a statewide non-profit membership association. Our members are water systems, professional individuals, and associate members such as industry representatives, manufacturing firms, and engineering firms that design drinking water infrastructure and wastewater treatment. I'm pleased to say we have over 500 members this year. We are part of the National Rural Water Association. There is a rural water association in every state. Our staff is dedicated to providing technical assistance and training on water systems, trying to help them comply with the Safe

Drinking Water Act. We do technical assistance for wastewater systems as well. Our Association does quite a bit of outreach and education for tribal water systems also. You mentioned the title of the talk, 'The Looming Crisis,' and I did want to say a little bit about that. I don't like fear-based statements that inspire panic or get people worried, but I honestly think groundwater quality degradation is a looming crisis, I think that title is accurate. In New Mexico we have been lucky, and now is a moment of opportunity that we can act upon to avert further groundwater contamination and surface water contamination. But it's with us now, it's everywhere in the United States, and that is going to be the focus of my talk.

I have a very singular point that I want to make. I am going to try to go through the PowerPoint presentation fairly

quickly and hopefully we can have some discussion and feedback. There are a lot of people in the audience who are a great deal smarter than I am. I am really here

In New Mexico, well over 100 communities have developed wellhead or source-water protection plans.

today to enlist your support.

I am very briefly going to go over source-water protection planning, which some of you may know as well-head protection planning. Most people are probably familiar with this concept. If you're not, I'm just going to give you a quick background. The United States Environmental Protection Agency (EPA) has offered a program since the early 1990s for communities to develop wellhead protection plans as a voluntary effort.

In New Mexico, well over 100 communities have developed wellhead or source-water protection plans. I think the New Mexico Environment Department (NMED) has documented somewhere around 130. Folks have been doing this for some time, and they are a volunteer effort. Our association assists folks in doing these plans. Our philosophy in this is to utilize the local expertise and local knowledge of the community in developing the plan. People who have lived there for a long time know where their contaminant sources are, they know what their issues are, what their problems are, and it pays dividends to tap into that local knowledge.

In New Mexico, the implementation of these plans is primarily educational. We try to educate consumers

of the water systems, all stakeholders, everyone in the community. The management methods that exist are limiting. Briefly, I will go over the process that we use to develop a source-water protection plan. It is the same process that the EPA promotes, with some slight differences, but for all intents and purposes, it is the same five steps.

The first step is to form a planning team. We get stakeholders together, including water system representatives, operators, any managers and professional staff, board members, but also you can have members of the community and other interested stakeholders, such as ranchers and farmers. If there are any major polluters, point-source polluters, it pays dividends to have them be involved too. Most of the time everybody is very positive about source-water protection efforts. I never have personally run into anyone who has said, "That's just a bad idea, we don't want to protect our groundwater or our source water." Everybody thinks it is important and polluters want to be viewed as trying to help the situation, trying to mitigate contaminants.

So after we develop the planning team, the second step is to delineate the source water protection area. The hydrologists or geohydrologists here would be able to run models that would basically capture the recharge area for the wells far more accurately than the very simple, unscientific delineation we use. Given the situation we have in New Mexico, we are just trying to develop some management methods for wellhead protection. What we do is usually put a 1,000 feet radius or 2,000 feet radius or 1,200 feet radius around a groundwater source. For example, Red River's wells are influenced by the river, so this is not a particularly good delineation. Certainly if they were pulling directly out of the river the area you would want to protect would be much larger, certainly upstream from the wells, something like that. Again, given the limited hydrologic information that is available for rural communities in New Mexico, we have to start somewhere with these plans.

The third step would be to go out and inventory all potential and actual sources of contamination. We use a differential GPS unit for identifying wells. We often find abandoned, hand-dug wells in New Mexico that are pretty exciting. You could throw a cow down some of them. It is historic certainly, but it is a direct route to contamination of the shallow aquifer. It is also an extreme hazard. Many are not very well covered - a child could come by and fall into them. Pretty much all

the shallow groundwater in the Mora area, for example, is contaminated; it is unusable as are most parts of the state that have septic systems. There are, of course, abandoned wells of more conventionally drilled wells all over the state. When I say abandoned, I really mean they are not used and have not been shut down correctly. They are direct routes to contamination. We also inventory contamination sources, point sources of contamination. We find open pipes flowing directly into a river and personal wastewater treatment systems that were probably installed sometime between midnight and 6 am. This situation exists perhaps more than you might imagine it does; if you go out and look for it, you'd be surprised. Non-point source pollution is a primary concern for a lot of systems such as agricultural runoff, grazing, and things like that.

Then the fourth step is to develop a management plan. As I mentioned, most of it is educational at this point. We've started providing communities with well-head protection signs and highway grade signs out of our existing budget. You might have seen them, perhaps not, but I think if you do look you will see them around the state. There are quite a few - over 300 signs around the state. They are educating the community and consumers that they are entering a sensitive area as well as alerting hazardous waste haulers, truckers, and anyone in that area that a spill may impact the community's drinking water source.

We have worked extensively with the New Mexico Environment Department to update our planning process template to make it the best we could without it being a huge burden to the water systems to complete.

A very important part of the planning process is the last step, and that's emergency response planning. This is a very critical and very important activity that we are doing in the state. Source water protection saves money. When you do a source water protection plan you avoid the cost of future remediation dollars. The EPA has done several studies on this; for every dollar you spend on wellhead protection, you save eight dollars in remediation costs. If you look in your packet, Cathy was kind enough to include in my abstract some examples from Arizona and Utah about source-water protection and contamination costs around this area. I haven't been able to find a lot of good information for New Mexico but this stuff happens, and it costs a lot of money. And you folks know that, right? There are a lot of people in the audience whose job it is to remediate these things. You just want to avoid that situation if at

all possible. Now I did mention the emergency response plan. We have talked to a lot of small systems and put on seminars where we talk about homeland security and emergency response. People initially react, "Well that is probably never going to happen to our system in rural New Mexico." Really, the more seminars you attend, and the more you educate yourself on security, the more you realize we need to have something in place for all systems so that they have a plan of action in case something happens. This isn't just going to be terrorist attacks. Water systems may have to respond to events that happen to them, but really have nothing to do with the system. It could be something in the community such as natural disasters, a fire, anything that happens. Water is essential to every activity that we do. If a natural disaster occurs and you do not have an emergency plan in place, it's too late. It's just too late to plan how you are going to deal with that emergency. Our Association staff learned that lesson when we sent some folks to Texas to help with their efforts after Hurricane Rita. The Texas Rural Water Association is by far the largest rural water association with 45 staff members, extremely professional, and they do have an emergency response plan. Their executive director told me they just got blown away by the hurricane. In Louisiana, the Rural Water Association is still responding to the situation, and they will be responding for probably the better part of this coming year.

Now, I mentioned that New Mexico has been comparatively lucky with respect to groundwater contamination. Folks here may want to argue with that. With rural water, we have the opportunity to go to training all across the country. In a lot of these training sessions, I have gone on field trips with other groundwater and sourcewater protection specialists and I have seen what they have dealt with in their states, and it is usually much worse than what we have here in New Mexico. We have septic contamination. Secretary Curry will tell you that it is the largest issue we have in this state. We have a few other issues to deal with, but other states are worse off. They also have better mechanisms to deal with these issues because they have been driven by these problems. We don't have as many ground contamination problems; we don't have as much heavy industry; we don't have the kind of economic development that other states have, but all that is coming, right? You read the newspapers, and certainly that is something that is being

promoted for New Mexico. So right now is the time to plan for the protection of our water sources.

Certainly, the cost of drinking water treatment is ever increasing. The federal government is placing more and more regulatory requirements on systems, and that costs money. Yesterday, we heard about the funding gap for infrastructure repair and replacement throughout the United States. There are different estimates, but take your pick from \$300 billion to \$800 billion over the next 20 years. It's starting to get close to that trillion dollar mark. So this is an incredible amount of money. If we can avert increased treatment cost for contamination it just makes good business sense.

We have federal regulations coming down, the arsenic rule on January 23rd, the groundwater rule, more surface water treatment rules; rules are ever increasing. The radon rule is probably on hold right now but that could be coming soon as well. One of the latest things that EPA is investigating is a distribution system rule. That is really going to affect small systems because they're going to be responsible for maintaining uniform quality of water in all points of their distribution system, which is going to cost a lot of money. They are going to have to test their entire distribution system in a way they have not done before. The groundwater rule is going to impact New Mexico, particularly rural New Mexico. This rule is going to make you responsible for the quality of water in your source.

Conventional wisdom says if you have a bad bacteriological sample, if a sample comes back positive for bacteria, then that probably is from coliform growth in your distribution system somewhere. You then use chlorine at a higher level to flush your system. Well, EPA has done a lot of study on this and actually found that a lot of the bacteria are originating in the source, even in the wells, in the groundwater. Between twenty and thirty years ago we thought, well, groundwater is clean because bacteria and viruses don't move very well through groundwater. Of course we know that is not true today. If you do have a bad bacteriological sample under the groundwater rule as is currently proposed, you're going to have to go back and do source water protection. We really need to get on top of this now. New Mexico systems are struggling with putting in infrastructure. The numbers aren't great right now for New Mexico, but these are large dollars obviously. For smaller systems, it is going to be hard for them to afford this and also for other regulations that are coming.

Other things are on the frontier. Endocrine disruptors are something of a hot topic for those of us who are watching EPA and their regulatory rulemaking scenarios. Endocrine disruptors, you might have heard of them as pharmaceuticals, are a variety of chemicals that we ingest in our water. Pharmaceuticals are a small category of the larger group of endocrine disruptors. They act like hormones in the body and include possibly thousands of chemicals. Right now you can test for these substances in all water sources, including rain. They go right through wastewater treatment; they go right through your body. Are these things bad? Well, they mimic hormones in your body. They cause your body to react if that hormone is present or else they block your receptors so that your hormones cannot act as they should. Or they act in a different way that triggers a reaction that is totally different and may be harmful to your body. I think you can debate whether or not we have too much regulation, whether our water is too clean, but it is hard to say that these health concerns and contaminants like these aren't important. Practically everybody has pesticides in his or her body now. These endocrine disruptors are present in every source of water as I mentioned. Endocrine disruptors may be particularly bad news for the male population, as they often lower testosterone and increase estrogen.

Fish in wastewater treatment outfalls have altered sex characteristics in Colorado. These things are starting to become more and more documented. My point is that regulation is not going to decrease; it is not going to go away. It is going to increase; it is going to be very hard to make an argument that these things aren't important.

We are implementing source water protection plans to address these issues. But here's my point, here's my plea. There are several problems with what we are doing right now. One is that the systems really aren't able to implement the best management practices in the plan. This could be due to funding. They don't have adequate dollars to implement the plan. Or it could be due to a lack of other resources. Most water systems in rural areas in New Mexico are operated by volunteers. The systems are often a mutual domestic water consumers association or they're a cooperative, or they are some other private small volunteer-run system. They don't have any authority to protect their water sources besides the existing federal regulations. They can come up with a great plan, and many of them have. They really jump into source water

protection, develop best management practices. They have a great living, breathing document that doesn't just sit on the shelf. Their community planning team meets and decides this is what they want to do. But really their options, other than education, are very limited because they do not have the authority to protect the water source. I think generally in this state there is a lack of recognition of how important these plans are.

I noticed back there on the table yesterday there was the Trust for Public Land brochure. I think someone here is from the Trust for Public Land. They have a good document about source water protection. They have best management practices for source water protection. Let's see how we are doing with their best management practices. We are certainly incorporating the voluntary strategies in the plan, but regulatory strategies; very few folks other than municipalities are doing land-use regulation or any other kind of regulatory strategy for source water protection.

What is our long-term vision in New Mexico for source water protection? This is a legacy that we are going to hand to our children. They are going to have to deal with the decisions that we make today. Having measurable goals is tough. We really don't have funding sources in place for anybody to implement these plans. Municipalities pay for it on their own dime. The plans that we prepare are largely free, they are voluntary, and we could be doing better. We have got to find a way to fund this.

Now let's look at collaboration. Certainly you need to collaborate with your consumers because they are key to your water system. If you don't have the support of your consumers, nothing you do is going to be successful. I think we are doing this through our current process. We are involving the local stakeholders through the planning teams. Certainly water systems can band together with each other. That does occur. There's a good example down here in Doña Ana County. There is an alliance of several systems banding together for mutual aid. There is a Western Mora County Unified Source Water Protection Council. They have been around for quite sometime, and they have united just to protect their water source. These are good strategies. However, if you don't partner with someone who has authority to regulate land-use regulation, it's only going to get you more education, maybe more political pull. Certainly partnering with state agencies is critical and there has been a lot of progress made in this area recently. I'll talk a little more about that.

The NMED has started an initiative to integrate all of their information, especially their locational information across the entire department so that all the individual bureaus that are pulling together information for septic tanks or water sources are going to be able to share that information, if they're not already. Now there is the ability for the groundwater permitting section to look at source water protection areas when they are permitting a septic tank. This has already been happening somewhat but not on the scale and not as the coordinated effort that is being done now. I think the NMED is to be commended for this effort. It's critical.

Land-use regulation is most effective through the counties. It seems to be where it makes more sense to work with. I know several water systems have told me, "Well, I don't want to work with my county; they're a problem." Somehow we need to encourage breaking down these barriers. This is the challenge that I'm giving to you. There are a lot of people in

...anywhere in the United States you can go and drink a glass of water and be reasonably sure that it is safe to drink. That is an amazing thing, which most people take for granted.

this room who are very influential in this field, and this is something we need to support. We need to support counties working with systems and other local governments; the Councils of Governments (COGS) are a good mechanism to work through. Municipalities can be a good partner if there is a rural system nearby, although sometimes that is not possible. I certainly don't want to leave out tribal water systems. They are in a unique position because they do have authority to manage their land use. We have a contract awarded through the EPA to work with the Region 6 Tribes and Pueblos. They have some great models out there for source water protection plans. They have different challenges. Often their challenge is to coordinate their different departments including their utility department, tribal council, housing, whatever departments they have, and try to get them to work together. As a sovereign nation, they have a different scenario. We can learn from a tribal water systems planning process. I actually think that some of the best source water protection plans in the state are on tribal lands.

State government: this is an area where leadership is needed and should be provided. If we can't work through the counties perhaps the state government and the legislature are going to have to implement a solution, or they can just promote and help us advance this.

Please support your drinking water and wastewater personnel. They are the first line of defense for public health. If you don't have a good operator for your system, you have a major public health threat. Yesterday somebody mentioned that anywhere in the United States you can go and drink a glass of water and be reasonably sure that it is safe to drink. That is an amazing thing, which most people take for granted. Dr. Catlett also said, "Give them what they want, when they want it, and where they want it, and price is not an issue." Well water is the exception to that, right? We give you high quality water where ever you want it. There is probably a tap somewhere near you virtually all of the time where you can get water, it is very convenient, and it is safe. But people don't even view it as a market good, so price is still an issue. So support those personnel.

Advocate source water protection. If you are interested in becoming involved certainly build partnerships. Today I am here trying to educate, but it's the politicians who can provide leadership to avert the looming crisis. It may be a regulatory crisis, it may be a financial crisis, or it may be truly a crisis of contaminated groundwater.

I would also recommend that you maintain the voluntary nature of this program. A lot of times people suggest this should be mandatory. It actually works very well voluntarily. It is by far the most successful voluntary program that the EPA has ever implemented. But it does need to have support. It does need to have regulatory support or the plans will not remain viable. It does allow folks to maintain local control over their water source and land use and provide them a stake in it. Somehow we need to provide funding for these folks to implement the plans. The Environment Department is talking about providing recognition through the office of the Governor or in some other way.

Folks may say, too, that we should be looking at watershed protection. That is another comment I get frequently. And that's true, watershed protection is critically important. It does affect your drinking water source and your source water. However, I think that we need to start here with the drinking water plans and try to implement this. It would be great to expand that to full watershed protection.

Regarding the counties, I do have one statistic I want to end with today. That is, the National Association of Counties surveyed 180 counties and found that fewer than 24 percent own or operate a drinking water system. But over 50 percent reported that they have statutory land-use authority to protect drinking water sources. Now there are counties here in New Mexico that have that statutory authority, but it is just not really happening.

With that I think I did go over my time. Is Secretary Curry here? I thank you very much. We may have time for a couple of questions while he is getting situated.

Q: It seems to me there is a sort of contradiction. I understand you are favoring the voluntary nature of source water protection, but how do you reconcile that with the obvious need as you say for protection?

A: The perspective I am coming from is that we are already putting a lot of regulatory burden on water systems. We are telling them a lot of things that they have to do. Then a technical assistance provider comes in and says here is something you can do for yourself that will yield the following benefits. They do this not because they have to do it, but because they want to do it. A whole other set of outcomes happens because of that. It is a good point. I think that certainly counties or the state, if they want to implement this and require it as a condition of funding, that may be a good idea. I think that does make sense, but the reason why I would maintain the voluntary nature is that the only pay volunteers receive is recognition, and if we force them to do something, they may not want to invest their time into doing it. Right now source water protection planning is something that is more than just lip service, it is more than just a plan that you are going to put on the shelf.

Thank you.

Estevan López was appointed as the Director of the Interstate Stream Commission by Governor Bill Richardson in January 2003. He also serves as the Deputy State Engineer. Estevan is a registered professional engineer in New Mexico and served as County Manager for Santa Fe County from 2001 to 2002. He was the Land Use and Utility Director for Santa Fe County from 1997 to 2000. A native New Mexican, he has a Bachelor of Science degree in chemistry and a Bachelor of Science degree in petroleum engineering from New Mexico Tech.



NEW MEXICO'S EXPERIENCE WITH INTERSTATE WATER AGREEMENTS

John Whipple and Estevan López
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102

INTRODUCTORY REMARKS

The State of New Mexico and its neighboring states have negotiated and utilized interstate compacts and related agreements as means to resolve controversy among the interests of the states and their water users over the water supplies of interstate stream systems. Compacts or related agreements often were required to obtain Congressional authorization and federal financing of reservoir and irrigation projects. Some compacts preserve the status quo in water use or deliveries, while others guarantee allocations of water for future development. All compacts were drafted to address specific concerns in the respective basins, and thus are as varied in their provisions as the conditions in each basin.

Implementation of the compacts has been controversial, in some cases resulting in continual arguments over one or more states' obligations under a compact and in other cases resulting in interstate litigation. New Mexico is party to eight interstate compacts and three US Supreme Court decrees that govern the use of interstate stream systems. Actions of Congress also have supplemented the provisions of the compacts. This paper summarizes the history of compact development and administration by basin, related litigation and Congressional action, and related current challenges.

COLORADO RIVER BASIN

Colorado River Compact

In the early 1900s, southern California sought federal assistance to construct a high dam on the mainstream of the Colorado River to provide water supplies for its agricultural and municipal growth. To obtain federal financing, California needed the consent and help of the other Colorado River Basin states. The other states were concerned that under the prior appropriation doctrine, fast growth in California's development of Colorado River water might preempt their ability to later develop water supplies in the basin to meet their future needs. The states in the Upper Colorado River Basin desired a guaranteed allocation of the waters of the basin in exchange for their support of a high dam on the Lower Colorado River.

After much negotiation, the Colorado River Compact was signed by Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming in 1922, and was subsequently ratified by the legislatures of all respective states except Arizona. In 1928, Congress, in the Boulder Canyon Project Act, approved the compact and authorized construction of the high dam on the Colorado River. The Colorado River Compact apportions the use of waters of the Colorado River System to the Upper Basin and to the Lower Basin. Parts of Arizona, Colorado, New Mexico, Utah, and Wyoming constitute the Upper Basin. The Lower Basin includes parts of Arizona, California, Nevada, New Mexico, and Utah. The consent of the United States to the compact was conditioned by Section 4(a) of the Boulder Canyon Project Act upon the California legislature passing a Limitation Act whereby the authorized dam (now Hoover Dam) would be built only if California would agree to limit its annual consumptive use to 4.4 million acre-feet per year of the 7.5 million acre-feet per year apportioned to the Lower Basin by Article III(a) of the compact, plus not more than one-half of any excess or surplus waters not apportioned by the compact. California met this requirement by enacting the California Limitation Act in 1929, after which the President of the United States in 1929 proclaimed the compact effective even though Arizona had not ratified it. Arizona opposed the compact and the Boulder Canyon Project Act for years, including via litigation in the US Supreme Court, but finally ratified the compact in 1944.

To administer the provisions of the compact, Article V of the compact provides that each signatory

state, through the state official charged with water rights administration, together with the directors of the US Bureau of Reclamation and the US Geological Survey, cooperate to promote the systematic determination and coordination of the facts as to flow, appropriation, consumption, and use of water in the Colorado River Basin; ascertain and publish the annual flow of the Colorado River at Lee Ferry, the point of division between the Upper and Lower basins; and perform such other duties as may be assigned by mutual consent of the signatory states. Article VI of the compact provides that controversies between two or more signatory states relating to the compact may be adjusted by commissioners appointed by the Governors of the states affected, subject to ratification by the legislatures of said states. No action has ever been initiated under this provision.

Articles III(a) and III(b) of the Colorado River Compact apportion from the Colorado River System to the Upper Basin and to the Lower Basin the beneficial consumptive use of 7.5 million acre-feet and 8.5 million acre-feet, respectively, of water per year. The Colorado River System is defined by the compact as that portion of the Colorado River and its tributaries within the United States. In addition, Article III(d) provides that the States of the Upper Division (Colorado, New Mexico, Utah, and Wyoming) will not cause the flow of the Colorado River at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of ten consecutive years.

Article III(c) provides that the States of the Upper Division are obligated to deliver at Lee Ferry whenever necessary additional amounts of water to supply one-half of the deficiency in the availability of surplus water to Mexico to satisfy any right in Mexico to the use of waters of the Colorado River System that may be recognized by the United States. Under the 1944 treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, which took decades to negotiate and was ratified by the US Senate and proclaimed by the President in 1945, normal water deliveries to Mexico on the Colorado River are scheduled at 1.5 million acre-feet per year.

Article III(e) of the compact provides that the States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses.

The Upper Colorado River Basin Compact of 1948 allocated among the Upper Basin states the

consumptive use apportioned to the Upper Basin by Article III of the Colorado River Compact. No such compact was negotiated to allocate among the Lower Basin states the consumptive use apportioned to the Lower Basin. But Arizona needed to settle the allocation of water from the Colorado River mainstream to obtain Congressional approval for a project to provide Colorado River water for agricultural uses and municipal growth in central Arizona.

In 1952, the US Supreme Court granted Arizona leave to file a complaint against California and seven municipal organizations of that state in order to determine the relative rights of those two states to utilize the waters of the Colorado River (*Arizona v. California, et al.*, US Supreme Court No. 8, Original). The United States and Nevada intervened in the suit, and New Mexico and Utah were made parties in their capacities as Lower Basin states only. After extensive evidentiary hearings before the special master from 1956-1958 and subsequent briefings and arguments before the special master and the Court, the Court in 1964 entered a decree that apportioned between the States of Arizona, California and Nevada the water supply available from the mainstream of the Colorado River in the Lower Basin in accordance with the apportionment of mainstream water provided by the Boulder Canyon Project Act, which authorized construction of Hoover Dam and its impoundment Lake Mead. With the allocation of Colorado River mainstream water in the Lower Basin confirmed by the 1964 decree, Arizona could seek from Congress the authorizations and funding necessary for the Central Arizona Project to provide a means for Arizona to utilize her allocation, which project was subsequently authorized in 1968 by the Colorado River Basin Project Act (Public Law 90-537). The Court, however, did not interpret the Colorado River Compact, and it did not apportion tributaries in the Lower Basin except for the Gila River Basin as between New Mexico and Arizona.

In order to allow the States of the Upper Basin to develop and use, consistently with the provisions of Articles III(d) and III(c) of the Colorado River Compact, the apportionment of water to the Upper Basin made by Article III(a) of the compact, Congress, in the Colorado River Storage Project Act of 1956 (Public Law 84-485), authorized the Colorado River Storage Project to regulate the flow of the Colorado River and several complementary water projects. The

largest project feature authorized was Lake Powell formed by Glen Canyon Dam and located just upstream from Lee Ferry. Pursuant to Section 602 of the Colorado River Basin Project Act of 1968, the Secretary of the Interior, in consultation with the seven basin states, in 1970 approved the Long-Range Operating Criteria for the coordinated operation of Colorado River System reservoirs, including for the storage and release of water from Lake Powell that addresses the delivery of water under Articles III(c), III(d) and III(e) of the Colorado River Compact.

In response to abundant water supplies in the basin in the late 1990s and uses by California in excess of her basic apportionment of 4.4 million acre-feet under the 1964 decree in *Arizona v. California*, the Secretary, in consultation with the basin states, in 2001 supplemented the Long-Range Operating Criteria by adopting interim surplus guidelines effective through 2016 on which to base determinations of surplus allocations of water from Lake

Mead for Lower Basin water uses. Now, in response to low reservoir storage resulting from a critical five-year drought in 2000-2004, the Secretary, again in consultation with the basin states, is working on development of criteria for coordinated reservoir operations during low storage conditions, including interim shortage guidelines on which to base determinations and allocations of shortage from Lake Mead to water uses in the Lower Basin and Mexico.

In the development and implementation of the Long-Range Operating Criteria, critical Colorado River Compact interpretations have been avoided or delayed. No determinations have been made as to the accounting of tributary uses and reservoir evaporation in the Lower Basin as against the basic apportionment to the Lower Basin made by Articles III(a) and III(b) of the compact. Nor have any determinations been made as to the burden of the deficiency, if any, of meeting delivery obligations of the United States to Mexico under the 1944 Mexican Water Treaty. Because of unresolved differences between the Upper

With the allocation of Colorado River mainstream water in the Lower Basin confirmed by the 1964 decree, Arizona could seek from Congress the authorizations and funding necessary for the Central Arizona Project...

Division States and the Lower Division States over the obligation of each to provide water to meet the Mexican Treaty delivery obligation, the Long-Range Operating Criteria provides for a minimum objective release from Lake Powell of 8.23 million acre-feet per year, which includes one-half of the Mexican Treaty delivery. The minimum objective release continues to this day to be controversial, and the 2000-2004 drought and consequent decline in Colorado River System storage has resulted in an increased level of concern in the Upper Division States. To date, the ability of the Upper Division States to develop the apportionment to the Upper Basin has not been impaired.

Pursuant to the requirements of Section 11 of Public Law 87-483, the State of New Mexico recently requested the Bureau of Reclamation to make a hydrologic determination that sufficient water is available within the State's Upper Basin apportionment to provide for domestic uses of the Navajo Nation in New Mexico under the proposed Navajo-Gallup Water Supply Project. Implementation of the proposed project is a key component of the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement that the State of New Mexico and the Navajo Nation signed in April 2005. If the Settlement Agreement were approved by Congress, the proposed project would develop the remainder of New Mexico's Upper Basin apportionment. The proposed project would divert water in the Upper Basin for use in the Upper Basin, the Lower Basin and the Rio Grande Basin. Based on section 303(d) of the Colorado River Basin Project Act, which provides a model for Congressional authorization of a specific diversion of water from the Upper Basin for use in the Lower Basin portion of an Upper Basin state, the Upper Colorado River Commission in 2003 by resolution approved the proposed use of New Mexico's Upper Basin water in the Lower Basin of New Mexico. The model provides a basis for resolution of conflicting provisions of existing law to permit an Upper Basin state to utilize its Upper Basin apportionment anywhere within its boundaries.

The provisions of the 1964 decree in *Arizona v. California* relating to the apportionment of Gila River Basin water limit the amounts of irrigated acreage and consumptive use from the Gila River, its tributaries and underground water sources in New Mexico by stream segments to uses existing as of 1960, including

uses in the Virden Valley under the Gila River decree of 1935 (Globe Equity No. 59). Neither Arizona nor New Mexico were party to the Gila River decree. To obtain New Mexico's support for the Central Arizona Project and provide a renewable water supply for future growth in southwestern New Mexico, the Colorado River Basin Project Act of 1968 authorized a New Mexico unit of the Central Arizona Project named Hooker Dam or suitable alternative. Section 304 of the Act authorized New Mexico through Hooker Dam or suitable alternative to increase consumptive use of water from the Gila River Basin by an average of up to 18,000 acre-feet per year, over and above the uses permitted under the decree in *Arizona v. California*; provided, that such increase does not cause economic injury or cost to downstream water rights senior to September 30, 1968, and that contracts are entered between water users in New Mexico and the Secretary of the Interior to provide for the use of the water in New Mexico and the delivery of Colorado River water, via the Central Arizona Project, to downstream users in Arizona in quantities sufficient to replace any diminution of their supply resulting from the use in New Mexico. The Arizona Water Settlements Act of 2004 amends the Colorado River Basin Project Act by limiting the increased consumptive use from the Gila River Basin in New Mexico to an average of 14,000 acre-feet per year, including reservoir evaporation, and approving specific diversion bypass parameters to protect downstream water rights in New Mexico and Arizona.

There are several major challenges ahead for New Mexico and the other Colorado River Basin states as to management of the Colorado River System within the framework of the Colorado River Compact. It is critical to the States of the Upper Division that Lake Powell be operated to ensure that Article III(d) of the compact can be met to avoid compact calls for curtailment of Upper Basin uses. This objective is an integral part of current discussions between the Secretary of the Interior and the seven basin states on the possible development of criteria for coordinated operations of Lake Powell and Lake Mead during low storage conditions. Shortage guidelines on which to base determinations and allocations of shortage from Lake Mead to water uses in the Lower Basin and Mexico need to be developed either independently or in conjunction with low-storage reservoir operating criteria. The Secretary plans to develop shortage guidelines or low-storage reservoir operating criteria

by the end of 2007, which may be only interim guidelines or criteria.

Also, the obligation of the Upper Division States under Article III(c) of the compact to deliver water to Lee Ferry for meeting the 1944 Mexican Water Treaty delivery needs to be determined by quantification of surplus and deficiency. Any release from Lake Powell at Glen Canyon Dam that is in excess of the release needed to comply with Article III of the compact reduces the yield available for consumptive use in the Upper Division States. Determining the deficiency and the Article III(c) obligation would involve system-wide accounting of consumptive uses, including on Lower Basin tributaries. Lower Division States do not agree with Upper Division States' positions that the apportionment of 8.5 million acre-feet of consumptive use to the Lower Basin under Articles III(a) and III(b) of the compact includes mainstream reservoir evaporation and uses on the Lower Basin tributaries such as the Gila and Little Colorado Rivers. Lower Basin mainstream reservoir evaporation currently amounts to about 1 million acre-feet per year, and Lower Basin tributary uses currently amount to about 2 million acre-feet per year.

Use by the Lower Basin in excess of its compact apportionment would result in lowering water levels in Lake Mead and could result in increased releases from Lake Powell to protect the Southern Nevada Water Authority's intake in Lake Mead to supply municipal water to the Las Vegas metropolitan area and to protect the power head at Lake Mead. The Upper Division States are concerned that such increased demands might increase the threat of a call against the Upper Basin. In addition, Nevada has nearly reached full use of her 300,000 acre-feet of mainstream water apportioned by the Boulder Canyon Project Act and *Arizona v. California*, and southern Nevada is looking for more water to support one of the fastest growing metropolitan areas in the country. The Southern Nevada Water Authority has announced its intention to divert and use for municipal purposes in and near Las Vegas water from the Virgin River, a Lower Basin tributary above Lake Mead. Nevada may contend that such tributary use is not accountable under the Colorado River Compact or *Arizona v. California*, similar to the position taken by Arizona on its tributary uses from the Little Colorado River.

Controversies among the basin states will require resolution of technical, legal and institutional issues. In connection with the process to develop Lower Basin

shortage guidelines and to evaluate low-storage operating criteria for Lakes Powell and Mead, the seven basin states have requested the Secretary of Interior to consider a suite of activities, including water supply augmentation, phreatophyte eradication and specific water conservation measures for coordinated future water management in the Colorado River Basin and to continue to work with the states on these issues.

The United States and the seven basin states have a significant challenge to comply with salinity control mandates of the International Boundary and Water Commission. The salinity of deliveries to Mexico under the 1944 Mexican Water Treaty began increasing in 1961 in response to the discharge of saline water drainage wells from the Wellton-Mohawk Division of the Gila Project into the Colorado River below the Imperial Dam but above the Mexican point of diversion. At the end of 1961, Mexico objected to the salinity of the Colorado River waters being delivered. The State Department, in consultation with the Committee of Fourteen (two representatives each appointed by the Governors of the seven basin states), in 1965 negotiated Minute 218 of the International Boundary and Water Commission, which was a five-year agreement on practical measures to reduce the salinity of the waters reaching Mexico. Minute 218 was extended through 1971, and Minute 241 provided temporary solutions to the salinity problem for 1972-1973.

After further negotiations between the United States and Mexico and State Department consultations with the Committee of Fourteen, Minute 242 of the International Boundary and Water Commission in 1974 provided the permanent and definitive solution to the Colorado River salinity problem. Minute 242 provides a quantitative salinity standard for deliveries under the 1944 Mexican Water Treaty that reflects little deterioration in water quality between the salinity of water available in the Colorado River to United States water users at Imperial Dam and the salinity of water available in the Colorado River to Mexico water users at Morelos Dam. Minute 242 also provides, among other things, for the bypass of Wellton-Mohawk drainage water to the Santa Clara Slough in the Gulf of California. In response to Minute 242, the Congress in 1974 passed the Colorado River Basin Salinity Control Act (Public Law 93-320).

Title I of the Act authorized the Yuma Desalt Plant to desalinate Wellton-Mohawk drainage water for delivery to Mexico under the treaty. Because the Yuma

Desalt Plant is very expensive for the United States to operate, it has remained on standby status since 1993 and drainage water has continued to be bypassed to

Environmental organizations also have sought delivery of Colorado River water in excess of the 1944 Mexican Treaty obligation for delivery to the Colorado River delta for habitat needs of species in Mexico.

the Santa Clara Slough without being accounted as a delivery to Mexico under the treaty. The basin states support operation of the plant with delivery of desalted water to the Colorado River so as to lessen the burden on the basin states of providing water for Mexican treaty deliveries;

however, environmental organizations believe the delivery of untreated drainage water to Santa Clara Slough should continue to protect the slough as an environmental resource. Environmental organizations also have sought delivery of Colorado River water in excess of the 1944 Mexican Treaty obligation for delivery to the Colorado River delta for habitat needs of species in Mexico. Minute 306 established a framework for joint United States-Mexico studies of the ecology of the delta region. The seven basin states oppose any delta restoration measures that would involve delivery of Colorado River water in excess of the current treaty delivery obligation.

Title II of the Act authorized the study, construction, operation and maintenance of salinity control projects to be undertaken to reduce salt loadings throughout the Colorado River Basin. Salinity projects implemented include Reclamation salinity control projects and Department of Agriculture on-farm salinity reduction programs. The Colorado River Basin Salinity Control Forum was created by the basin states for the purpose of developing and recommending basin-wide water quality standards for salinity, which are then adopted by the states. Through the forum, the basin states recommend salinity control projects and cost-sharing for the projects. Greater reductions in salinity loadings will be needed in the future to offset the effects on salinity concentrations of continued water resource development in the Colorado River Basin, primarily

in the Upper Basin, and meet the water quality standards for salinity.

Upper Colorado River Basin Compact

In order to provide for the development of water projects in the Upper Basin, the Upper Basin states in 1946 began negotiations of a compact to effectuate a division of the Colorado River waters apportioned to the Upper Basin by the Colorado River Compact. The Upper Colorado River Basin Compact was signed by Arizona, Colorado, New Mexico, Utah and Wyoming in 1948, and was approved by Congress in 1949. The compact creates the Upper Colorado River Commission to administer its provisions, with members of the commission representing the United States, Colorado, New Mexico, Utah and Wyoming. Arizona is not included on the commission. The Upper Colorado River Commission maintains an office and staff in Salt Lake City, Utah.

Article III of the Upper Colorado River Basin Compact provides an allocation among the Upper Basin states of the apportionment of water from the Colorado River System made to the Upper Basin by Article III of the Colorado River Compact. Arizona is allocated a fixed 50,000 acre-feet of consumptive use annually, and the states of Colorado, New Mexico, Utah and Wyoming are allocated percentage shares of the amount remaining available to the Upper Basin. Article IV of the compact provides for the curtailment of uses within the States of the Upper Division when necessary to meet the requirements of Article III of the Colorado River Compact. Article X of the compact incorporates the 1922 La Plata River Compact to apportion waters of the La Plata River and its tributaries between Colorado and New Mexico. Article XIV of the compact provides that Colorado deliver to New Mexico from the San Juan River and its tributaries which rise within the State of Colorado a quantity of water which shall be sufficient, together with water originating in the San Juan River Basin in New Mexico, to enable New Mexico to make full use of the water apportioned to New Mexico by Article III of the compact; subject, to recognition of first and prior rights for water uses existing and federal water projects authorized as of October 11, 1948, to sharing of physical water supply shortages between uses not so recognized that are dependent upon a common source of water, to preferential uses of water to which Indians are entitled, and to any curtailment of water use by either state to comply with Article IV.

The Upper Basin states, with cooperation from the Department of the Interior, have been working toward development of their compact apportionments. Several substantial federal water projects have been developed in the Upper Basin pursuant to the Colorado River Storage Project Act of 1956, Public Law 87-483, the Colorado River Basin Project Act and other Congressional authorizations. The Upper Colorado River Commission has not had to make any significant finding of fact or decision on administration of provisions of the compact relating to curtailment of use in order to meet the requirements of Article III of the Colorado River Compact, primarily because the Upper Basin use has not approached full development of the yield available to the Upper Basin at Lee Ferry. In recent years, the Commission has directed major effort toward the operation of Lake Powell and Lake Mead, including annual operation plans, the Glen Canyon Adaptive Management Program and endangered species issues. The 2000-2004 period brought the most severe five-year drought recorded on the Colorado River, which severely depleted storage in the Upper Basin and raised concern over the operation of Lake Powell under the Long-Range Operating Criteria. Discussions continue among the seven Colorado River Basin states and the Department of the Interior regarding the operation of the Colorado River System reservoirs. The operation of Lake Powell affects the yield available to the Upper Basin at Lee Ferry under Article III of the Colorado River Compact.

Upon review of the Hydrologic Determination prepared by the Bureau of Reclamation in 1988 and signed by the Secretary in 1989 which studied the yield available to the Upper Basin under varying assumptions of Lake Powell operations, the Upper Colorado River Commission by resolution determined that the yield available to the Upper Basin at Lee Ferry is at least 6.0 million acre-feet per year. Based on this estimate, the State of New Mexico and the Navajo Nation negotiated provisions of the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement that provide for full development of the remainder of New Mexico's share of the Upper Basin yield allocated by Article III of the Upper Colorado River Basin Compact without displacing existing water users in New Mexico. The Settlement Agreement recognizes that Navajo Nation uses in the Upper Basin in New Mexico must be subject to New Mexico's obligations under the Colorado River and Upper Colorado River Basin

compacts. The Secretary, in consultation with the Upper Division States, must update the Hydrologic Determination to determine whether sufficient water is available within New Mexico's share of the yield available to the Upper Basin to source the proposed Navajo-Gallup Water Supply Project that is a major component of the settlement. Obtaining Congressional approval of the Settlement Agreement is likely to be as large or larger a challenge as was negotiating the agreement. The proposed settlement would cost almost \$1 billion in current dollars to implement.

The Upper Colorado River Commission in the coming years has the challenge to protect the yield available to the Upper Basin under Article III of the Colorado River Compact. Again, it is critical to the States of the Upper Division that Lake Powell be operated to ensure that Article III(d) of the compact can be met and to avoid compact calls on Upper Basin uses. At the same time, the commission must be prepared to implement, pursuant to Article IV of the Upper Colorado River Basin Compact, curtailments in the Upper Basin, if and when necessary, to comply with Articles III(c) and III(d) of the Colorado River Compact. Part of this preparation involves determining the methodologies for computing consumptive uses in the Upper Basin chargeable against the compact apportionments.

The commission and the Upper Basin states also participate in activities of the Glen Canyon Adaptive Management Program formed by the Secretary of the Interior as a consequence of the Grand Canyon Protection Act. As the Secretary receives input from the program on ways to operate Lake Powell at Glen Canyon Dam to conserve sediment and biological resources in Glen, Marble and Grand Canyons, the objective of the Upper Division States in the program is to protect the authorized purposes of Lake Powell and Glen Canyon Dam and to ensure that water is not released from Lake Powell to the impairment of uses in the Upper Basin. Also, the States of the Upper Division continue to participate in endangered fish species recovery efforts in the Upper Colorado River Basin with an objective to meet endangered fish habitat needs and recovery goals while development of the states' Upper Basin apportionments proceeds. Colorado, Utah and Wyoming participate in the Upper Colorado River Endangered Fish Recovery Program that covers the Upper Colorado, Green and Yampa rivers in the Upper Basin, and Colorado and New Mexico participate in the San Juan River Basin

Recovery Implementation Program that covers the San Juan River.

The annual costs of the three environmental programs currently total about \$16 million per year and are funded by revenues obtained from the sale of hydroelectric power produced at Colorado River Storage Project units. Such power production has declined with storage levels during the recent drought, and could be suspended at Lake Powell if the drought continues and storage in Lake Powell drops to minimum power pool. Although the use of water for hydroelectric power generation is subservient to the use of water for domestic and agricultural purposes under Article IV of the Colorado River Compact, continued development of the Upper Basin apportionment is dependent upon the environmental programs and implementation of capital recovery projects funded jointly by the United States, the Upper Division States and power revenues for Endangered Species Act compliance. Also, the operation and maintenance of federal water projects, and to some extent salinity control projects, in the Upper Basin, including Glen Canyon Dam, are funded from Colorado River Storage Project power revenues. Obtaining alternate funding for project operations and for the environmental programs may become a challenge if Lake Powell storage drops below minimum power pool.

La Plata River Compact

The La Plata River is a small tributary to the San Juan River. The snowmelt runoff in the La Plata River typically ends at the beginning of the summer, and low base flows during the summer and fall are insufficient to meet the water demands of all users on the stream system in Colorado and New Mexico. Irrigation ditch diversion rights in Colorado and New Mexico had been decreed in separate actions by district courts, but an equitable apportionment was needed between the states to attempt to resolve controversy between the water users in both states as to their relative rights to waters of the La Plata River drainage. The La Plata River Compact was signed by Colorado and New Mexico in 1922 and approved by Congress in 1925. The compact provides that the state engineers of the two states daily shall administer its provisions. In 1938, the US Supreme Court rendered a final decision on appeal in the case of *Hinderlider v. La Plata River and Cherry Creek Ditch Company* that upheld the La Plata River Compact and found that an

equitable apportionment of the waters of an interstate stream made by compact between two or more states with the consent of Congress is binding on the citizens of each state and all water claimants or appropriators within the states party to the compact.

Article II.2 of the La Plata River Compact provides that on each day between February 15 and December 1 of each year, Colorado must deliver to New Mexico at the state line a quantity of water equivalent to one-half the mean flow at the Hesperus Station in Colorado for the preceding day, but not to exceed 100 cubic-feet-per-second. Article II.3 of the compact provides that the state engineers of the two states may, in the alternative, rotate the use of the waters of the La Plata River between the two states for such periods of time as the state engineers may jointly determine. Article II.4 of the compact provides that Colorado is not required to deliver any water not then necessary for beneficial use in New Mexico.

Disputes between the state engineers of Colorado and New Mexico as to Colorado's compliance with Article II.2 of the La Plata River Compact have continued for decades. At issue from time to time most years is Colorado's unilateral determinations of New Mexico's beneficial use demand and Colorado's unilateral determinations that curtailing her water uses or otherwise adjusting her operations within the La Plata River Basin to meet the Article II.2 obligation are either not subject to the compact or are futile. Colorado essentially turns the compact, and compact deliveries, on and off at her discretion. Each year on the La Plata River brings the same challenge of trying to make Colorado more responsive to her compact delivery obligation.

Animas-La Plata Project Compact

The Animas-La Plata Project was authorized in 1968 by the Colorado River Basin Project Act to provide for municipal, industrial and agricultural water supply development in the Animas and La Plata river basins in both Colorado and New Mexico. Included in the authorization was Congressional approval of the Animas-La Plata Project Compact, an interstate agreement between the States of Colorado and New Mexico. The legislatures of both states ratified the compact in 1969.

The Animas-La Plata Project Compact provides that the right to store and divert water in Colorado and New Mexico from the Animas and La Plata river systems for uses in New Mexico under the Animas-

La Plata Project shall be of equal priority with those rights granted by decree of the Colorado state courts for the uses of water in Colorado for the project, providing that such uses in New Mexico are within the allocation of water made to that state by Articles III and XIV of the Upper Colorado River Basin Compact. New Mexico uses under the project are thus protected from more junior appropriations and further water development within Colorado. The Colorado Ute Settlement Act Amendments of 2000 amended the project authorization to a smaller municipal and industrial water supply project, but did not affect the project compact. Project construction is anticipated to be completed in 2011, and the Bureau of Reclamation has established a project operations committee to determine how the project will operate to both bypass direct flow and pump water to off-stream storage for the delivery of water to Colorado and New Mexico project contractors with equal priority.

RIO GRANDE BASIN

Rio Grande Compact

Controversy over the apportionment of the waters of the Rio Grande between irrigators in southern New Mexico's Mesilla Valley against irrigators downstream around El Paso, Texas, and Juarez, Mexico, began prior to the turn of the twentieth century. A need to resolve the controversy arose in the early 1900s out of growth in water use in the San Luis Valley in Colorado that further depleted base flow in the lower Rio Grande and competing plans for reservoirs to capture spring snowmelt runoff at Elephant Butte for uses in New Mexico and at the international boundary for uses in Texas and Mexico. Texas and Mexico claimed priority of right over uses in southern New Mexico. After years of debate among affected interests, including on the floors of Congress and in court, the National Irrigation Congress in 1904 endorsed a plan prepared by the US Reclamation Service to construct a storage reservoir at Elephant Butte to provide irrigation service to lands in southern New Mexico and Texas through a distribution system that would become known as the Rio Grande Project and to provide water to Mexico to satisfy that country's demands if a treaty could be negotiated.

In 1905, Congress enacted legislation to extend the 1902 Reclamation Act to the El Paso Valley in Texas and also authorized the Reclamation Service to

construct works to deliver waters of the lower Rio Grande to water users in the Rio Grande Project based on the results of its irrigable lands surveys. In 1906, Congress ratified a treaty providing for the delivery each year of 60,000 acre-feet of water to Mexico at the head of the Acequia Madre on the Rio Grande near El Paso, Texas. The 1906 treaty between the United States and Mexico was proclaimed by the President in 1907. Elephant Butte Dam was completed in 1916, and the Reclamation Service subsequently finished its surveys and determined that the Rio Grande Project would serve 88,000 acres in New Mexico and 67,000 acres in Texas. Water users in both states endorsed these allotments.

In the meantime, an embargo limiting development of Rio Grande waters on public lands in Colorado and New Mexico that had been instituted by the Secretary of the Interior in 1896 remained in effect. After the Colorado River Compact was signed in 1922, Colorado and New Mexico began attempts to negotiate a compact to apportion Rio Grande waters. Such a compact, it was felt, might then result in the embargo being lifted as desired by residents of the Middle Rio Grande Valley in New Mexico and the San Luis Valley in Colorado. Concerns grew in the 1920s that expansion of irrigation in the Middle Rio Grande Valley and the San Luis Valley might undermine the allotments within the Rio Grande Project. After several years passed, compact negotiations began in earnest in 1928.

The 1929 Rio Grande Compact signed by Colorado, New Mexico, and Texas and approved by the United States provided for the maintenance of the status quo of the Rio Grande above Fort Quitman, Texas, for a period of six years until a permanent compact could be negotiated to apportion the waters of the Rio Grande among the states and suggested that the United States construct a drain from the Closed Basin area of the San Luis Valley in Colorado to the Rio Grande to compensate for 60,000 acre-feet of Rio Grande water dedicated for delivery each year to Mexico by the 1906 treaty. Events subsequent to completion of the 1929 Rio Grande Compact, including the Great Depression, disagreement among the states and a lawsuit brought by Texas in the US

[Animas-La Plata] Project construction is anticipated to be completed in 2011...

Supreme Court in 1935 against New Mexico and the Middle Rio Grande Conservancy District alleging violations of the compact and interference with the water rights of the Rio Grande Project, did not allow for negotiation of a permanent compact prior to the expiration date of the 1929 compact. However, by action of the respective state legislatures, the 1929 compact was extended to allow completion of the Rio Grande Joint Investigation which had been undertaken by the United States in response to requests by the states. The *Texas v. New Mexico* suit was held in abeyance until final action on the permanent compact was taken by the affected states and the Congress.

The 1938 Rio Grande Compact was signed by Colorado, New Mexico and Texas in 1938, and was ratified by the respective state legislatures and approved by Congress in 1939. The 1938 Rio Grande Compact apportions the waters of the Rio Grande above Ft. Quitman, Texas, among the three states. Articles III and IV of the compact establish annual water delivery schedules for the States of Colorado and New Mexico, respectively, and Articles VI, VII and VIII limit water storage and accruals of debits and credits in deliveries from year to year. To administer the provisions of the compact, the compact provides for a commission consisting of the state engineers of Colorado and New Mexico, a commissioner appointed by the Governor of the State of Texas, and a representative of the United States. The Rio Grande Compact Commission has adopted Rules and Regulations for administration of the compact, including for measurement and accounting of deliveries of water, storage of water and credits and debits under the compact.

The Article IV delivery schedule set New Mexico's deliveries at San Marcial at the head of Elephant Butte Reservoir. The Rio Grande Compact Commission in 1948 by resolution changed from the schedule shown in Article IV of the compact the gaging stations and measurements of deliveries by New Mexico beginning 1949, finding that such change would result in substantially the same results so far as the obligations of New Mexico to deliver water are concerned. Deliveries by New Mexico beginning 1949 are measured at Elephant Butte Dam.

The compact did not define the relative rights of New Mexico and Texas below Elephant Butte Dam or provide to the states a division at the Texas state line of the waters below the dam. The question of the division between the two states of the water available

for release from Elephant Butte Reservoir is taken care of by contracts between the districts under the Rio Grande Project and the US Bureau of Reclamation, which provide that lands within the project all have the same rights. The Bureau of Reclamation each year allocates water under the project according to the respective areas in New Mexico and Texas defined and allotted by Reclamation pursuant to its surveys completed in response to the 1905 federal legislation. Under the 1938 Rio Grande Compact, the compact commissioner appointed by the State of Texas represents the interests of water users within the Rio Grande Project in both New Mexico and Texas.

In the October 1951 term of the US Supreme Court, Texas filed a motion with the Court for leave to file a complaint against the State of New Mexico and the Middle Rio Grande Conservancy District. Texas sought an injunction restraining the latter parties from increasing the amount of storage in reservoirs constructed after 1929 in New Mexico above San Marcial when there is less than 400,000 acre-feet of usable water in Rio Grande Project storage as per Article VII of the Rio Grande Compact, from diverting and using in New Mexico above San Marcial waters of the Rio Grande allocated to Texas by the compact, and from diverting or using waters of the Rio Grande until the accrued debit of New Mexico shall not be in excess of 200,000 acre-feet, except as such debt may be caused by holdover storage of water in reservoirs constructed after 1929 in the Rio Grande Basin above San Marcial, and requiring them to release water from storage in strict accordance with Article VIII of the compact. After hearing and oral argument before a special master, the Court in 1957 dismissed the bill of complaint because of the absence of the United States as an indispensable party.

By 1961, Colorado continued to be unable to meet its schedule of deliveries under Article III of the Rio Grande Compact, and the States of New Mexico and Texas requested Colorado to expedite that state's processing of the Bureau of Reclamation's report on its plan for development of the Closed Basin Division of the San Luis Valley Project to salvage water being lost to non-beneficial use in the closed basin and convey the salvaged water to the Rio Grande for delivery to New Mexico and Texas. The Rio Grande Compact Commission in 1964 adopted a resolution requesting the Secretary of the Interior to expedite completion of the feasibility report on the Closed Basin Division of the project. In 1966, Texas and New

Mexico filed in the US Supreme Court a motion for leave to file a complaint against the State of Colorado. The complaint alleged that Colorado had accrued a debit of 939,300 acre-feet of water in violation of the Rio Grande Compact.

After a series of briefs and conferences, the Court in 1968 accepted the complaint for filing (*Texas and New Mexico v. Colorado*, US Supreme Court No. 29, Original). Simultaneously, the parties reached an agreement under which a continuance was granted to provide Colorado an opportunity to demonstrate its willingness and ability to meet the annual delivery obligation established by the schedules of Article III of the Rio Grande Compact. The continuance provided that Colorado deliver water at the Colorado-New Mexico state line each year according to the annual delivery obligation and make frequent reports to New Mexico and Texas on all measures taken to effect compliance. Colorado instituted water rights priority administration in its portion of the Rio Grande Basin; the Bureau of Reclamation implemented the Closed Basin Division, and the obligations of the continuance were met through 1984. In 1985, the Rio Grande Compact Commission determined that all previously accrued water debits by Colorado were cancelled by an actual spill of usable water at Elephant Butte Dam. Consequently, the suit was dismissed in 1985.

Maintaining scheduled compact deliveries at Elephant Butte Dam is a major continuing challenge for New Mexico. The Elephant Butte Reservoir pool receded more than 20 miles during the extreme drought of 2000-2004. Since 2000, the State of New Mexico and the Bureau of Reclamation have excavated, extended and maintained a pilot channel through the exposed sediment delta to provide for more efficient water delivery to the reservoir pool. Also, the delivery schedules, in addition to hydrology, limit the amount of water available for use in the Rio Grande Basin in New Mexico. Each acre-foot of non-beneficial consumptive use by invasive salt cedar and Russian olive in the Basin above Elephant Butte Dam is an acre-foot of water less available for beneficial use by New Mexico. Unlike Colorado, the State of New Mexico to date has not had to actively administer water rights by priority in the Rio Grande Basin to meet its scheduled deliveries, but New Mexico must prepare for such possibility in the future. In addition, the State of New Mexico participates in the Middle Rio Grande Endangered Species Act Collaborative Program with an objective to meet endangered species habitat needs

without negatively impacting compact deliveries to Elephant Butte Reservoir or beneficial consumptive uses in New Mexico.

Another major challenge looming for the State of New Mexico is the adjudication of the water rights of the numerous Pueblos within the Rio Grande Basin within the constraints of the compact.

Amended Costilla Creek Compact

Controversy over the waters of the Costilla Creek stream system, principally the water stored in Costilla Reservoir, began in 1938. When constructed by 1920, it was contemplated that Costilla Reservoir would be part of a reservoir system irrigating a substantial amount of acreage. However, only a small fraction of the anticipated irrigation development occurred by 1941. In 1938, the New Mexico State Engineer granted the owner of the reservoir an extension of time to develop the irrigation use, provided that the owner cease irrigation from the reservoir of lands in Colorado because the reservoir had been constructed solely for the benefit of New Mexico irrigators. The State Engineer in 1940 ordered as such, and also ordered the owner not to store in Costilla Reservoir water decreed to Eastdale Reservoir in Colorado. As a consequence of an injunction suit subsequently brought by the owner against the New Mexico State Engineer, compact negotiations between New Mexico and Colorado were initiated in 1941 to attempt to resolve the issues.

The Costilla Creek Compact was signed by Colorado and New Mexico in 1944, and subsequently was ratified by the respective state legislatures in 1945 and approved by Congress in 1946. The Costilla Creek Compact provided for delivery of apportioned water to users in New Mexico and to Colorado at interstate points of delivery on the New Mexico-Colorado state line. Apportioned water includes apportionments of direct flow from the Costilla Creek stream system and of water stored in Costilla Reservoir. By the early 1960s, Colorado desired to transfer water uses from one interstate ditch to another, and the compact was amended in 1963 to account for revised interstate delivery requirements on the two affected ditches as described. An account of the adjustments made by the compact amendments is provided in Article III of the Amended Costilla Creek Compact. The Amended Costilla Creek Compact provides for a commission to administer its provisions, said commission to be composed of the official in each state charged with

administering public water supplies (e.g., the state engineers of the two states).

Articles IV and V of the Amended Costilla Creek Compact provide for the daily administration of the direct flow and storage waters of the Costilla Creek stream system during

By the early 1930s, New Mexico irrigators proposed construction of Alamogordo Dam and Reservoir (now named Fort Sumner Reservoir) to provide replacement storage for silted McMillan Reservoir...

the irrigation season to ditches in both Colorado and New Mexico. A water master performs this function. The Costilla Creek Compact Commission in 2002 adopted by rule an operations manual and a daily accounting spreadsheet to calculate required water deliveries and

record actual deliveries. The operations manual resolved administrative and operational issues effective through the 2005 irrigation season. The commission in 2005 extended use of the operations manual, with minor modifications, indefinitely.

PECOS RIVER BASIN

Pecos River Compact

Development of surface water in the Pecos River Basin for irrigation in New Mexico south of Roswell and in Texas north of Girvin began about 1880. Two storage reservoirs (McMillan and Avalon reservoirs) constructed prior to 1900 by New Mexico irrigators were inadequate to serve established rights, and Texas irrigators planned construction of a large reservoir on the Pecos River near the New Mexico state line. Base flows during the irrigation season were insufficient to meet irrigation rights if available at all, and storage of flood waters was necessary to provide for irrigation uses. The Pecos Valley of Texas Water Users Association in 1916 sent a petition to the Secretary of the Interior requesting engineering and financial aid to construct Red Bluff Dam near the state line and to rehabilitate irrigation works in Texas, and also requesting the federal government to arbitrate water rights and supervise the apportionment of Pecos River water between users in New Mexico and Texas and among the users in Texas. No federal assistance was available at that time, however, due to available funds

going to other Reclamation projects already underway and the involvement of the U.S. in World War I.

In 1923, representatives of New Mexico, Texas and the United States began negotiations in an effort to solve problems that arose involving the interests of both states in the Pecos River Basin. A compact was negotiated and signed in 1925, and was subsequently ratified by the legislatures of both states. However, the Governor of New Mexico vetoed the ratification. The New Mexico legislature in 1933 ratified an amended version of the 1925 compact, but final approval of the amended compact did not occur.

By the early 1930s, New Mexico irrigators proposed construction of Alamogordo Dam and Reservoir (now named Fort Sumner Reservoir) to provide replacement storage for silted McMillan Reservoir of the Carlsbad Irrigation Project. Texas irrigators opposed the proposed Alamogordo Reservoir, and New Mexico irrigators opposed the proposed Red Bluff Reservoir at the state line which would impound for use in Texas water that had been appropriated for use in New Mexico but that had to be passed downstream to Texas because of inadequate storage facilities upriver. The Secretary of the Interior in 1935 suggested that the two states settle their differences or risk both proposed projects. Representatives of the Carlsbad Irrigation District in New Mexico and the Red Bluff Water Power Control District in Texas and the US Senators of the two states subsequently signed the Alamogordo Agreement, which provided for construction of both Alamogordo and Red Bluff dams, with New Mexico to continue to pass downstream to Texas the same proportion of floodwaters originating above the Carlsbad Project that had reached Texas during the previous twenty years. The Alamogordo Agreement also contemplated the subsequent negotiation of a compact between New Mexico and Texas incorporating this principle. Both dams were constructed in the late 1930s. Also, large-scale ground water development for irrigation uses in the Roswell Basin occurred during the late 1930s and 1940s.

The two states and federal agencies jointly participated in the Pecos River Joint Investigation between 1938 and 1942 to provide material to aid in compact negotiations between the states. Compact negotiations were reinitiated in 1943, and the resulting Pecos River Compact was signed by New Mexico and Texas in 1948 and ratified by the respective state legislatures and approved by Congress in 1949. The

compact provides for a commission that is comprised of a commissioner from each state and a federally appointed commissioner to administer its provisions. New Mexico's Pecos River Compact commissioner is appointed by the Governor. The compact in essence apportions the consumptive use of the waters of the Pecos River by limiting the development of floodwaters in New Mexico after 1946 as a result of the Article III(a) limit on depleting state line flows.

Article III(a) of the Pecos River Compact provides that New Mexico shall not deplete by man's activities the flow of the Pecos River at the New Mexico-Texas state line below an amount which will give to Texas a quantity of water equivalent to that available to Texas under the 1947 condition. The Pecos River Commission was unable to make determinations as to whether New Mexico was in compliance with Article III(a) of the compact, and Texas in 1974 submitted to the US Supreme Court a complaint that asserted that New Mexico during the period 1950-1972 had not complied with Article III(a) of the Pecos River Compact and had under-delivered at the Texas state line in a cumulated amount of 1.2 million acre-feet of water during the period. The Court accepted the complaint in 1975 (*Texas v. New Mexico*, US Supreme Court No. 65, Original).

After numerous hearings before special masters and oral arguments before the Court from 1978-1987 regarding the interpretation of Article III(a) of the compact, the determination of the 1947 condition and the inflow-outflow methodology for quantifying departures from the 1947 condition, the Court in 1987 issued an opinion which affirmed the special master's determination of an under-delivery by New Mexico on the Pecos River of 340,100 acre-feet from 1950-1983. In 1988, the Court remanded the case to the special master to recommend appropriate monetary damages or terms for water repayment. In July 1989, the states stipulated to a total under-delivery of 45,700 acre-feet for the period 1984-1986 and a total under-delivery of 385,800 acre-feet for 1950-1986.

Texas estimated that as a result of the cumulative under-delivery, the damage to Texas may have been \$51 million and the benefit to New Mexico may have been \$912 million. New Mexico estimated that a conservatively high estimate of the damage to Texas may have been about \$8 million. After hearings before the special master in 1989, Texas requested a negotiated settlement and agreed to release its claims for all equitable or legal relief arising out of New

Mexico's violations of the Pecos River Compact for the years 1950-1986 in exchange for \$14 million. The 1990 Legislature appropriated the funds, and payment was made to Texas in 1990.

In 1988, the Court also had adopted the special master's proposed amended decree for operation of the Pecos River Compact and appointed a river master to compute annual compact compliance under the terms of the decree, beginning with the year 1987. The decree directs the river master to follow the procedures in a river master's manual to account deliveries at the Texas state line. The decree approved the river master's manual and also provided a procedure for making modifications to the manual. The decree permits New Mexico to accumulate over-deliveries, but not to accumulate under-deliveries that are in excess of accumulated over-deliveries. Net shortfalls in delivery must be paid back within a six-month period, mainly during the non-irrigation season, following the river master's determination of a net shortfall and approval of a shortfall repayment plan. New Mexico during the period 1988-1993 filed with the river master and debated six motions to modify certain computational procedures in the river master's manual so that resultant computed net shortfalls might better reflect shortfalls caused by man's activities in New Mexico, as opposed to other causes such as nature or computational error. Under Article III(a) of the Pecos River Compact, New Mexico is responsible only for shortfalls resulting from man's activities. After considerable argument and deliberation on the motions, the river master adopted the third motion as proposed and approved most of the other motions in amended form. During the time that the third motion was under consideration, the river master used internally inconsistent assumptions for the same variable in two different equations. The use of inconsistent assumptions would have been avoided using the procedures of the third motion adopted in 1992. In 1991, New Mexico filed a motion with the US Supreme Court to review the accounting of state-line delivery for the previous year on the basis that the river master's use of internally inconsistent assumptions is clearly erroneous, but the court denied the motion. Because the decree does not allow for retroactive corrections to previous river master determinations of delivery without agreement of the states, and because Texas refuses to agree to retroactive corrections, the accumulated over-delivery since 1987 has not been increased to reflect retroactive application

of the manual modifications that were approved by the river master.

To date, no net shortfall has been computed. As a result of studies conducted by the State Engineer Office in 1990 to evaluate options that may be used to satisfy water delivery shortfalls in the Pecos River, the New Mexico Legislature beginning in 1991 has appropriated tens of millions of dollars for the Interstate Stream Commission to purchase water rights or lease water from willing sellers for the purpose of increasing state line flows to avoid the occurrence of net shortfalls. The water rights purchase and lease program instituted by the legislature was meant to respond to the State of New Mexico's compact and decree obligations without involuntary and

Maintaining compact deliveries at the New Mexico-Texas state line in compliance with the decree in *Texas v. New Mexico* is a major continuing and costly challenge for New Mexico.

uncompensated reductions in water uses. New Mexico's Pecos River Basin water users supported the program because it would avoid a large-scale priority call against junior ground water uses in the Roswell Basin whose pumping effects on river flows are

delayed and because river pumpers between Roswell and Artesia, that the Carlsbad Irrigation District for years charged took district water, would be bought out and removed from the river. Additional water rights acquisitions for this purpose were approved by the Legislature in 2002 as part of a long-term Consensus Plan developed by the Lower Pecos River Basin Committee, an organization comprised of irrigation districts, county and municipal governments, and business representatives along the lower Pecos River, as well as the Bureau of Reclamation. In addition to long-term purchase and retirement of water rights and short-term leasing of water in the lower Pecos River Basin, other components of the Consensus Plan include augmentation pumping from the Roswell artesian aquifer to the Pecos River and water salvage projects. During the period 1991-2004, the State of New Mexico spent approximately \$34 million on Pecos River water rights acquisitions and water leases.

Maintaining compact deliveries at the New Mexico-Texas state line in compliance with the decree in *Texas v. New Mexico* is a major continuing and

costly challenge for New Mexico. In spite of water rights acquisitions and water leases to date, New Mexico has been able to accrue only a limited cumulative over-delivery in state line deliveries through 2005. The challenges for New Mexico and its water users are to fund and implement the long-term Consensus Plan, to avoid the occurrence of a net shortfall and to develop the augmentation well field to either avoid a net shortfall or have some capacity to repay one if necessary. New Mexico must develop a backup shortfall repayment plan. Further, implementation of the Consensus Plan is an attempt to avoid priority administration in the lower Pecos River Basin as desired by the New Mexico legislature. Should the plan fail and a need for priority administration to comply with the decree arise, the State Engineer is in the process of preparing criteria for such administration if needed.

Also, the state-line delivery requirement under the decree in *Texas v. New Mexico*, in addition to hydrology, limits the amount of water available for use in the Pecos River Basin in New Mexico. Non-beneficial consumptive use by invasive salt cedar and Russian olive along the Pecos River depletes water that otherwise could be available for use in New Mexico. Large-scale salt cedar eradication efforts on tens of thousands of acres along the Pecos River have taken place, and cleared areas must be maintained. In addition, the State of New Mexico is working with federal agencies and the Carlsbad Irrigation District to address endangered species habitat needs in the Pecos River without negatively impacting deliveries of water from Fort Sumner Reservoir to the Carlsbad Irrigation Project diversion at Avalon Dam and without negatively impacting state-line flows. Since 1998, Reclamation has offset new depletions resulting from its modification of dam operations and other activities related to conservation of endangered species in the Pecos River, but agreements to continue to do so in the future have not been made.

Since the Court appointed a river master in 1988, the Pecos River Commission has not administered Article III(a) of the Pecos River Compact or actively participated in the accounting of state line deliveries under the decree in *Texas v. New Mexico*. The commission continues to administer other provisions of the compact, such as those relating to data collection. Nothing in the decree prohibits the commission from reaching agreement on accounting of deliveries under Article III(a) of the compact, but

such attempts to date have been futile. Nevertheless, if a net shortfall were to occur, New Mexico may seek from the commission or from the court credit in delivery to reflect retroactive adjustments for manual modifications approved by the river master. Under Article III(a) of the compact, New Mexico should not be held responsible for net shortfalls caused by technical error in accounting state line deliveries, as opposed to man's activities in New Mexico. Further study of the accounting methods in the river master's manual may indicate that additional shortcomings need to be addressed through manual modifications. New Mexico also must remain diligent each year in critically reviewing, and challenging when appropriate, the river master's accounting of deliveries.

CANADIAN RIVER BASIN

Canadian River Compact

Studies conducted by the New Mexico State Engineer in 1925 to investigate the amount of water and lands in the Canadian River Basin physically available for storage and irrigation in New Mexico, including available dam sites, concluded that economically feasible development plans might involve costly upstream conservation storage with flood protection to downstream areas. To explore this possibility and to reach agreement with neighboring states on an equitable apportionment of the flow of the Canadian River, a negotiating commission was formed with the States of Arkansas, New Mexico, Oklahoma and Texas participating. In 1926, New Mexico, Oklahoma and Texas signed a compact (Arkansas abstained), but the agreement did not become effective because ratification by the states was not completed.

Conchas Dam, originally authorized as a Works Relief Program project and constructed by the US Army Corps of Engineers, was completed in 1940 to provide storage for water to irrigate lands under the Tucumcari Irrigation Project in New Mexico and flood control. In 1949, the Bureau of Reclamation prepared a report for a project to develop Canadian River waters for irrigation, municipal and industrial uses in Texas. Congress authorized the project, provided that project construction could not commence until the States of New Mexico, Oklahoma and Texas entered a compact apportioning Canadian River waters. Congress also required that a representative of the United States

appointed by the President participate in the negotiations of any such compact.

The Canadian River Compact was signed by New Mexico, Oklahoma and Texas in 1950, was subsequently ratified by the respective state legislatures, and was approved by Congress in 1952. The compact provides for a commission to administer its provisions. New Mexico's Canadian River Compact commissioner is appointed by the Governor. The compact in essence apportions the waters of the Canadian River by limiting conservation storage in each of the signatory states.

Article IV(a) of the Canadian River Compact provides that New Mexico has free and unrestricted use of all waters originating in the drainage basin of the Canadian River above Conchas Dam, and that New Mexico has free and unrestricted use of all waters originating in the drainage basin of the Canadian River below Conchas Dam provided that the amount of conservation storage in New Mexico available for impounding the waters which originate below Conchas Dam shall be limited to an aggregate of 200,000 acre-feet. The compact defines conservation storage as that portion of the capacity of reservoirs available for the storage of water for subsequent release for domestic, municipal, irrigation and industrial uses, and it excludes any portion of the capacity of reservoirs allocated solely to flood control, power production or sediment control.

In the mid 1980s, New Mexico in the drainage of the Canadian River below Conchas Dam enlarged the physical capacity of Ute Reservoir to 246,000 acre-feet and provided operating criteria to administratively limit the amount of capacity available to store water that originates below Conchas Dam to comply with Article IV(b) of the compact. The operating criteria considered New Mexico's right to store in the drainage below Conchas Dam those waters originating in the drainage above Conchas Dam, and also water stored in Ute Reservoir for sediment control purposes. In 1987, Oklahoma and Texas submitted to the US Supreme Court a complaint which alleged that New Mexico had violated Article IV(b) of the Canadian River Compact by building reservoir capacity in excess of 200,000 acre-feet in the drainage of the Canadian River below Conchas Dam. The Court accepted the complaint (*Oklahoma and Texas v. New Mexico*, US Supreme Court No. 109, Original).

After hearings before a special master and oral arguments before the Court from 1988-1991 regarding the interpretation of Article IV(b) of the compact, the Court in 1991 ruled that New Mexico may not store for conservation purposes water within the physical drainage of the Canadian River below Conchas Dam in excess of 200,000 acre-feet, regardless of whether or not some portion of such water originated above Conchas Dam. As a result of the ruling, New Mexico would have to increase storage capacity at or above Conchas Dam to more fully utilize the water originating above Conchas Dam, the use of which New Mexico remains entitled to under the compact.

After an additional hearing before the special master in 1992, the Court in 1993 adopted a stipulated judgment and decree that included the Court's 1991 ruling, a schedule for operating Ute Reservoir, releases of water from Ute Reservoir stored in excess of the operating schedule, and payments totaling \$400,000 from New Mexico to Oklahoma and Texas in exchange for their release of claims for all equitable and legal relief arising out of New Mexico's violation of the compact during 1987-1993. Current compliance with the decree basically requires updating the allowable storage level in Ute Reservoir annually for estimated sediment deposition and for any changes in storage capacities of other reservoirs located within the physical drainage of the Canadian River below Conchas Dam and releasing water in excess of the allowable storage level at the maximum physical release capacity or on an alternate schedule if requested by Texas.

CONCLUDING REMARKS

Implementing and complying with interstate compacts and associated court decrees and federal laws continues to be a challenge. Many technical details and other administrative issues remain to be resolved by New Mexico and the other states with which it has entered compacts. In some instances, resolution and certainty as to how much water a state may develop has come through litigation. Nevertheless, the compacts to which New Mexico is a party and related agreements have, for the most part, allowed New Mexico and other states to move forward with projects to develop and use water.

In the years ahead, the State of New Mexico will continue to have challenges. New Mexico must meet its delivery obligations under the Rio Grande Compact

and under the decree in *Texas v. New Mexico* on the Pecos River. New Mexico also must work with the other Colorado River Basin states to resolve issues relating to the interpretation and implementation of Article III of the Colorado River Compact, and to promote reservoir operations, including at Lakes Mead and Powell, which protect the yield available to the Upper Basin at Lee Ferry under Article III of the compact. The Colorado River Basin states continue to work with the United States to identify and promote the implementation of measures

...the State has the challenge to negotiate Indian water rights settlements that stay within the framework of the compacts, preferably while not displacing existing uses, and to get such settlements authorized and funded by Congress.

needed to meet salinity standards in the Colorado River. Threats to the availability of water for uses in New Mexico resulting from application of the Endangered Species Act within the United States or from Colorado River delta issues must be addressed. Also, the State has the challenge to negotiate Indian water rights settlements that stay within the framework of the compacts, preferably while not displacing existing uses, and to get such settlements authorized and funded by Congress.

Note: This paper was compiled in large part from OSE/ISC annual reports.

John D'Antonio was appointed as the New Mexico State Engineer by Governor Bill Richardson in January 2003. He also serves as Secretary of the Interstate Stream Commission. John is a registered professional engineer in New Mexico and Colorado and has experience in hydraulic design, acequia rehabilitation, water resource management, and water policy development. He was Cabinet Secretary of the New Mexico Environment Department in 2002. Before that, he was the Director of the Water Resource Allocation Program for the Office of the State Engineer from 2001 to 2002 and served as the District 1 Supervisor in Albuquerque from 1998 to 2001. John worked 15 years with the U.S. Army Corps of Engineers as a hydraulic design engineer, as the Chief of the Hydrology, Hydraulics, Sedimentation, and Floodplain Management Program, and was the project manager for the Acequia Rehabilitation Program. A native New Mexican, he received a bachelor's degree in civil engineering from the UNM in 1979 and pursued graduate coursework in water resources engineering, hydraulic structures, and water resource administration. John is chairman of the Water Trust Board for the State of New Mexico. He is also the New Mexico Commissioner for the Rio Grande Compact, the Costilla River Compact, and the Upper Colorado River Basin Compact.



ACTIVE WATER RESOURCE MANAGEMENT

John D'Antonio
New Mexico State Engineer
Office of the State Engineer
PO Box 25102
Santa Fe, NM 887501

Good morning, everybody. Thanks for being here today. I want to touch on our Active Water Resource Management (AWRM) initiative. People understand and know that it is something essential for the state of New Mexico. We are not going to settle for the status quo. We are not going to manage water for convenience's sake. That is what we have done in the past. We had a large amount of rainfall from 1980 to 1995. We had a six to seven year drought period before

last year. We had good snow conditions, probably better than average snow conditions last year as well. It is easy for complacency to set in and for all New Mexicans to go back to thinking that the drought is over. The monsoons were late in arriving. We have had some good rain lately. In my estimation, we are technically still in a drought. There are still management considerations that need to be understood. What has happened in many areas is over drafting

groundwater. There are limited surface water supplies in some areas. Some of the reservoirs have come back. The reality is that if we have another period of sustained drought, water shortages again are inevitable. Our agency needs tools in place to manage our water resources for the next drought.

I have heard that AWRM might be just a new program driven by Santa Fe. I want to assure you it is for the benefit of the entire state that takes into account what we have to deal with – the physical availability of water, the variable water cycles, and the understanding that drought cycles are going to continue to happen in New Mexico. We have to be able to put a mechanism in place with which to manage the drought cycles we are going to inevitably see in the future. I think Em Hall made some interesting comments on

regionalization and recognizing that even in New Mexico, we have different needs on how to manage water. We are in the process of developing basin specific rules and regulations. My job as State Engineer is to

Active Water Resource Management (AWRM) refers to a broad range of activities, including transfers, monitoring and metering diversions, and limiting diversions to the amount authorized by existing water rights.

balance, maintain, and protect water needs throughout the state of New Mexico.

As you know, our agency put together a State Water Plan that had about 11 common goals and priorities within the state of New Mexico. I am going to run through these quickly, so that it just refreshes everybody's memories as to what we are doing and what we are using as a blueprint for how to manage our future water resources.

First is the vitality of economic development. We all know we want our children and grandchildren to have jobs here when they grow up. For that reason, we have to grow in a way that is smart. We need water so we can accommodate that growth. A safe drinking water supply obviously is a major concern. We need water resources to expand available supply.

Other concerns include the enhancement of watersheds. We must look at desalination technology. And, of course, conservation is the cheapest form of obtaining additional water supply. We must promote drought planning. At our agency, we take our jobs

seriously. We must enhance the quality of state waters. Environment Department Secretary Ron Curry, who spoke earlier today, said some kind things this morning about our agency's interaction with his agency. Water quality and quantity are integrally linked. We are concerned about water quality within the state. We are also concerned with providing for fish and wildlife habitat preservation. I will talk a little bit about what we are doing in that area. Also, my concern is to continue to protect the senior status of water rights. The last three areas of concern for our agency include: maintaining and enforcing interstate stream compact compliance, preserving state administrative authority over the state's waters, and completing water rights adjudications. Believe it or not, each and every one of these areas is interconnected. If all issues are not kept in balance, the whole fabric of the system can begin to unravel.

Active Water Resource Management (AWRM) refers to a broad range of activities, including transfers, monitoring and metering diversions, and limiting diversions to the amount authorized by existing water rights. We have designated basin managers. We have also made some progress in each of the seven critical basins within the state that we will be administering as part of this initiative, which include: the Lower Pecos, the Lower Rio Grande, the San Juan, the Upper Mimbres, the Rio Chama, the Nambé-Pojoaque-Tesuque Stream System, and the Rio Gallinas in order of priority.

Effective communication is essential to furthering these initiatives. A communication plan has been prepared and is now being implemented. Already, we have held several public meetings, which have generally focused on the top, three priority basins: the Lower Pecos, the Lower Rio Grande, and the San Juan Basin as well as in the Rio Gallinas. We held a public meeting in Las Vegas, New Mexico in April of 2004 for water users in the Rio Gallinas Basin. We held public meetings in the cities of Roswell, Carlsbad, Ft. Sumner, Hondo, and Weed, New Mexico in August and September of 2005 to further AWRM in the Lower Pecos Basin. We met in public forums with water users, we talked with them, and we allowed them to ask questions and express their concerns. Most importantly, we listened.

This is a very public process. It is an open process of communication and exchange of dialog. We typically go in to meet with the key water stakeholders within those various communities before we even put together a draft set of rules and regulations for basin-specific

Active Water Resource Management

areas. Meeting with key stakeholders before the public meetings means that we have a well-vetted version of the rules and regulations before it actually goes before the general public for review. We always have a public comment period for the rules and regulations. At the present time, we are taking public comments in those areas of the Lower Pecos Basin.

What Active Water Resource Management does is provide a mechanism to explain what priority administration is and how we plan to administer water in the future. If I have to call priorities because we have limited water supply in a given year, I have to do that. That’s my job. I must have the tools in place to make that happen effectively. I need to have subdistricts defined, Water Masters hired, the rules and regulations defined, the metering and measuring devices in place. Currently, we do not have readily available information or tools necessary so that we can manage our water supplies by priority administration. I am also providing for a mechanism in which the local groups can come up with their own alternative forms of administration, which is a preferable option. There will be problems when the state goes through future drought cycles, because much of the state is over-appropriated or fully appropriated. We know that there are additional depletions to many of the systems from just domestic well usage. My challenge as State Engineer is how do I get the general public to understand that we have to be prepared for those future drought cycles? We need to be able to manage by priority – which is the law – but also to allow for that alternative administration among water users. When everybody is on the same page as to how to manage their water resources, we can have a much better way than to administer by priority administration, which can often be very ugly when you get right down to it.

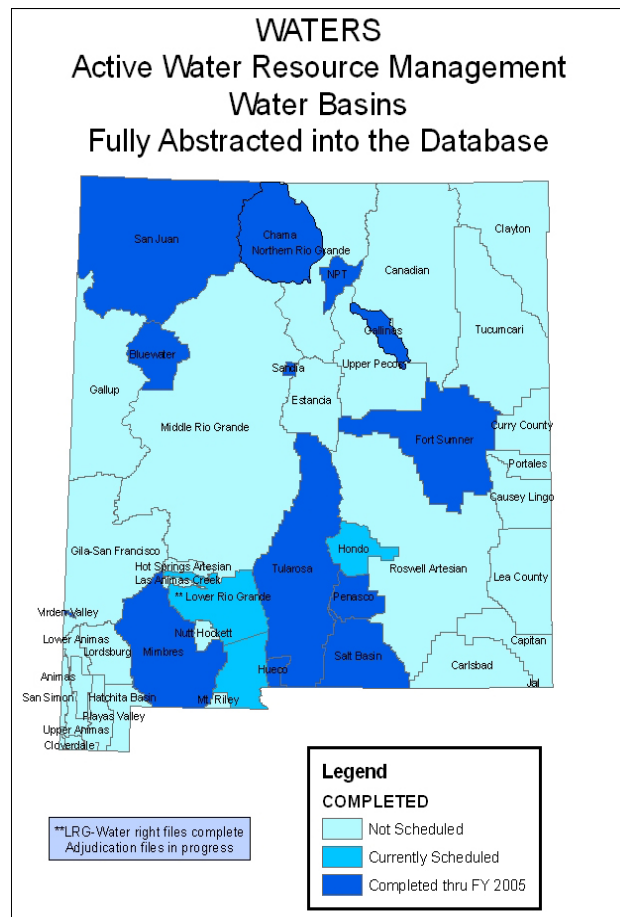
Here is a picture of three of our agency’s Water Masters working out in the field. We have actually hired seven new Water Masters as part of the AWRM initiative – one for every basin. Some basins will require more than one to effectively manage water supplies. Our next steps are drafting the district-specific rules and regulations followed by getting the necessary measuring and metering installed.

I signed a metering order requiring the Lower Rio Grande to meter groundwater use by March of 2006. There are going to be other metering orders to follow in other basins. Putting together the Water Master manuals for each priority basin will come as a next

step, which is a critical one. The Water Masters manuals are essentially the Bible that the Water Masters can take out into the field and clearly indicate which people own water rights in the area, their priority dates, the point of diversion, and the place of use of that water.

How are we going to physically make that happen in the field, if we have a 10 percent shortage, and we know that 10 percent of an area needs to be cut-off or at least curtailed for specific use in that year? Again, getting back to the AWRM plan, if that were to happen, we would essentially have an individual curtailed user that could then go out into the marketplace and acquire a short-term lease for water from a more senior user to help facilitate that market need on a temporary basis. This may be necessary for a junior user who needs to provide jobs for an area, or to provide drinking water, or other beneficial needs to a community.

The figure below is a map that indicates the progress we have made on the WATERS program, water information and data can be accessed via the



Internet. You can see the dark blue areas are completed for fiscal year 2005. Currently scheduled are the areas that are in a little lighter blue. The ones that aren't scheduled yet are just a shade lighter. The dark areas you'll notice are also the keys areas and the priority basins for Active Water Resource Management. All the money that the state legislature gives us is being geared towards making progress in those priority basin areas.

There are other efforts within the state to make sure we balance our water resources and manage them effectively. We have just recently declared new underground water basins and basin extensions. I can go over some of those quickly. Extended or declared basins are in Tularosa, the Canadian River, Clayton, Curry County, Ft. Sumner, Causey-Lingo, Lea County, Nutt-Hockett, Mt. Riley, Cloverdale, Aqua, Animas

...conservation is still very important.

Upper, Animas Lower, Lordsburg, and the Playas Valley. All of those areas amount to,

believe it or not, 9 percent of the surface area within the state of New Mexico that was not declared. People did not have to go out and get a permit from the State Engineer's Office to use groundwater in these areas. We have just recently declared all of those areas as basins, and they will be the subject of a public hearing on December 9, 2005, held in Santa Fe. All of those areas are going to come under State Engineer jurisdiction. I want to make sure that to use groundwater in New Mexico, you will need the benefit of a permit. You will have to go to the State Engineer's Office and get those water uses permitted throughout the state.

What progress have we made in protecting our state's waters? I am going to go through these really quickly. Interstate Stream Commission Director Estevan Lopez talked about the Arizona Rights Settlements earlier today, so I won't talk about that again. The Strategic Water Reserve legislation passed last year, which gives us an additional tool essentially to help us deal with compact deliveries and endangered species act issues. The goal is to protect New Mexico's water for use within the state of New Mexico. That is how the regional planning concept came out. Regional planning areas needed to show they were going to use their water for use within New Mexico, so that surrounding states could not take that water. We have 13 of the 16 regions completed, and we are trying to integrate the best parts of those plans into our State Water Plan as we move forward. What progress have

we made with respect to adjudications and settlements? I will not talk about the Pecos settlement, since Estevan Lopez addressed that in his talk earlier. The state of New Mexico and the Navajo Nation signed a historic settlement agreement on April 19, 2005, but since we have a speaker coming up on that issue, I'll let him cover that progress made in more detail. We had an Aamodt settlement conceptual proposal agreement signing on June 1, 2005. That settlement process is back at the negotiating table at this time to work out details. The problem with these water rights settlements, especially with Native American water rights settlements, is the federal obligation on funding, which we are finding is more and more difficult everyday. We also have settlement talks ongoing in Taos. We made progress with the last state legislative session on getting an Indian Water Rights Settlement Fund established. This session, we will be seeking money for that fund.

Technical innovation is something that is extremely important for our agency as we move forward. The way that we adjudicated areas in the past has been cumbersome, so what we are trying to do now is use digital imagery in that process. We had a contract that we signed and worked on in conjunction with some money that was routed through the Army Corps of Engineers to fly over the entire state of New Mexico. Now we'll have that database to provide a basis for our aerial imagery as we move forward. We can also use the historic satellite imagery from the early 1970s. We have some pretty good information to look at the continuous use of water, which helps define water rights and to try and put that in a GIS format that allows us to go out and actually make offers of judgment on a timely basis. Although we still have to do verifications of the data, it essentially means our personnel can spend less time in the field. Our Deming District Office took on a special project using E-GIS to map the Virden Valley in southern New Mexico, and now that same method is being applied in the San Juan Basin. Coupled with our hydrological models that get better and better everyday, we are getting these things done a lot quicker than in the past.

We are also making progress with new sources of water, including desalination. The City of Alamogordo had a permit that was authorized, and we are closely monitoring the progress. We are trying to evaluate whether or not cloud seeding makes sense. We think it does in certain areas.

We've made progress with interstate compact compliance. Compact deliveries are essential for the state of New Mexico. Work continues on the Elephant Butte Pilot Channel as well as other items on this list to keep us out of a liability situation and make sure we continue to manage our water effectively within the state of New Mexico.

We've also made strides on a lot of wildlife, habitat, and river protection areas, as well as with the ESA Collaborative Program. There is the Albuquerque refugium, and a second refugium is planned. We have to be able to make sure these environmental issues are taken care of and the water rights associated with those. When we deal with the federal government, we want a permit in place. We want there to be an acquisition of water from an existing use. We do not have additional water to take care of endangered species act needs. It has to be water that is within the system. They are going to acquire water through permits from somebody and compensate that user that they are acquiring the water right from. Also, our staff has major plans to renovate habitat along the Middle Rio Grande in the coming year.

We have made progress mitigating the impact of drought in our state. Successful drought summits were held the past three years. We have a Governor's Drought Task Force established, and Active Water Resource Management essentially addresses drought conditions and how we can manage limited supplies through drought scenarios.

The other things that we are doing within the state include looking at community water systems, as well as looking at asset management and running water systems as a business. Some of this is coming through Governor Richardson's office, in which we are a participant. With other agencies, we are looking at collaborative planning efforts, a regionalization of projects, and some capital outlay reform. Hopefully, money is going to systems, and the end users are paying the amount that they should be paying in certain areas, in order for us to really put in the infrastructure that we need to continue to improve our water systems. The infrastructure needs are billions of dollars, and we do not have billions of dollars to invest.

Preserving and enhancing water quality is an area where we are making progress. Environment Secretary Ron Curry touched a little bit on all of these areas. We are working closely with the Environment Department to ensure that quality comes into play when we talk about quantity issues also. You can see some of the

areas here that we are involved with including: basin watershed management, well drillers rules and regulations, making sure regional water plans address water quality issues as well as our participation in the Water Quality Control Commission, among other measures.

Also, I want to mention our government outreach efforts with Native Americans in our state. We have 22 tribes and pueblos within the state of New Mexico. We only have one tribe whose water rights are fully adjudicated—the Jicarilla Apaches. I mentioned that we have made progress on our water settlement with the Navajo Nation. We are also close to an agreement with the Mescaleros. That leaves 19 other pueblos that we still need to be able to adjudicate water rights for as we move forward. Consultations are ongoing with these groups. Also of note, we instituted a Native American Water Institute this year, which we will meet with on a quarterly basis to discuss common issues.

As far as updating our rules and regulations goes, our agency could not be busier. I already mentioned the district-specific rules and regulations we are looking at for AWRM and the public input process we are following. We have also updated our rules and regulations for surface water, groundwater, well drillers, and dam safety. Surface water regulations have not been updated since 1953. Groundwater rules and regulations have not been updated since the 1980s. Also, we have come up with rules and regulations for our Strategic Water Reserve. We are very busy getting rules and regulations in place to make sure that the things we do are defensible, that they make sense, and that they are moving forward.

As a final note, conservation is still very important. Our agency has come out with a new rainwater/snowmelt harvesting policy, new gray water guidelines, as well as new education materials for the public. I cannot say enough about conservation. It is the keystone for our future in New Mexico. With that, I'll close. Thanks everyone.

This is a very public process. It is an open process of communication and exchange of dialog.

Hydrology

The hydrology of the LRG is quite diverse, but its dominant features are the Rio Grande and the hydrologically connected aquifers. The Rio Grande Project, which the U.S. Bureau of Reclamation authorized in 1905 and substantially built by 1917, appropriated “All the unappropriated water of the Rio Grande and its tributaries” (Hall, L.C., 1908) with a priority date of January 23, 1907. The Rio Grande Project provides water to 90,640 water-righted acres in New Mexico’s Elephant Butte Irrigation District (EBID), 69,010 acres in the El Paso County Water Improvement District No. 1 (EPCWID) in Texas, and 60,000 acre-feet of water pursuant to the 1906 treaty between the U.S. and Mexico.

In the 1950s, a period of persistent drought began that continued through 1978. The Bureau of Reclamation operated the Project during this period as a single project, paying little attention to the New Mexico Texas state line. In response and at the urging of the Bureau, farmers of the Rio Grande Project installed wells and began pumping groundwater to supplement the surface water supply.

The surface water supply recovered in 1979, coincidentally the time the Districts paid off their construction loans to the federal government and began taking over operations no longer as a unit, but as two separate Districts. The full water supply continued through 2002. In 2003 and 2004, the surface water supply was severely reduced again. While the water supply improved markedly in 2005, 2006 is looking dry again. Fortunately, the two Districts left water behind in 2005 that will help greatly in 2006.

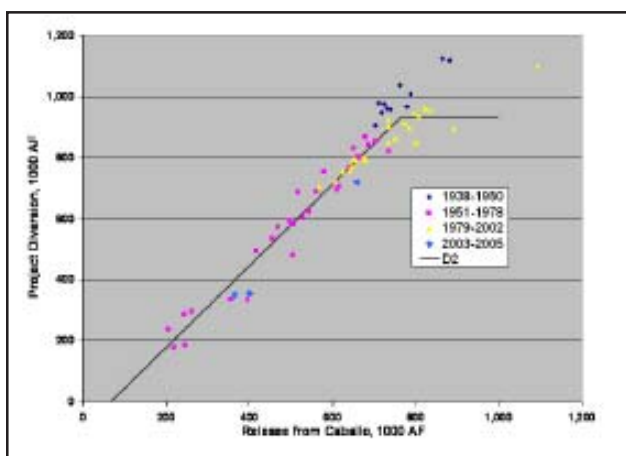


Figure 2: Rio Grande Project releases from Caballo Dam and Total Project Diversions, 1938-2005. Note: 2005 is an estimate.

Institutional Setting

The institutional setting is a bit more convoluted than the hydrology in the area. In 1938, the states of Colorado, New Mexico, and Texas developed the Rio Grande Compact, which divides the water of the river among the three states and provides for compliance with the 1906 treaty with Mexico. The Compact specifies a delivery obligation for Colorado to New Mexico at the state line based on available water supply at index gauges in the headwaters of the Rio Grande.

The Compact also specifies a delivery obligation for New Mexico to Texas based on flow at Otowi gauge, just below the confluence of the Rio Chama and Rio Grande. However, at the time of the Compact’s development, the Rio Grande Project was operated as a single unit by Reclamation, and the Compact delegates from New Mexico and Texas stated that the interests of EBID and EPCWID could not be separated. Therefore the delivery point for water to Texas is Elephant Butte Dam, some 100 miles north of the New Mexico – Texas state line, and most of the LRG is regarded as Texas by the Compact.

While the Rio Grande Project and the Rio Grande Compact deal directly with surface water, administration of groundwater is under the auspices of the State of New Mexico. Due to the operation of the Rio Grande Project by the Bureau of Reclamation from 1916 to 1978, the New Mexico Office of the State Engineer (OSE) did not have a very high profile until the basin was declared in the early 1980s. Irrigators filed well permit applications with the OSE, but no reporting of groundwater use by irrigators was required.

The use of groundwater was informal during the drought period of 1951-1978. Due to the short water supply in those years, the Bureau of Reclamation encouraged irrigators served by the Rio Grande Project to install wells to pump for themselves and their neighbors, the beginning of conjunctive use of surface water and groundwater in the area.

Water Use in the LRG

The City of Las Cruces and other municipal areas in the LRG have been growing steadily and quite rapidly in recent years. Their combined water use is still much less than that of irrigators. The 2004 LRG Regional Water Plan stated that 90 percent of the water diverted in the LRG is for irrigation, mostly within EBID, but also some primary groundwater irrigation. As the

Regional water plan makes clear, the amount of water in the LRG is not increasing significantly, and the available water in the Rio Grande and its associated aquifers is fully appropriated; the pie in Figure 3 is not growing. In order to provide water for inevitable municipal growth without impairing downstream water users in Texas and Mexico, the water must come from an existing use, and Figure 3 makes clear that the logical use is irrigated agriculture.

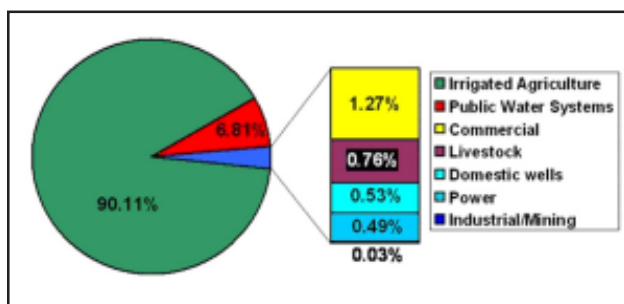


Figure 3: Water use in the LRG by sector. (LRGWUO, 2004).

Current Developments

The preparation of the Regional Water Plan by the Lower Rio Grande Water Users Organization (LRGWUO) proved to be a useful exercise in collaboration among the water users in the area. The local consensus on the water resource situation in the basin provided the members of the LRGWUO with a common base for planning the region's hydrologic future.

One of the important outcomes of collaboration among the City of Las Cruces, EBID, Doña Ana Mutual Domestic Water Consumers Association (DAMDWCA) and the OSE was the Special Water Users Association, an institutional tool supported by legislation. The SWUA essentially allows designated uses – publicly owned municipal suppliers, state universities, and the New Mexico Interstate Stream Commission – to become constituents of EBID. These entities can purchase water rights or lease water from a willing seller for non-irrigation uses. This provides municipal suppliers access to the large quantities and early priority dates of EBID's water supply in a way that protects the irrigators who choose to stay in farming, and to enhance the market value of farmers' water.

More recently, the OSE promulgated the state-wide Active Water Resource Management (AWRM) general regulations to allow state administration of water in the absence of a completed adjudication. The regu-

lations did meet some opposition in the state, as water users are understandably concerned about government efforts to regulate highly complex systems in which the users have substantial investment. The LRGWUO has chosen to take a collaborative approach, seeking to work with the OSE to develop alternative administration regulations for the LRG that are tailored to the specific hydrologic and institutional setting of the basin.

Managing Water in the LRG

Intelligent management of water in the LRG must first recognize the constraints faced by water users. The first and immediately pressing constraint is external – ensuring that downstream water users in Texas and Mexico are not impaired. As groundwater is withdrawn from the aquifers hydrologically connected to the Rio Grande in New Mexico, measures must be taken to ensure that the downstream users get their equitable share of Project water. Unfortunately, this equitable share is the subject of much dispute. One necessary development in LRG water management will be a specific obligation for water delivery to Texas and Mexico by the Rio Grande Project. This is the subject of ongoing negotiation among EBID, EPCWID, and the Bureau of Reclamation.

The second constraint is internal – ensuring that water is distributed equitably among water users within the LRG. New Mexico water law bases priority of use on seniority, so older water rights are served first. Therefore, water rights and water use with high seniority must be made available to critical uses, such as municipal supply. The SWUA provides the mechanism to do exactly this.

The management scheme must also recognize the inseparability of surface water and groundwater management. The division of authority over surface water (EBID) and groundwater (OSE) in historical operations has led to the false sense among many users and regulators that the two are separate – they are not. Some means of conjunctive allocation, usage, measurement, and accounting for surface water and groundwater is necessary that will require cooperation and sharing of authority among agencies. The logistical difficulties with such an arrangement are painfully obvious to those involved in the process.

The surface water supply of the area is commonly beset with severe and sustained drought such as the period from 1951 through 1978. The LRG is now in the midst of another drought cycle whose effects will

be exacerbated by the extensive urban growth in the area that occurred without water resource planning. The economic stakes are much higher than in previous drought cycles, making the environment ripe for the water wars that are as much a part of the region's hydrology as drought.

It may become necessary for the LRG to actually reduce its use of its share of Rio Grande Project water in times of drought and offset with increased groundwater use, but ensure that the groundwater is recharged in full supply times by pushing surface water as the primary source for the area. The use of surface water improves the aquifer status by reducing the need for groundwater withdrawals and by recharging the aquifer directly through deep percolation and canal seepage. Such conjunctive strategies are not well supported by off-the-shelf New Mexico water law, and they are complex, requiring sophisticated modeling tools.

True conjunctive management of surface water and groundwater, in the sense described in the preceding paragraph, will allow the LRG to maximize the economic – and perhaps even non-economic benefits of the water resources of the LRG. Such a view of the future of water management in the LRG may be thought to be a naïve, Pollyanna rant from the Ivory Tower. The author (who is loathe to refer to himself in the third person) is well aware of the adversarial traditions of water management in the southwest and much of the world. However, there have been notable periods when water agencies were able to transcend the usual brawl and craft principled agreements that guide generations of water management.

Such was the case in the development of the Rio Grande Compact of 1938, when the entire Rio Grande above Fort Quitman was allocated by consensus among Colorado, New Mexico, and Texas. In his letter of transmittal to the Compact delegates, Frank Adams and Harland H. Barrows, Consulting Board Chairs for the technical investigations that led to the Compact, stated (Natural Resources Committee, 1939):

“... The cordial willingness with which the official representatives of Colorado, New Mexico, and Texas entered into the undertaking exemplified constructive statesmanship... Each of these States is vitally concerned with its own welfare, yet in the Rio Grande Joint Investigation each recognized its obligation to its sister States; each accepted the principle that an equitable adjustment of conflicting interests in the waters of the river is imperative.”

What is now as important to the water users of the LRG, and to the taxpayers of the state, as a reprieve from the drought is constructive statesmanship among the agencies that will develop the AWRM administration regulations. We must live up to the standards of our hydrologic ancestors.

References

Hall, L.C., 1908. Supplemental notice of the United States to use the waters of the Rio Grande for irrigation purposes on the Rio Grande Project. Rio Grande Project Supervising Engineer's letter to V. L. Sullivan, Territorial Engineer, New Mexico. April.

Natural Resources Committee, 1938. Rio Grande Joint Investigations. Report for the Rio Grande Compact.

New Mexico Office of the State Engineer, 2005. Active New Mexico Adjudications. Map from <http://www.ose.state.nm.us/water-info/misc-maps/ActiveAdjudication2003.html>.

Jerald A. Valentine was born in Clovis, New Mexico and graduated from Clovis High School. He went on to earn a B.S. in mechanical engineering from NMSU and a J.D. from the University of Texas. His bar memberships include New Mexico; Texas; Federal District Court, District of New Mexico; Federal District Court, Western District of Texas; and Tenth Circuit Court of Appeals. Jerald began his legal career in Las Cruces in 1972. He became District Judge, Division IV, 3rd Judicial District Court in 1993. He served as Chief Judge, 3rd Judicial District Court from 1999-2002. He has been the Presiding Judge, Lower Rio Grande Basin Stream Adjudication since 1995.



ADJUDICATIONS: GETTING TO “FINISHED”

Jerald A. Valentine
Third Judicial District Court
201 W. Picacho Ave., Suite A
Las Cruces, NM 88005

INTRODUCTION

The draft of the Adjudication Rules at this time has not yet been approved by the Stream Adjudication Rules Committee. The Committee consists of judicial officers, a representative of the State Engineer, and private attorneys and engineers expert in water law. There is an ethical prohibition for judicial officers to speak to one party of a pending case about the substance of the case outside the presence of all other parties. Because there are only five stream adjudications pending in state court, it is difficult to discuss problems without skirting the *ex parte* prohibition.

To avoid the possibility or even the appearance of *ex-parte* contact, the Committee has been divided. The Judicial Subcommittee discusses proposed rules in closed session then submits them to the Committee-at-large for their consideration. These meetings are open meetings, and any attorney in a pending case may attend and comment.

The draft which was discussed at the Water Conference was submitted to the Committee-at-large for comments. Since my remarks at the Water Conference, the Judicial Subcommittee has received comments and has redrafted some of the proposed rules. The Committee-at-large will vote on the re-draft soon.

After the Committee-at-large has approved the draft rules, the draft must go to the Supreme Court for its approval before it goes out to publishing for comments, following the same procedure required to obtain approval for all proposed rules. Three members of the rules committee have been speakers at this conference: Chuck DuMars, Em Hall, and John Hernandez. State Engineer John D'Antonio is also a member, but he designated his chief council D.L. Sanders to serve in his stead. We have a very qualified and hard-working committee.

I asked the Supreme Court to establish this committee three years ago almost. When I did, I did

The purpose of the stream adjudications is to adjudicate all rights on the stream system, which then will be incorporated into a final decree. This final decree will provide the State Engineer with accurate, reliable information of all water rights on the stream system.

not think it would take nearly so long as it has taken. We have been faced with very difficult problems.

I was invited to this conference to talk about the status of

the proposed stream adjudications rules. When I received the agenda for this program, the title assigned by the WRRRI for my talk was "Adjudications: Getting to 'Finished.'" I will tell you that I was a little bit concerned about that. I ran across a quote in a different context, but I thought it applied both to stream adjudications and the rule making process: "It is not a safe harbor, a resting place, a final objective, a finished work, but a challenge constantly renewed." I think that as long as you take a pretty liberal interpretation of what the word "finished" means, perhaps these adjudications rules can provide the necessary impetus to complete state stream adjudications in a more timely fashion.

You frequently hear the question "Why is it taking so long to get through stream adjudications. What can we do to speed up the process?" I have a very, very simple answer to both questions. Why does it take so long? Primarily it has been a great concern about the concept of due process. An easy solution that could expedite stream adjudications would be to ignore due process. If we could ignore due process, we could finish this in about a year by the State's updating the

hydrographic survey and the court entering a final decree determining the water rights based on the survey. If you wanted to expedite criminal matters, you could do the same thing. You could hang the accused criminal without the inconvenience of a trial. The Constitutions of both the United States and New Mexico require that the courts afford due process to litigants which necessarily include water right claimants.

What the rules committee has tried to do is to look at the unique characteristics of stream adjudications and see what is needed to preserve due process, yet eliminate obstacles that delay completion of adjudications. The Committee has concluded that several procedures applicable to typical civil cases may be modified or eliminated in stream adjudications without compromising due process.

The New Mexico Water Code is short and concise. The statutes have very little procedural guidance for the court and litigants. In essence, the Water Code says "The State shall enter suit for the determination of all the rights to the use of water in the stream system. All who claim the right to use the water so far as they can be ascertained by reasonable diligence shall be made parties, and the court shall enter a decree that shall declare the water rights adjudged to each party for the priority, amount, purpose, periods, and place of use and ask that irrigation water be specific to pertinent property."

Purpose of Adjudication

Everyone here is familiar with beneficial use being the basis for measuring the right to the use of water. That is a constitutional provision as well as a statutory provision. As a part of the procedure, the statutes require that a hydrographic survey is to be made to obtain and report all available data regarding the usage of the stream system

Sometimes we have been so intent on the process of the adjudication that we forgot what the purpose was. The purpose of the stream adjudications is to adjudicate all rights on the stream system, which then will be incorporated into a final decree. This final decree will provide the State Engineer with accurate, reliable information of all water rights on the stream system. This will enable the State Engineer to manage and supervise the state's water resources as the law in New Mexico requires him to do.

Prompt Court Management

The proposed rules provide that court management of the adjudication commence promptly after the adjudication complaint is filed. Stream system issues must be identified early in the adjudication. There is an initial case management hearing before claimants are joined, and it requires the State Engineer and several of the corporate governmental entities to come in and advise the court about how the matter should be managed. The proposed rules provide the court with information from many knowledgeable sources as soon as the adjudication is filed. Even before the claimants are joined, the court will formulate and file a case management order to manage the adjudication.

Prompt Joinder of All Claimants before or after the Hydrographic Survey

These proposed rules will now require that all water users must be joined promptly. The Lower Rio Grande Basin adjudication was filed in 1986. The adjudication actually began after many legal disputes, primarily regarding jurisdiction of the court, in about 1995. The Court entered an order compelling the State Engineer to commence the adjudication. Tom Turney, the State Engineer at the time, asked the Legislature for monies to do the hydrographic survey. The hydrographic survey was completed in sections. The survey for all sections has been completed for some period of time. However, approximately half of the water users have yet to be joined.

The starting point for most adjudications is a hydrographic survey. Hydrographic surveys can be massive, expensive undertakings. They can take a significant amount of time. Joinder of claimants typically did not occur until the survey of the entire stream system or a specific section of a stream system was completed. The proposed rules require prompt joinder whether or not the survey is complete.

The State Engineer’s attorneys have told me that during this delay in joining claimants after completion of the hydrographic survey, approximately twenty to twenty-five percent of the information acquired in the survey is now stale. The proposed rules will require prompt joinder of all water users, even before completion of a hydrographic survey in some cases. This benefits everyone. With prompt joinder the courts can address and decide issues that may affect the entire stream system or a large number of claimants and the decision will be binding on all.

If all the claimants have not been joined, then it is difficult for the court to make any kind of decisions that affect more than the individual claimants before him because district court decisions are not precedent. If the court decides an issue regarding one water right, each subsequent claimant may decide to assert the same issue. If he does not, he waives the right to assert the issue. If the court could decide an issue one time that would be binding on all, this would reduce the time and resources needed to complete an adjudication. If all claimants can be joined promptly and the State and claimants have a reasonable time to resolve factual issues informally, the court can address legal disputes as they arise, binding all parties to the adjudication. The joinder of the claimants early in the adjudication is an important part of what the committee is trying to do so that the court can timely decide issues that affect more than one claimant in the adjudication or a substantial number of them.

The proposed rules in the draft that existed at the Conference included a provision that claimants were to be joined by first class mailing a claims deadline order to claimants. This has been modified in the current draft. The current draft provides that the claims deadline order will be served by Rule 1-004 (E) through (N). This rule is a recent change in the Rules of Civil Procedure. Among other things, it permits service by mail with return receipt with some restrictions.

Elimination of Summons and Complaint for Joinder of Claimants

In a typical civil case a defendant is joined when he is served a summons and a complaint. The complaint gives a short and plain statement showing that the plaintiff is entitled to relief. A defendant is served with a summons and complaint. The court will enter a default judgment granting the plaintiff’s requested relief unless the defendant responds by filing an answer. The defendant may admit or deny the allegations of the plaintiff’s complaint in his answer. The Rules of Civil Procedure ensure due process by protecting a defendant’s right to notice and an opportunity to respond and to be heard before court decisions are reached. In most civil causes of action, there is a clear adverse relationship between plaintiff and defendant.

In lieu of a summons and a complaint, the proposed rules require the State to serve claimants with a claims deadline order. In lieu of an answer, the proposed rules require the following process:

1. A claimant must serve the State with a water right claim form or be bound by the State's Claims Adjudication Report of claimant's right.
2. After serving the State with a water right claim form, the Claimant must discuss his contentions regarding his water right with the State to try to reach an agreement.
3. If the claimant is unable to agree with the State, he must file an objection to the Claims Adjudication Report.

The dispute then is at issue and the court will conduct a civil matter to resolve the issue.

Stream adjudications have an adverse relationship between the state and a claimant, but in a materially different way from a typical civil case. The State Engineer is adverse to all the claimants on the stream system. There is adversity because the State Engineer is charged with identifying all who have a right to use the water in the stream system and quantifying each water right owner's right. He must, as accurately as he can, determine the elements of the right of each party. Substituting service of a claims deadline order for a summons and a complaint emphasizes the purposes of the adjudications and avoids the implication of the adversity present in typical civil disputes.

Informal Discussion between Claimants and the State, Early in the Adjudication

The proposed rules aim to reduce antagonisms between claimants and the State by providing early informal discussions between claimants and the State. They can share relevant information without the necessity of court processes. The rules provide the State and claimants this opportunity before the court is called upon to resolve the specific dispute with the exacting formal method of litigation resolution. This should be much more efficient. Technical information and hearsay information can be discussed without evidentiary limits. Neither the State nor the claimant needs to concern themselves with evidentiary requirement of foundation. Many factual questions can be resolved without court action.

The State Engineer may send technical staff out to check out contentions of the claimants. Claimants may get a better understanding of their water rights and what they must do to assert them. This process should assist the State Engineer and claimants to reach an agreement without court action and resulting expense and delay.

Benefit of Adjudication to Claimant

In a typical civil case, the litigants may compromise their disputes as they see fit subject to approval of the court. However, the State Engineer must consider all water rights on the stream system. A stream system may be analogized as just one pie where many people claim a legal right to a piece. If the State Engineer concedes a larger piece of the pie to one claimant than the evidence will support, that reduces the pie remaining to divide among the other claimants. It is not the same kind of adversity that you would have in a typical civil case. In fact, most claimants receive the major benefit of a stream adjudication. The adjudication determines water rights and gives claimants the best title to their rights. That is a very big benefit for a water right owner.

That is quite different from the result of most civil cases. In most civil cases if a plaintiff prevails, a defendant loses. Most defendants in a stream adjudication will get their water right confirmed. The court may determine that a claimant does not have all the water right he may think he has. The court also may determine that a few claimants have no water right. However, the very great majority of claims will be adjudicated to the benefit of claimants.

Updating Information During Pendency of Adjudication

The proposed rules give claimants the opportunity early in the adjudication to address with the State the accuracy of the hydrographic survey to enable the State to identify and correct errors. The proposed rules require claimants to notify the court of changes of addresses and new owners to report change of ownership. Additionally, the State is required to notify the court when a water right owner notifies the State of changes of ownership, and the State enters the changes in their records.

As indicated earlier, hydrographic surveys can be massive, expensive undertakings. They can take a significant amount of time. If no court action is taken when the survey is accurate, typically right after the survey has been completed, the accuracy of the information regarding water rights may be compromised or lost. Neither the court nor the State Engineer presently has any effective way to update the hydrographic survey during the pendency of the adjudication. If the court cannot address these matters timely, the amount of resources the court and the State

Engineer needs to insure the accuracy of the survey will grow rapidly affecting timely resolution of the adjudication.

Timely Disposition of Stream System Issues

Issues may arise in a stream adjudication that affect all or a substantial number of claimants. The proposed rules encourage early identification of these issues and timely resolution. Timely may mean early in the adjudication, but the rules provide the court with flexibility to set stream system issues for resolutions at a stage in the adjudication most conducive to expeditious completion of the adjudication.

Adjudication of Water Rights in Mass When No Claim Form and No Objection Is Filed

A circumstance that has contributed to significant delay was that the courts typically adjudicate one right at a time, governed by the standard rules of civil procedure. Each claimant on the stream system is entitled to have his rights adjudicated. Each claimant has a right to contest the State Engineer’s evaluation of his water right. Due process requires claimants receive adequate notice and a meaningful right to be heard. It has been comfortable for the courts and the State Engineer legal staff to use the familiar rules of civil procedure. The standard rules ensured that lack of due process would seldom be asserted.

If claimants do not timely file a claim after receiving the claims deadline order, then they will be adjudicated according to the claims adjudication report which is an updated hydrographic survey after an error correction process required in the draft rules. Pursuant to current procedure, after a hydrographic survey, the State makes an offer of judgment to claimants. The offer is frequently developed with little input from claimants. Experience has shown that it is not uncommon for claimants to either ignore the offer or dispute the offer of judgment without any real understanding of water law and the nature of their rights. Refusing to respond to the offer has sometimes created deadlock. Lack of understanding has resulted in a substantial amount of unnecessary antagonism that the court is frequently called upon to resolve.

The proposed rules are designed to prevent inordinate delay. If claimants do not file claims pursuant to the claims deadline order, they will be bound by the Claims Adjudication Report of the State. If claimants do file claims, the rules require claimants to discuss their rights with the State and try to reach an

agreement with the State. To dispute the State’s *prima facie* evidence, a claimant must file an objection to the report. A claimant must also file an objection to the claims adjudication report of another claimant, if he disputes the claims adjudication report of that right.

Procedure When There Is an Objection

Claimants have a right to their day in court. If an agreement cannot be reached, then after submitting their claim and filing an objection, the matter will be litigated in court. Litigation of individual claims will generally be governed by the standard Rules of Civil Procedure. The Claims Adjudication Report is the updated hydrographic survey and is the State’s *prima facie* evidence of water rights.

The proposed rules aim to reduce antagonisms between claimants and the State by providing early informal discussions between claimants and the State. They can share relevant information without the necessity of court processes.

Claimants must come forward with competent, admissible evidence or be bound by the Claims Adjudication Report. All objections to a water right shown in the claims adjudication report will be consolidated into one trial, whether the objections are filed by the owner of the right or other claimants who dispute the rights. The proposed rules strongly encourage informal resolution, but protect the right to a party’s day in court.

Notice and Service of Papers by the Monthly Adjudication Activity Report

The rules provide for a “monthly adjudication activity report.” In a standard civil case, the court is required to send notices of all hearing to all parties. Additionally Rule 1-005 requires that parties serve other parties copies of all papers they file. Stream adjudications may have thousands of parties. This could become a great burden for both the court and parties. For the most part, individual claimants are interested in their individual claims and have only a passing interest in other parties’ claims and other issues that come to the court. However, due process requires notice and an opportunity to be heard.

The monthly adjudication activity report will give notice to all parties of most matters that are coming before the court without the necessity of mailing a copy of the notice to all parties. If parties follow prescribed procedures, they will have an opportunity to respond regarding any issue that comes before the court.

The rule regarding monthly adjudication reports includes procedures that allow service of motions and

The monthly adjudication activity report is a very significant innovation.

briefs by listing a description of the document filed, not the document itself. The report will only list the papers that have been filed in the stream adjudication court for the last month in categories. If a motion has been filed, it will describe the relief requested in the

motion. If a brief has been filed, it will give a short summary. If a party wants a copy of the document itself, it must request the copy and pay the court's usual fees for copying. The listing of a document in the monthly adjudication activity report will be effective service on everybody in the stream adjudication. The monthly adjudication activity report will not be personally mailed to any party. Any party may subscribe for a nominal fee. The court will post the report on the internet.

The monthly adjudication activity report is a very significant innovation. All parties must be attentive to the report because listing a document in the report is effective service to everyone. All parties will be bound by the decisions of the court made after notice by listing on the report. Due process is preserved. Claimants will have notice and an opportunity to respond. This will do much to reduce the expense of an adjudication and expedite the resolution of the adjudication.

Document Repositories

Every county district court within the boundaries of the adjudication will be a document repository. The court may also establish additional document repositories. Claimants may go to the district court in the county of their residence and look at and obtain copies of any papers filed in the adjudication. Individual water right claims will not be opened as case files unless there are specific disputes the court must resolve.

IN SUMMARY

1. The court must take immediate and continuing control of managing the adjudication.
2. The State must timely provide the court with information to assist in appropriate case management, and assist in maintaining accurate information to the court during the pendency of the adjudication.
3. Claimants will be joined early in the adjudication by service of a claims deadline order.
4. Claimants are encouraged to work informally with the State to ensure the hydrographic survey is accurate and ensure reasonable opportunities to resolve disputes informally with claimants before direct court involvement.
5. Parties must identify stream system issues promptly as they manifest, and the court must timely resolve them.
6. Claimants must take active steps to assert and protect their rights and object to others rights or be bound by the State's claims adjudication report.
7. Objections to a water right identified in the claims adjudication report by the owner or other claimants will be consolidated and litigated governed by the standard Rules of Civil Procedure.
8. Listing documents in the monthly adjudication activity report provides notice and substitute service of filed papers on all parties to the adjudication.

Stanley M. Pollack is the Water Rights Counsel for the Navajo Nation in Window Rock, Arizona. Since 1985, he has represented the Navajo Nation in all matters affecting the tribe's water resources, including five general stream adjudications in Arizona and New Mexico. He also represents the Navajo Nation in settlement negotiations with the State of Utah and recently filed a lawsuit in the U.S. District Court for Arizona against the Department of the Interior alleging that the Department breached its trust responsibility to the Navajo Nation by failing to quantify the Navajo water rights claims to the Colorado River or to otherwise provide water for the Navajo Nation. Stan has lectured extensively on Indian Reserved Rights, Colorado River issues, and the impact of the Endangered Species Act on tribal water rights. He received his law degree from the University of Colorado in 1978 and pursued undergraduate and graduate studies in water resources at the University of Michigan. He is admitted to the bars of Arizona, Michigan, New Mexico, and the Navajo Nation. He has practiced before various federal courts, including the Ninth and Tenth Circuits, the Federal Court of Claims, and the U.S. Supreme Court.



INDIAN WATER RIGHTS SETTLEMENTS BRINGING CERTAINTY TO UNCERTAIN WATER RESOURCES

Stanley M. Pollack
Navajo Nation Department of Justice
PO Box 2010
Window Rock, AZ 86515

I've been asked to speak about Indian water rights settlements in New Mexico. I am not sure why they asked me to talk about such settlements, since I am hardly an expert. The Navajo Nation has been working on its water rights settlements since 1996, and we still have a long way to go. If you want to hear from an expert you will want to talk with my friends here from the Jicarilla Apache Nation. They are the only tribe in New Mexico that has successfully gone from start to finish in terms of concluding a settlement. Their settlement legislation was approved by Congress in

1992, and their settlement decree was approved by the court in 1999.

I would like to share with you some perspectives I have on the settlement process based on my experience in the settlement negotiations between the Navajo Nation and the State of New Mexico. Although most of you are not from the San Juan River basin and may have little interest in the specifics of that deal, there are some lessons to be learned from the settlement process we have been through. In keeping with the theme of the conference – water resources

in the past, present, and future – I would like to talk about the settlement process in terms of the past, present, and future.

The Past – Starting the Discussions

Some of you were in Farmington for the 41st WRI conference. At that conference, in September 1996, Navajo Nation President Hale announced that he had invited New Mexico Governor Johnson to engage in settlement discussions to resolve the long outstanding claims of the Navajo Nation to the San Juan River. This was extremely important, not just to the Navajo Nation, but to the state of New Mexico. The Navajo Nation is the largest water user in the state of New Mexico, using the bulk of the water from the San Juan

The Navajo Nation is the largest water user in the state of New Mexico, using the bulk of the water from the San Juan River, the largest water resource in the state of New Mexico.

River, the largest water resource in the state of New Mexico. The San Juan River basin is in the northwest corner of the state, and the city of Farmington is the largest community in the basin. So in Farmington in 1996, the settlement process began when an olive branch was extended.

The Navajo Nation and the State of New Mexico were urged to put aside their “water wars” rhetoric in order to find common ground for all water users in the basin. Subsequently a Memorandum of Agreement was signed by Governor Johnson and President Hale to pursue the exploration of whether a settlement made sense of these particular claims.

I was also a speaker at that conference, and I outlined a roadmap of the various issues to be addressed as a necessary predicate to a Navajo settlement. Back in 1996, there were a myriad of outstanding issues in the San Juan River basin. The Jicarilla settlement had been approved by Congress and a settlement contract had been executed for a water supply out of Navajo Reservoir. But, the Jicarilla settlement decree had yet to be approved by the court, and the Jicarillas had a water supply from Navajo Reservoir but no way to use their settlement water. The Navajo Nation was also embroiled in a protest over Navajo Reservoir contracts with the Department of the Interior. The Department was trying to renew various Navajo

Reservoir water contracts, including a contract with the Public Service Company of New Mexico. That contract threatened a supply of water that would be necessary for a Navajo settlement and Navajo water development. Before discussions with the State of New Mexico could be productive, it was important to resolve this issue. Ultimately, we combined the issue of the PNM water contract with the Jicarilla settlement by bringing the company and the tribe together through a subcontract. The subcontract provided a mechanism for the Jicarilla Apaches to put some of their settlement water to use and provided a firm supply of water for PNM, which freed up a block of water in the Navajo Reservoir supply, making that block of water available for use ultimately in a Navajo Settlement. That water is now part of the supply for the proposed Navajo-Gallup Project in the proposed San Juan settlement.

Another outstanding issue was the proposed Animas-La Plata Project, which prior to 1996 the Navajo Nation did not fully support. Ultimately, the Navajo Nation got on board with Animas-La Plata as a project participant. We worked out a water supply for the project through an agreement with our neighbors in New Mexico and Colorado and laid the foundation for regional support of a Navajo San Juan River settlement.

Endangered species issues were an important constraint on water development in the basin in the early to mid 1990s, and it was unclear at the time of the Farmington conference whether there would ever be additional water development in the basin as a result of endangered fish. In the early 1990s, water developers were inclined to oppose all efforts of the U.S. Fish and Wildlife Service to recover the endangered species. However, there were those who had the vision to see that the problem of the endangered species would not simply go away and that collaborative efforts between the states, the tribes, the water users, and the Service would be necessary to recover endangered species.

Chuck DuMars presented a wonderful tribute to the great Al Utton yesterday. Al Utton was one of the visionaries who recognized that recovery of endangered species was essential to ensure the continued development of water in the San Juan River basin, and he was instrumental in the development of the San Juan River Recovery Implementation Program. Although the future of water development in the basin was uncertain in 1996, through that recovery program progress was made, and in 1999 Fish and Wildlife

Service opined that the Navajo Indian Irrigation Project, the largest water user in the basin, could be fully developed without jeopardizing the survival of the endangered fish. Although the endangered species issues are not likely to go away, the foundation was laid for a process to ensure both the recovery of native fish while proceeding with water development, particularly water development by Native American tribes.

The Present – The Settlement Process

The Farmington conference and the resolution of the issues identified at that conference represented an important past in the settlement process. By way of the present, I would like to discuss how the Navajo Nation and the State of New Mexico have worked and are continuing to work on the formulation of a settlement of the Navajo water rights claims.

The negotiations of the Navajo claims were very, very difficult, because as I mentioned, the Navajo Nation is the largest water user in the State of New Mexico and has the largest claim to water in the state. These claims are based not only on the existing uses of water by the Navajo Nation but also include claims under the *Winters Doctrine* for reserved water rights based on practicably irrigable acreage and on other theories. The magnitude of these water rights claims not only puts the rights of all of the water users in the basin in jeopardy, it puts the State in jeopardy of not being able to meet its compact obligations described earlier here in Estevan Lopez' talk concerning the Upper Colorado River Basin Compact.

As I said, these negotiations have been very, very difficult. They have also taken quite some time. For the first couple of years, the state and the tribe met several times, and with each meeting there was a better understanding of each other's positions and needs. It was like a dance or a courtship. But we knew the State of New Mexico was serious about developing a relationship with the Navajo Nation when State Engineer John D'Antonio brought Al Utton's son, John, into the negotiations on behalf of the State. Chuck DuMars spoke of Al Utton as a person of impeccable integrity and civility, and his son John brought those same qualities to the settlement discussions. It is a fitting tribute to Al Utton that his son John played and continues to play an instrumental role in the settlement process. I say this, not because John bought me a couple of margaritas at La Posta the other night, but because he brought so many skills to the negotiations.

I remember negotiations in John's office in Albuquerque, and we would be pondering various problems in the settlement documents. We would look out the window, and John would say, "look at the horizon, if you look closely you will see a big green spot, so pay attention." Miraculously a big green spot appeared, but then I had to turn to John and say, "John that is not a green spot, that's a balloon and we're in the middle of the balloon fiesta." In any event, the negotiations were fun, but difficult.

So what does the proposed Navajo settlement really look like? The settlement confirms the Navajo Nation's rights to water in three basic categories. First, the water for the Navajo Indian Irrigation Project is clearly defined and quantified. Although Congress authorized the project in 1962, it did not define clearly what the Navajo water rights would be for that project. There are three different opinions from the Solicitor of the Department of the Interior that attempt to opine as to the nature of those rights. The settlement quantifies those rights in a way that provides greater certainty to Navajo and non-Navajo water users. Second, the settlement quantifies what are also the substantial water rights the Navajos have from historic and existing irrigation projects; projects that were developed in the nineteenth century and continue to be used today. And third, the settlement recognizes a water supply for the proposed Navajo-Gallup Water Supply Project that I mentioned earlier. The actual settlement package consists of numerous documents; the most important document is Settlement Agreement between the Navajo Nation and the State of New Mexico which was executed this past April. The Settlement Agreement provides an "umbrella" for all of the components of the settlement, and includes an agreement to address a myriad of issues of common concern to the State and to the Nation, including the administration of water rights, the leasing and transfer of water rights, groundwater development, and the settlement of all claims.

The magnitude of these water rights claims not only puts the rights of all of the water users in the basin in jeopardy, it puts the State in jeopardy of not being able to meet its compact obligations...

The Settlement Agreement contains several appendices that are key supporting documents, including proposed decrees that define with specificity the water rights, a water contract for Navajo Reservoir water, and the proposed legislation for Congress to authorize the settlement, including authorization of the Navajo-Gallup Water Supply Project and authorization of the funding necessary to implement the settlement.

The Future – Congress and the Courts

The agreement with the state is not the final step. Conceptually, water rights settlements involve money and water. This is because tribes typically lack the financial resources to fully develop the water rights

that they may claim in water rights litigation or adjudications. Thus, tribes will often compromise the water rights they might receive by virtue of litigation, so-called “paper water” rights, in favor of receiving the financial resources to develop somewhat smaller water rights and put those so-called “wet water” rights to

Congressional approval of this expensive project and this expensive [Navajo] settlement will require a strong commitment of the political resources of the State of New Mexico and the Navajo Nation. This process could take years.

practical and beneficial uses. The proposed Navajo settlement follows this model and Congress is being asked to provide most of the funding for the settlement, including the construction of the Navajo Gallup Water Supply Project to provide drinking water to Navajo communities in New Mexico and to the City of Gallup. Congressional approval of this expensive project and this expensive settlement will require a strong commitment of the political resources of the State of New Mexico and the Navajo Nation. This process could take years. More on the political process later.

Once Congress approves the legislation to authorize funding the settlement, the money part of the deal is done, although it will take continued efforts to ensure that the authorized appropriations are actually made by future Congresses. The next step in the process is to finalize the water part of the settlement. A final court decree is required to quantify the extent and nature of the Navajo water rights, so those rights can be administered along with all other rights adjudicated in

the basin. At that stage in the process, the other water users in the basin will have the opportunity to object to the water rights of the Navajo Nation. Once again, the court’s approval of a final settlement decree may take more years to achieve. But wait, the process is still not complete. In addition to Congressional and court approval, the settlement is contingent on certain things being done, including the construction of certain water projects. Those projects will require a contract for water out of the Navajo Reservoir supply, so the settlement also will require a contract with the Secretary of the Interior for that supply.

So this settlement is a package, a bundle. For the settlement to work, Congress has to appropriate the money. The decree has to be entered. The projects have to be built. There are a lot of contingencies. In fact, we have optimistically set the year of 2026 as the year the final settlement becomes effective. Hopefully, I will not still be working for the Navajo Nation on this. Perhaps at a future WRRI conference, a young lawyer working for the Navajo Nation can report that all of these planned efforts were in fact successful.

Guns, Lawyers, and Money.

With the Navajo settlement as a framework, let’s talk more generally about why settlements are important and why settlements should be pursued. In addition to the “Past, Present and Future” theme of this conference, the sub-theme is “Guns, Lawyers, and Money.” The reason settlements should be pursued is that without settlements the alternative is “Guns, Lawyers, and Money.” Let’s talk about money first. Litigation is extraordinarily expensive. In the San Juan River basin there are an estimated 18,000 different claimants. The adjudication was filed in 1975, and only one water right has been adjudicated to a final decree. That water right belongs to the Jicarilla Apache Nation by virtue of a water rights settlement. The adjudication process is extremely expensive and time consuming. The hope is that through settlements you can streamline the process, but that remains to be seen. Settlements can still be protracted, involving a lot of lawyer time and a lot of money. As discussed above, even if everything goes as planned, the Navajo Nation’s water rights settlement may not become final for another twenty years

However, a settlement allows the parties the flexibility to obtain benefits that cannot be achieved through litigation. The final result of litigation is merely a piece of paper; a decree. The court’s decree says

that these parties are entitled to these rights, and that is it. It is a fairly limited process. A settlement, by way of contrast, offers the possibility of benefits accruing to both the Indian and non-Indian water users that are not necessarily available litigation. Let me give you a couple of examples. In the proposed Navajo settlement, the role of the State Engineer with respect to the administration of the Navajo water rights is very well-defined. In comparison, the general stream adjudication for the San Juan River basin will adjudicate the rights of the various parties, but the powers and limits of the State Engineer to administer the Navajo water uses within the basin could conceivably require separate litigation.

In addition, the proposed settlement contains a mechanism that provides certain protections of non-Indian water uses without significantly diminishing the paramount water right of the Navajo Nation. The settlement recognizes that the Navajo Nation possesses the most senior right to run-of-the-river diversions from the San Juan River and such rights are substantially larger than any other water user. The settlement would also recognize the Navajo Nation as the largest water user with storage rights in Navajo Reservoir. Under natural flow conditions, flows in the San Juan River drop precipitously in the late summer months jeopardizing all but the most senior water users of irrigation water. Without storage rights, the Navajo Nation could place a call on the upstream junior irrigators so that flows diverted to non-Indian farmers would be curtailed to satisfy the downstream senior water rights of the Navajo farmers. However, through the operation of the settlement, the Navajo Nation would utilize water from Navajo Reservoir to satisfy Navajo run-of-the-river rights instead of curtailing the upstream non-Indian farmers. Based on the hydrologic records, we believe that the risk of calls on the non-Navajo farmers would be reduced from forty-five percent of the irrigation years to just five percent of the years. No amount of water rights litigation could create such an elegant solution. This settlement solution creates far more certainty for all water users than litigation could ever produce.

Settlements also offer a vehicle for tribes to obtain “wet water” development in lieu of the “paper water” rights available through litigation. At the end of the day, or the decade, or several decades, of litigation, all that the tribe has is a piece of paper that describes a certain quantity of water that the tribe can use if the tribe has the means to put the water to beneficial use.

But where the tribe lacks financial resources to put that water to beneficial use, even a positive litigation outcome may not be worth all the guns, lawyers and money in the basin. The basic paradigm that many tribes have followed has been to trade a portion of the “paper water” rights that would be claimed in litigation for the benefit of a small amount of “wet water” development by virtue of a settlement. The swapping of “paper water” for “wet water” has fueled many Indian water rights settlements and provides potential win-win scenarios for all the water users.

...the proposed settlement contains a mechanism that provides certain protections of non-Indian water uses without significantly diminishing the paramount water right of the Navajo Nation.

Settlements are also attractive because they provide a certainty that is not necessarily available in litigation. I previously referred to uncertainties that arise out of the future administration of water rights and the uncertainties to water supplies that may arise from calls against the non-Indian water users. Then there is the uncertainty of litigation that never seems to end. After thirty years of litigation in the San Juan River basin no one, other than the Jicarilla Apaches, has a water right with any degree of certainty. Settlements can resolve the large claims of the tribes which create the uncertainty for all other water users in the basin. Chuck DuMars talked yesterday about parties that are driven toward settlements to avoid uncertain outcomes in a risk adverse process, and I agree. Litigation is a crapshoot for all the parties, but settlements can provide not only certainty as to your own rights but also certainty over the cloud that may exist over the entire basin by virtue of unquantified *Winters* rights claims by tribes.

Although we may discuss settlements as an alternative to litigation, it is my theory that in the context of Indian water rights cases, all litigation will ultimately result in a settlement. For example, the *Big Horn* adjudication involved the water rights of the Northern Arapahoes and the Shoshones living on the Wind River Reservation in Wyoming. The tribes were determined to litigate their water rights and the case went to trial from start to finish. Then after the trial, there were appeals through the state courts. Eventually the case went to the U.S. Supreme Court. Today, what is the

status of the tribes' water rights? They have not put their water rights to beneficial use and engaged in protracted litigation with the state of Wyoming over the administration of such water rights and whether the rights could be devoted to instream flows. That litigation also went back to the Wyoming Supreme Court. In the end, the tribes are beginning to realize that to get anything done, they will have to negotiate the resolution of these issues rather than continue an

The lesson is that when it comes to “wet water” development, if you don’t have the financial wherewithal to put the water to beneficial use, you must be prepared to settle with the very people you were willing to litigate against.

endless litigation process. This has sent a strong signal to other tribes that if you they want certainty, if they want “wet water,” then perhaps litigation is not the way to go.

These principles are not unique to the water rights of tribes. The most famous water rights case of the twenty

th century is *Arizona v. California*. What happened in *Arizona v. California*? Arizona did not ratify the Colorado River Compact because she was concerned that California, as a much larger and prior appropriator, might get the right under the prior appropriation doctrine to almost all of the water that was apportioned to the lower basin. Arizona opted for “guns, lawyers, and money.” She sued California in a series of cases each entitled *Arizona v. California*. The most famous of which is the one filed in 1952, in which Arizona claimed that the Boulder Canyon Project Act of 1929 effectively apportioned the waters of the Lower Colorado River Basin to Arizona, California, and Nevada. In its decision in 1963, the Supreme Court agreed with Arizona on virtually every issue. Arizona wanted to limit California to the 4.4 million acre-feet of water apportioned by the Boulder Canyon Project Act despite the fact that California was growing and growing. The Supreme Court agreed. Arizona wanted to exclude the one million acre-feet of tributary water awarded to the Lower Basin from the 2.8 million acre-feet apportioned to Arizona. The Supreme Court agreed. By all measures, Arizona kicked California’s butt in this litigation.

So as a result of *Arizona v. California*, Arizona obtained a “paper water” right of 2.8 million acre-feet

of water. Of course, the question that remained was how would Arizona put this water to beneficial use? The dream of Arizona was to build an aqueduct from the Colorado River to bring water the heart of Arizona for use in Phoenix and Tucson. Of course such a project would require the expenditure of billions of dollars. Where could Arizona possibly get that kind of money? Uncle Sam. So, the day after the Supreme Court announced its decision in 1963, Arizona Senators Hayden and Goldwater of Arizona introduced legislation to authorize the Central Arizona Project. Now these Senators were a couple of pretty powerful guys, but they were no match for California and its forty-five congressmen. So when it came time for Arizona to put her water to beneficial use, she had to make a deal with the devil California, the state that just got its butt kicked in court by Arizona. As a result, Arizona was forced to make a deal with California as part of the Colorado River Basin Project Act of 1968. Arizona’s water right for the Central Arizona Project is subordinated to all the other water uses on the Colorado River in the Lower Basin. In other words, the Central Arizona Project is the junior water user. That means that California gets every drop of its 4.4 million acre-feet, before Arizona’s Central Project can take a single drop of water. In the end, Arizona made a settlement with her enemy from the litigation. The lesson is that when it comes to “wet water” development, if you don’t have the financial wherewithal to put the water to beneficial use, you must be prepared to settle with the very people you were willing to litigate against.

What does this mean for the Navajo Nation? Navajo can go to court, assert huge claims, jeopardize the water supply for the non-Indians and threaten the ability of the state to comply with its compact obligations. But the Navajo Nation needs drinking water for its people. On a reservation where almost half the people must haul their drinking water, the Navajo Nation needs costly municipal water infrastructure. The centerpiece of the proposed settlement is the Navajo-Gallup Water Supply Project. Of course the Navajo Nation could try to ask Congress to fund such a project without a settlement. But what is the first thing the New Mexico Congressional delegation would ask – “Do your neighbors support this bill?” Simply put, the Navajo Nation would have a difficult time telling the delegation that it wants to continue to litigate, to dry up the non-Indian communities, and to put New Mexico’s apportionment at risk while asking for Congressional support for

Indian Water Rights Settlements -
Bringing Certainty to Uncertain Water Resources

Navajo municipal water infrastructure. What would happen if Navajo went that route? The delegation would call up our friends in Farmington, and all of the other good folks in the San Juan Basin that we are litigating with and ask them what they think of the project. Everyone is going to say, “How can you build a project for the Navajos when they are clobbering us in court?”

So in order to create certainty, settlements are a necessity. No matter how much you fight in court, at the end of the day when it comes time to build water infrastructure and Congressional funding is needed, you still must make a deal with the same people you would fight with in court. Ultimately, the paradigm right now is that water cases will eventually result in a settlement. You either settle now or settle later. With the advent of tribal gaming and additional revenues that are flowing in tribal government, perhaps that paradigm will change in the future. For now, tribes will either have to settle now or settle later.

Does the future portend guns, lawyers, and money? I would like to think that we have made a lot of success in reaching this Settlement Agreement with the State of New Mexico. To paraphrase Winston Churchill, perhaps we are not at the beginning of the end, but at least we are at the end of the beginning. The settlement process continues as we now must convince Congress to spend the money necessary for the settlement. Our settlement is expensive. Municipal water infrastructure is expensive, but I would submit to you that it is even more costly not to settle this case. New Mexico does not need more years and decades of litigation or having its water supply and the water uses of all the water users put at risk.

As the State Engineer mentioned, we signed an agreement on April 19th of this past year. The United States did not sign the agreement. The United States does not want to spend money. We have to go to Congress, and we have to have Congress tell the Secretary to sign the agreement, spend the money, and build the projects. Hopefully we can get it done. Hopefully the future will not be guns or litigation. Hopefully we will have these issues resolved. I look forward to hopefully reporting back a more favorable outcome to this conference in the future. Thank you very much.

Information on the proposed Navajo settlement can be found at: http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj.html

Bonnie Colby is Professor of Agricultural and Resource Economics at The University of Arizona, where she has been a faculty member since 1983. She received her doctorate in resource economics from the University of Wisconsin. Her expertise is in the economics of interjurisdictional water disputes, water rights valuation, water transactions and water policy. She has authored over one hundred journal articles and five books, including the books Braving the Currents: Resolving Conflicts Over the River Basins of the West, Water Markets in Theory and Practice, and Negotiating Tribal Water Rights. In addition to her teaching and research, Bonnie advises public and private sector organizations throughout the western United States on drought preparedness, water acquisitions, and water pricing.



STRUCTURING VOLUNTARY DRY YEAR TRANSFERS

Bonnie G. Colby
Katie Pittenger, Research Assistant
Department of Agricultural and Resource Economics
University of Arizona
1110 East North Campus Drive
Tucson, AZ 85721

Water supply variability is a challenge throughout the western United States and worldwide. Numerous western cities have recently made efforts to acquire agricultural water to enhance supply reliability. Elsewhere in Australia, Chile, Spain, and parts of Africa there has been an ongoing concern between rural and urban interests trying to firm up supplies and get through drought. In dry years, voluntary, temporary water transfers are an essential tool in “firming” supplies for those sectors which value reliability most highly. The temporary nature of such transfers make them effective in managing drought-induced supply variability. However, because they are a temporary “borrowing” of water from an established user, they are not suitable to provide long term supplies for population growth. There are several tools available

to structure dry year transfers, including water banks and dry year option contracts.

Water Banks

Water banks are typically created during drought to facilitate water transfers. Dozens of regional water banks exist throughout the U.S. that perform a range of functions. Water banks can assist with water transfers by facilitating negotiations and transactions between willing buyers and sellers. Often, a water bank will negotiate contracts with agricultural districts to lease water. Banks can also coordinate with private sector water brokers.

It is important for a water bank not to displace private interests which are involved in water business in the region. In most parts of the West, there are now

professional water brokers who help facilitate transactions. Publicly authorized water banks can coordinate with private sector water brokers and represent the public interest (such as water quality, local economic effects and fish and wildlife habitat) in water transactions and negotiations. The private sector can play a crucial role even when a public entity coordinates temporary transfers for dry year reliability.

When a drought is over and wet conditions return, water banks typically continue to operate, taking on coordination functions. Water banks can store water

As is the case with other forms of water transfers, water bank transactions can cause third party impacts on the environment and/or communities in the source area.

for future use, which requires adequate storage. In Arizona, for example, many years of groundwater overdraft have created vast underground storage space. Similar underground storage is possible in parts of New Mexico. Flexi-

bility in reservoir use and river system operations is also important in the operation of a water bank.

Another important function for water banks is to screen out “paper water,” that is, legal access to water that may not provide actual wet water for the desired purpose at the desired time. Paper water, for instance, can be created when irrigation districts receive “credit” for reducing their diversions, but actual consumptive use in the district is not reduced. In this case, wet water is not generated for other purposes. Banked water needs to be water that is physically available for use, particularly during dry periods.

In the Truckee-Carson Basin in western Nevada, for example, water was needed for dry year endangered fish recovery programs and to buffer drought impacts in the urban areas of that part of Nevada. There was a large quantity of agricultural water that had not been consumptively used for many years, which meant that water was paper, not wet water. As a result, it became the task of the organization that arranged temporary transfers to coordinate with the State Engineer’s office to identify which agricultural water entitlements had recently been consumptively used. This was necessary so that water acquisitions actually would firm dry year supply by ensuring that wet water was being acquired.

As is the case with other forms of water transfers, water bank transactions can cause third party impacts on the environment and/or communities in the source area. Water banks can account for third party impacts by negotiating with potential third parties or their representatives, and arranging appropriate compensation.

The following are examples of active water banks in the western US:

Idaho Water Bank: Dry Year Following

The Idaho Water Bank along the Snake River is the oldest water bank in the western United States. Conflict in the region stems from groundwater-surface water issues and endangered fish concerns. In 2001 in anticipation of electricity supply shortages stemming from drought and price shocks in California’s energy market, Idaho Power Company (IPC) initiated an “irrigation electricity buyout” program. IPC solicited bids from large irrigators to voluntarily reduce their 2001 energy consumption. IPC hoped to evade shortage by reducing energy (and water) use among irrigators.

Low crop prices and threatening drought prompted greater program participation than was expected. Within two weeks of the program’s initiation, 400 farmers had contracted to forego use of 500 million kWh of electricity used for pumping groundwater to irrigate almost 150,000 acres of cropland. Bids at or below 15 cents per kWh were accepted, with IPC ultimately paying 15 cents per kWh, or approximately \$485 per acre, to all participating irrigators. This is equivalent to approximately ten times the annual rate for a piece of average quality farm land, which explains why the arrangements were finalized so quickly (Hamilton and Taylor).

Klamath Water Bank

The waters of the Klamath Basin support irrigated agriculture, the municipal and industrial sectors, hydroelectric power, fishing, recreation, and environmental uses. However, in seasons when stream diversions coincide with dry conditions, the remaining streamflow is inadequate to support endangered fish populations, and the result has been bitter water conflicts. In 2003, the Bureau of Reclamation created the Klamath Water Bank as an overall response to the conflicts and to address a NOAA-Fisheries Biological

Opinion establishing specific flow requirements to meet the needs of endangered fish species.

The Klamath Water Bank is charged with creating voluntary reductions in water diversions in order to ensure flows for fish recovery. Since 2003, the bank has met its flow requirement through soliciting bids from farmers for temporary land fallowing and for replacing surface water irrigation with groundwater irrigation. In 2003, irrigators were offered \$187.50 an acre, which generated approximately 14,400 acres of fallowed land that year. The water conserved by land fallowing actually exceeded the flow required by the biological opinion, so the following year the bank switched to a bid solicitation process in which farmers were asked to submit bids per acre. In 2004, approximately 4,400 acres of land were fallowed, and the average cost per acre-foot was \$65.

In 2005, the flow requirement was 100,000 acre-feet, and lands irrigated with surface water in both 2003 and 2004 were eligible to submit a bid for the 2005 fallowing program. This time, the bid price per acre-foot of water was calculated based on consumptive use according to farm-specific crop and soil type. This value was then used to select the least expensive bids. As an additional criterion, large contiguous acreages were favored for fallowing, as this helps the district manage its water deliveries. A total of 258 applications for land fallowing were submitted in 2005, representing 43,400 acres. The average bid price per acre was \$159.80, and 159 bids were selected for inclusion in the banking program (Bureau of Reclamation Mid-Pacific Region).

California Drought Water Bank

There are about a dozen water banks currently operating in California, each with different authorizations, regions of the state, and reasons for existence. One example is the California Emergency Drought Water Bank which was established in 1991 as an adaptation mechanism following five years of drought in the state. The California Department of Water Resources (DWR) negotiated voluntary contracts to purchase water for \$125 per acre-foot from farmers who chose to fallow their land or substitute groundwater for surface water irrigation. DWR negotiated 351 supply contracts in less than five months, making available over 820,000 acre-feet of water to meet the critical needs of the state.

The \$125 offer price was around six to seven times the net return to water for an acre-foot of consumptive

use for crops grown in the areas the bank was targeting. DWR was obliged to accept all of the water offered to them because of the way the program was written, and as a result DWR obtained more water than the end users were willing to pay for and the state had to bear the unreimbursed costs. In the next few years, the bank remained operational but wetter conditions and more restrictive participation led to lower trading activity and a lower offer price. Irrigators vary their response based on offer price, so it is essential to set a price designed to obtain the desired quantity (Clifford, Landry, and Larsen-Hayden).

Irrigation Suspension in Texas

The Edwards Aquifer in the San Antonio area of Texas supports agricultural, municipal and industrial water use in the greater San Antonio region, and also supports a diverse biological environment (including five threatened or endangered species). The springs in this area of Texas are very closely tied to groundwater pumping and groundwater levels around San Antonio. The area came under very intense pressure after a federal court ruling involving the need to maintain spring flows for native fish species in the region and ponds that relied on the springs. In the 1990s, drought-induced water shortages prompted an irrigation suspension program aimed at meeting municipal and environmental needs.

The City of San Antonio solicited offers for irrigation suspension because they were the urban area most at risk of cutbacks and imposed water rationing. Farmers submitted a bid price per acre of land fallowed. Bids were evaluated based on a farm's crop types, irrigation system, commitment to dry land farming, and the bid price per acre. Lower valued crops were favored by both the City and the irrigators because the compensation to irrigators would be less for lower value crops and also because farmers wanted to fallow their marginal, least profitable lands.

Twenty-thousand acre-feet were quickly obtained through land fallowing. Ten-thousand acre-feet were auctioned off to municipal users to cover the costs of

Dry-year option contracts are something that has been experimented with in arid regions worldwide, but they have become increasingly sophisticated in the western U.S. in the last ten years.

acquiring the water. The remainder was dedicated to meeting endangered species needs (Keplinger and McCarl).

Dry Year Options Contract

Dry-year option contracts are something that has been experimented with in arid regions worldwide, but they have become increasingly sophisticated in the western U.S. in the last ten years. Dry-year options are contractual agreements that provide for voluntary and temporary drought-triggered water transfers. They are a mechanism for maintaining the agricultural base while serving municipal, environmental, and industrial needs throughout a drought because the ownership of the water right does not change. Water is temporarily transferred out of senior agricultural water uses to municipal or environmental restoration uses, but the water right remains with the district that holds the long-term water contract to use the water under a public project or with the original agricultural holder or that right.

Typically, buyers pay an up-front fee which secures the option to transfer irrigation water to a new use if specified dry-year conditions are met. Then, if the option is exercised, buyers pay on a per acre-foot basis to exercise the option. For example, dry-year options contracts between the Metropolitan Water District of Southern California (MWD) and several Sacramento Valley irrigators were negotiated at \$10/acre-foot for the water district to secure the option. Then, growers were paid \$90/acre-foot to exercise the option. In this instance, participating irrigators in the Sacramento Valley switched to less water intensive crop production in order to provide water for transfer. In 2003 almost 100,000 acre-feet of water were transferred via dry year options contracts in the Sacramento Valley (Metropolitan Water District of Southern California).

Successful dry year options programs usually require a sound working relationship between water districts and their member irrigators. The issue of splitting the proceeds from dry year leases between the district, who does have certain management obligations and extra in management concerns, and the growers, who are ceasing to irrigate and therefore forgo income from crop production, is a challenging negotiation that has to take place. Often, a water entity, such as a water bank, will negotiate the contract terms with water districts, and the districts then negotiate payment for land fallowing with individual irrigators.

In the 1980s in Utah, for example, an electric power generating facility needed 45,000 acre-feet of water to operate its plant. The power facility was located in a rural, agricultural region of Utah, and the local communities were concerned about the plant being built in their area. When the power company began seeking water rights, the communities involved set up an arrangement in which all members of the irrigation companies were invited to participate in making water available. The power company negotiated with the local irrigation districts and ultimately purchased a package of 45,000 acre-feet of water that was composed of water rights of relatively small quantities from many different irrigators (Saliba and Bush).

Major impediments to the development of active land fallowing programs are unfamiliarity with the process (by both irrigators and water districts), lack of program momentum, and rivalry among growers to receive payments. One approach to addressing these obstacles is to offer an early response bonus to farmers who embrace the program in its early stages. For example, if every irrigator in a specific district were given an option right to sell 10% of their water in a given year, negotiations and trades to sell and acquire options could then also occur between farmers. That is, if one farmer wanted to lease out more than 10% of his water, he could buy an option from a farmer who did not wish to lease out his water. This means that even those farmers who did not choose to sell their water would still be involved in, become familiar with, and benefit from the program. It also avoids a divide and conquer approach, which has been the case in many of the early years of water transactions between cities and agriculture. This is a public, open process involving publicly authorized entities on both ends of the transaction, that is, the water bank or water authority and the district. Each district member receives some form of benefit, and the revenues from the acquisition program are spread very broadly.

The cost of paying for dry-year options should be evaluated and weighed against the additional reliability the options will provide to municipal supply, fish recovery programs, and so on. Dry-year options are much more expensive (often four times more expensive) on a per acre-foot basis than outright water purchases. The desire to avoid the third party impacts associated with permanent fallowing and to maintain

a reliable agricultural sector are the chief impetus for considering these drought-triggered transactions.

Third Party Impacts

Third party impacts can generate significant controversy and opposition to water transfers, ultimately preventing some transfers altogether and making others more costly. Community opposition stems from concerns that local businesses and workers will suffer due to reduced spending by farmers as agricultural land is fallowed. Third party impacts can be quantified using standard regional economic models, which are relatively transparent and can accommodate differing assumptions about changes in farmer expenditures when land is fallowed. There are viable options for addressing community impacts, thereby lessening opposition to temporary water transfers out of agriculture.

There can be a rebuttable presumption using these local economic impact models to estimate the magnitude of the impacts. These local impacts, everywhere they have been documented, have been a small fraction of the drought costs that are being averted through these temporary transfers. Compensation for third party impacts does not “break the bank” in terms of dry year transactions. It is something to be put in place and made part of the dry year reliability program structure. State and federal agencies have the power to encourage investment in the area through other types of non-water-related programs, such as small business loans. It is important to consider bringing some of these other policies into use when considering dry year firming and supply reliability for a region.

The key to addressing third party impacts is cost. Parties or communities who object to transfers out of agriculture can generate very high costs for the participants in a supply reliability agreement. One way to address third party impacts is adequate payments to farmers. In voluntary fallowing agreements, farmers generally receive two to three times what they would have earned irrigating crops, including having federal program payments that would have gone with crop production. Options programs can be designed to provide incentives to irrigators to spend or invest their fallowing payments locally in agriculture or agriculturally linked businesses.

In general, dry-year options are more expensive on a per acre-foot per year basis than the outright purchase of water rights. The higher cost of options

contracts must therefore be justified by a significant improvement in dry year supply reliability. This means dry year options programs must be carefully structured to maximize supply reliability benefits and must be based on reliable “wet water” sources rather than “paper water.”

Firming water supplies is not simple or inexpensive, but pre-planning is more effective and less costly than reactive, crisis management response to drought-related shortages.

In sum, effective voluntary dry year lease programs require careful structuring, but if well planned, can decrease the pressure for permanent water transfers out of agriculture. Typically, senior consumptive users such as irrigators and Native American tribes have the most reliable water in a region that could firm supplies for other users by temporary land fallowing. The third party impacts generated by temporary transfers are less than permanent purchases, but it is still important that direct local economic impacts be systematically quantified and compensated.

Firming water supplies is not simple or inexpensive, but pre-planning is more effective and less costly than reactive, crisis management response to drought-related shortages. Water in the West creates an “inextricable web of mutuality” between rural and urban users at the tribal, municipal, state, and federal levels. Tackling supply reliability necessitates integrated participation and acceptance of reliability enhancement strategies from all parties involved.

REFERENCES

- Booker, J. and B.G. Colby. 1995. Competing Water Uses in the Southwestern U.S.: Valuing Drought Damages. *Water Resources Bulletin* 31, pp. 877–888.
- Clifford, P., C. Landry, and A. Larsen-Hayden. July 2004. “Analysis of Water Banks in the Western States.” Prepared by Washington State Department of Ecology and WestWater Research.
- Colby, B.G., J. Thorson, and S. Britton. 2005. *Negotiations Over Tribal Water Rights*. University of Arizona Press.

- Colby, B.G., and T.P. d'Estrée 2004. *Braving the Currents: Resolving Conflicts Over the Rivers of the American West*. Kluwer Academic Publishers.
- Colby, B. G. 2001. Resolving Interjurisdictional Disputes over Water and Environmental Quality. *Water Resources Update* 36: 20-29.
- Ganderton, P.T., D. Brookshire, B.G. Colby and M. Ewers. 2004. Market Prices for Water in the Semi-Arid West. *Water Resources Research*. 40:9:W09S04.
- Hamilton, J.R. and R.G. Taylor. Winter, 2001. Brownouts in California, Brown Fields in Idaho. *Choices*. 16:4:5-10.
- Keplinger, K.O. and B. McCarl. 2000. An Evaluation of the 1997 Edwards Aquifer Irrigation Suspension. *Journal of the American Water Resources Association*. 36:4:889-901.
- Leones, Julie, Bonnie Colby, Dennis Cory, and Liz Ryan "Measuring Regional Economic Impacts of Stream Flow Depletions," *Water Resources Research*, 33: 831–838, 1997.
- Metropolitan Water District of Southern California. 2003. "Metropolitan Calls on Water Transfer Options from Sacramento Valley Rice Farmers." <http://www.mwdh2o.com/mwdh2o/pages/news/press_releases/2003-02/Options_Exercised.htm>
- Saliba, B. C. and D. B. Bush. 1987. *Water Markets in Theory and Practice: Market Transfers, Water Values and Public Policy*. Boulder, CO. Westview Press.
- "2005 Water Bank." Bureau of Reclamation Mid-Pacific Region website. <http://www.usbr.gov/mp/kbao/pilot_water_bank/>

Ari Michelsen is Center Director of the Agricultural Research Center at El Paso and Professor of Agricultural Economics, Texas A&M University. His research includes studies on water markets, valuation and prices, effectiveness of agricultural and residential water conservation programs, and decision support systems for river basin resource management and policy analysis in the U.S. and China. He serves on the Board of Directors of the American Water Resources Association, Board of Directors Texas Economists, Board of Directors and is Past-President of the Universities Council on Water Resources, Southwest Hydrology Advisory Board, and is on the New Mexico-Texas Water Commission.



WESTERN WATER MARKETS AND PRICE DIVERSITY

Ari Michelsen

Texas Agricultural Experiment Station
Texas A&M University, 1380 A & M Circle
El Paso, TX 79927

Thomas Brown

U.S. Forest Service, Rocky Mountain Research Station
4825 E. Mulberry Street
Fort Collins, CO 80524

I want to follow up very briefly on Bonnie Colby's talk. It is wonderful to see dry year options making progress. A number of economists, including myself, worked on these many years ago. In the late 1980s, I worked with the City of Fort Collins, some electric utilities, and The Nature Conservancy. They were all interested in pursuing dry year options with farmers so that water could remain in agriculture and then be transferred during drought years for payment. They all opted at that time to just go ahead and buy up water rights and lease them back to the farmers because it

was so much cheaper for them to actually purchase the water rights than to enter into dry year options. I am glad that option terms are working out much more favorably.

I'd like to start by acknowledging my co-author, Tom Brown who is with the Rocky Mountain Research Station. Tom has worked with data on water markets that are very recent. I am very pleased we were able to report on market prices and trends.

In preparing slides for this talk, I ran across an old photo that I had that goes back about twenty-five years.

You'll notice in Figure 1 a farmer that had been told by the Bureau of Reclamation that the Bureau was going to turn off the head gates. He took issue with this. I thought it fit well with the conference theme, "Guns, Lawyers, and Money." You will notice the shotgun on the hood of the truck. He invited the Bureau to come on out and try to turn off the gate. I have two young kids. "Guns, Lawyers, and Money" seems to fit water markets pretty well, but the title also reminded me of something like "Rock, Paper, and Scissors." How do we determine who wins the situation?



Figure 1.

As most of you know, water rights transfers are not new. They really started occurring with prior appropriation early on. There are a number of conditions that are necessary for transfers spanning from hydrologic, economic, and legal conditions to the transaction process, which is very important. Phil King mentioned that EBID is working on some of the transaction processes along with the State of New Mexico. There are also a variety of institutions and methods used for water transfers, and these work to varying degrees but take much different time periods. We have administrative techniques that are often used by state engineers or simply irrigation district exchanges. Judicial or water court exchanges are used in states such as Colorado. And then informal exchanges occur from farmer to farmer. Those really make a difference on the prices, the transaction costs, and the length of time that it takes to accomplish those exchanges.

Water markets have been talked about, and many have said, "Yes, let's have a water market. That will make things efficient." Well, what is a market? Just very generally, it is an unspecified number of voluntary trades that for water has common physical and legal characteristics. That is pretty tough, because water is differentiated in terms of priority, where it is, how you

can move it, and what types of uses it is for. Markets have a great deal of diversity. As we will see, diversity varies from market to market. Some of them are quite thin, and some of them are very active.

What do you need for a market? Clearly, we must have defined property rights. Several of the speakers earlier brought this up: Frank Ward, John Shoemaker, and Phil King. You need to know what you have and where to sell it. Otherwise it is like a pig in a poke. You have to know where it is and when you can move it. It has to be mobile, legally and physically, and in an efficiently administered system. In addition, one speaker said that price does not really matter. Well, it does when you look at the expected value. What do you expect to get out of what you are purchasing? That has to exceed both the price and the other costs involved.

Water markets are in addition facilitated by information. Several of our speakers, especially John Shoemaker brought this up. Do we have adequate information for markets? Do you know the quantities, prices, and trading opportunities? Certainly for an efficient market, the presence of many buyers and sellers is necessary. Do we have that? Are there limited transaction costs? Bonnie Colby brought up the importance of third-party issues and the lack of return flow issues. You also actually have to have water in order for a water market to exist. Figure 2 depicts the mighty Rio Grande looking south toward El Paso.



Figure 2. You need to actually have water.

There are two main kinds of water trades. I am just hitting some of the very basics here. Water rights—the perpetual ownership of water. Water leases—the temporary purchase of water. Some of the questions that I am going to try and address here are where are the markets? How widespread are they? How many market transactions are occurring? We keep saying, "water markets." They are all over the place, right? How much? What types of transactions? How many of these are leases and which are sales of water rights?

Who is selling and buying? What are the prices and price trends?

Water market information is critical for markets to operate. There is really limited information available. Most is from voluntary reports, because these are often private transactions. A small number of studies have been done on select markets. That includes studies by Bonnie Colby, Chuck Howe, Larry MacDonnell, Richard Howitt, Chris Goemans, and David Yoskowitz, and I've done some studies. These studies have been on very select water markets. Some of them are fairly dated. The broadest, most readily available information is through a company called Stratecon, which publishes a newsletter with reports of water sales that they have been able to obtain.

The first part I am going to cover is based on the sales reported by Stratecon. This is evidence of fourteen years of water sales, and Tom Brown compiled the most recent set of these. Again, these are voluntarily reported, so they are not a complete census of trade. They are not all of the transactions that have occurred, and they are not a random sampling. However, they do provide an indication of the market activity, composition, locations, prices, and trends. I am also going to cover some other studies that were done recently.

Looking at fourteen years of data, there were 2,453 plus transactions reported in total (Table 1). Of those, a number were culled out for several reasons. The Colorado Big Thompson (CBT) water rights market is probably the most active water market, not only in the West, but in the world. They would really dominate any of the results. Therefore CBT transactions or trades were combined. If you had ten trades in a month for farmer sales to municipalities, they were combined as one trade. That really reduced the number and disproportionate weight. You can see that CBT transfers accounted for about a quarter to a third of the total trades. A lot of trades also include more than just water. Maybe water and land and other rights were sold, so those were culled out. Some of these were just exchanges and did not represent a water sale or price. Some included treated water effluent. Sometimes no water quantity was listed. They sold some water, but you do not know how much. In other cases, they were not market trades. They were donations. Again, no prices were associated with that or other information. This resulted in just fewer than 1,400 transactions included over the period.

Table 1.

Number of Transactions from Stratecon Inc. 1990-2003	
• Total Transactions	2453
• Trades removed from consideration:	
– by combining CBT trades	722
– more than just water included	81
– exchanges, not sales	31
– not raw water (treated water or effluent)	81
– no water quantity listed	19
– not market trades (e.g., donations)	138
• Number of qualifying trades	1381

What was the distribution of the market? Three states accounted for about two-thirds of all of the trades: Colorado, California, and Texas (Table 2). In the case of Texas, most of those were leases and not water rights sales. When you add in Arizona, you are up to almost three-quarters. Notice four states covered about seventy-three to seventy-five percent of all the trades. They are very concentrated.

Table 2.

Activity is Concentrated in a Few States		
	Number of Trades by State	
	N	Cum prop
Colorado	427	0.31
California	290	0.52
Texas	207	0.67
Arizona	90	0.73
Nevada	69	0.78
Idaho	66	0.83
New Mexico	60	0.88
Oregon	44	0.91
Utah	43	0.94
Wyoming	36	0.96
Washington	25	0.98
Kansas	16	0.99
Montana	5	1.00
Oklahoma	3	1.00
	1381	

Where were they occurring? The numbers on the chart in Figure 3 are hydrologic units. The dark areas represent greater than seventy-five trades or cases. Colorado, parts of California, and the lower valley of Texas are all dark areas. Then you start looking around the rest of the western United States, it gets pretty thin. There are very few transactions in many of these areas.

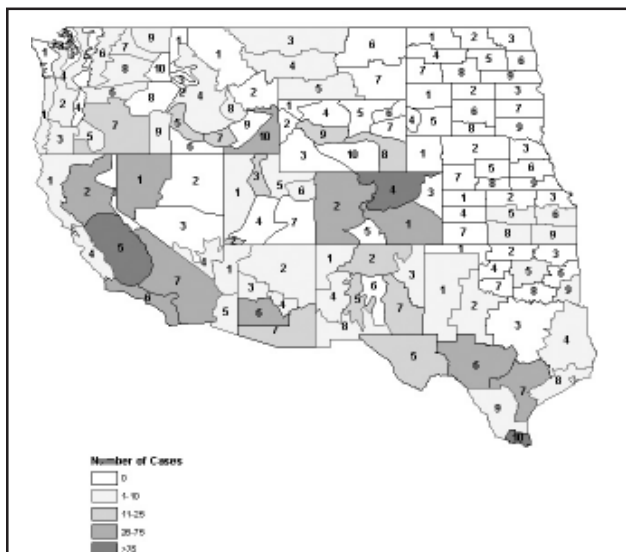


Figure 3. Water Market Activity: Number of water market trades by climatic division occurring over the past 14 years

How consistent are these markets, and where are they going? Let's look at the trends in the number of trades and leases versus rights (Fig. 4). The number of rights traded bounce around a little bit, but stay at an even keel in terms of the number of trades over the 14 years. The number of leases, though, is increasing over that period of time. These are short term. It is easy to go out and get a short-term lease.

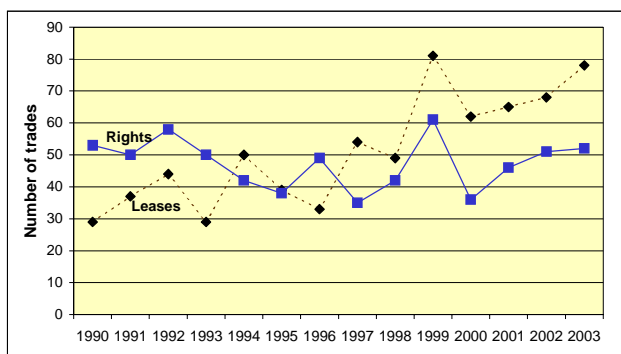


Figure 4. Trend in number of trades

What about the water volume of trades? Leases very much dominate water market transactions (Fig. 5). They are as much as ten, twenty, to one hundred times the number of water rights transactions that are occurring. Water rights transactions remain fairly stable, but are relatively low in number.

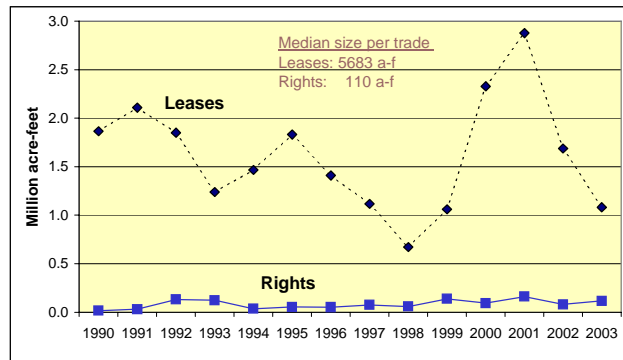


Figure 5. Trend in volume of water sold

To and from where are these transactions occurring? In other words, who is buying and who is selling? Table 3 depicts the information well. It shows where the water starts, and where water is going. Water is moving from farmers to municipalities and urban areas. Along the left side are the sellers. Water is going from farmers to municipal water providers in large part.

Table 3. Number of trades from seller to buyer (both leases and rights, all years)

Seller	Buyer							Total
	Munic.	Farmer	Envir.	District	Public	Other	Severall	
Municipality	26	9	0	7	18	7	4	71
Farmer	175	96	10	60	95	40	55	531
Environmental	1	0	1	0	1	0	0	3
Water district	21	19	1	38	32	8	16	135
Public agency	39	48	1	32	46	18	40	224
Other	60	12	1	26	22	69	4	194
Severall	53	21	0	20	20	21	87	222
Total	375	205	14	183	234	163	206	1380

Water district includes water storage or irrigation district, water association, water company
 Public agency includes federal or state agency, conservancy district, water bank,
 Other includes power plant, mining, developer, feed lot, country club, home owner,

Then we get to the issue of price. There is a little bit of a gamble here, and I will talk about that in a moment. Is water a risky market? Looking at all of the leases and water rights transactions over 14 years, you can see the mean and median on the left (Table 4). When you are looking at the median, there is a difference between leases and rights. Rights are reported on an annualized basis. They are essentially capitalized over the life of a right to make them comparable to leases.

Table 4. Western Water Market Lease and Right Prices 1990-2003 (2003 dollars per acre-foot per year)

	Mean (\$)	Median (\$)	N	Min (\$)#	Max (\$)
Lease	85	47	715	0	2258
Right*	108	72	662	1	630
All	96	56	1377	0	2258

*annualized using a 3% interest rate.

#cases with a \$0 price were not included. \$0 indicates rounding of a very low price.

Let’s look at the range in prices. For leases, you go to near zero as a minimum to over \$2,200 for one year of water. What is going on? Consider the conditions. In a drought when you need water, you are willing to pay for it for that year. When you are buying a right, you are buying a long-term right to that water. Again, you see a wide range; in this case, you are looking at roughly a one dollar minimum up to an annualized \$630 per year. There is a lot of diversity within these markets. When you talk about water rights markets or water leasing, you really need to be specific about what market you are dealing with.

Let’s look at leases and rights by state (Table 5). I do not expect to be able to go through all of this, but we will highlight a few states in particular. If we look at places like Montana, it was \$6 for a lease and \$9 in Oregon. There were no water rights sales in Montana and very few in any other state. If you look at New Mexico, it cost \$55 for leases and \$76 for rights. Again, these are capitalized. There is a huge variation, and some of these are hard to explain. What is going on with water in Oklahoma? It is being leased for almost \$350 an acre-foot per year. Some of the reasons have to do with the users in the market. In both Oklahoma and Texas, we have some very high leases, even though the median for Texas is \$29 per acre-foot for a lease. Some of the mining companies, including oil and gas, are paying \$500 an acre-foot. They do not need that much water. They know a few sellers, and simply pay for it.

Table 5. Water Lease and Right Market Prices by State

	Leases		Rights*	
	Median (\$)	N	Median (\$)	N
Arizona	58	48	40	38
California	68	250	37	44
Colorado	18	58	84	369
Idaho	8	49	3	15
Kansas	50	11	16	5
Montana	6	5	-	0
New Mexico	55	29	76	30
Nevada	83	4	109	65
Oklahoma	347	2	46	1
Oregon	9	34	7	9
Texas	29	159	24	48
Utah	7	11	17	32
Washington	37	21	13	4
Wyoming	40	34	43	2
All	47	715	72	662

* Annualized using a 3% interest rate.

Figure 6 illustrates the trends of prices. When you look at all users, prices do look like they are trending up slightly. They are going along fairly evenly, but trending up slightly since about the mid-90s.

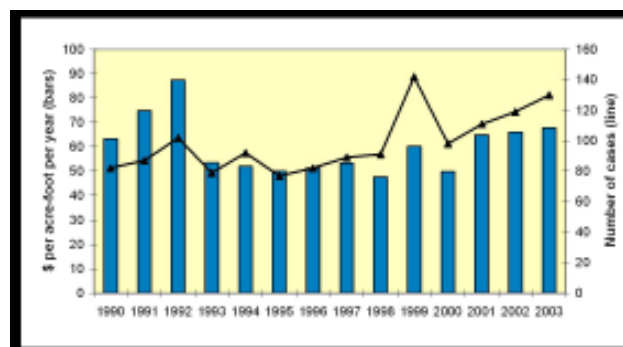


Figure 6. Trend in Price - all water uses

A different story is told when we look at individual uses (Fig. 7). Those individual uses include agriculture, municipalities, industries, recreation, and environment. It is interesting to look at water prices for environmental uses. They are certainly going up and are approaching municipal payments on average.

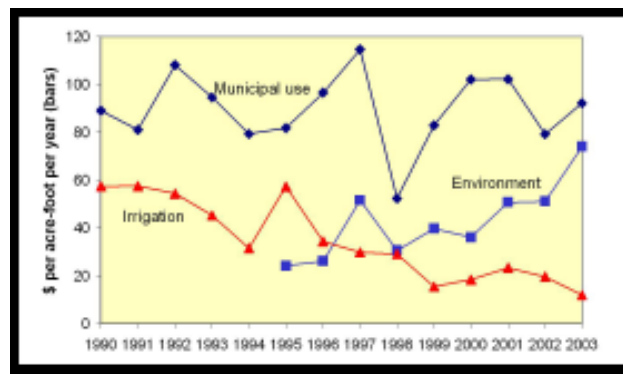


Figure 7. Trend in Price by Purpose of Buyer

Figure 8 is a graph of transfers and prices for a variety of environmental issues. One that is near and dear to most of your hearts is the silvery minnow. Here we look at the trend in the number of cases or the number of trades for environmental purchases and the purchase prices over time. You see a sharp increase. This is very important, because it is the composition of the market that plays a large factor. The composition of who is buying and how much they can afford to pay. Most of the payments for these environmental purposes are paid for by the government. It is the government buying water largely for endangered species. What happens to prices as that happens? They go up dramatically, and they compete much more with agriculture and municipal water demands.

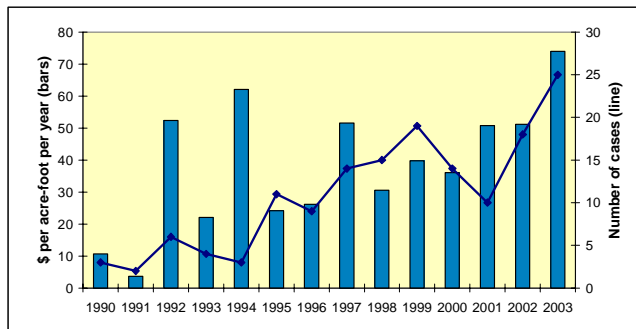


Figure 8. Trend in Price - Environment

Let's take a brief look at the diversity in water markets in terms of leases. Five cases are represented in Figure 9. The green lines at the top and bouncing around are lease prices of San Juan-Chama water. Then you also have Central Arizona Project water prices fluctuating. The Rio Grande water in the lower valley in Texas and the Upper Snake water prices are both pretty low. Look at the difference in prices. We go from just under \$10 an acre-foot to almost \$90 an acre-foot when you look across markets.

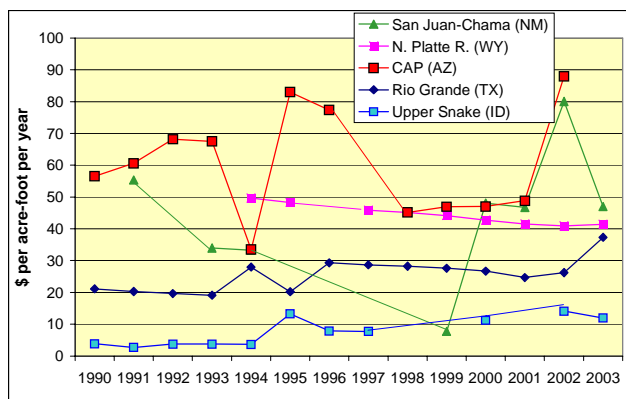


Figure 9. Trend in Water Price - Selected Markets

Back to what is a water market? Again, they are very site specific, and there are only a handful that are very active. This is the case looking at rights, where we see the same thing (Fig. 10). All of these are in Colorado. Again, we are looking at roughly \$50 an acre-foot for the purchase of a right on an annualized basis to well over \$500 an acre-foot. For a number of years, there were zero trades.

How can you go out and say, "I am going to get a good price, because it is a market? It is efficient. It has to be. It's a market." You have to ask and know, is there much activity going on? Is there much competition going on in these markets? No. Many of them are very limited.

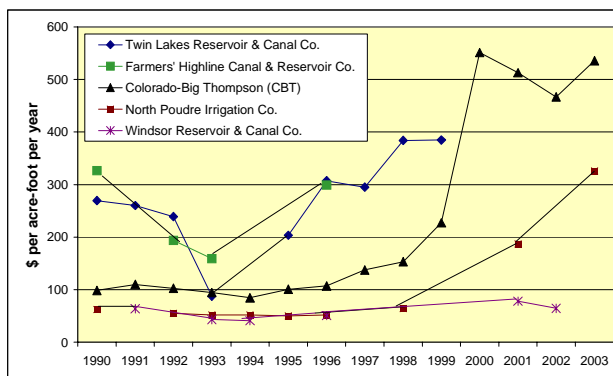


Figure 10. Trends in Water Price - Selected Markets
Median price of water rights in five Colorado markets, 2003 dollars

I am going to move on to a study that was done very recently by Richard Howitt and Kristiana Hansen, in *Choices* (2005). It was published in 2005, but uses water strategist data also (Table 6). In this study, they actually excluded Colorado Big Thompson sales completely, but they took a look across the states at the volume of water traded by leases and by water rights sales, and then the lease to sale ratio—in other words, how many leases per sale? You have places like Idaho where there were 692 leases and only one sale over this four-year period. In general, leases really dominate. The average was eight to one of leases to sales of water rights. You also can observe the prices of leases versus sales. For New Mexico, lease prices were \$66 per acre-foot, and this is much cheaper than middle Rio Grande water at this point at \$1,200 per acre-foot for the sale of a water right.

Table 7 comes from a study done by Larry MacDonnell, and it covered the period from 1975 to 1984. There were a lot of contributors to this study from each of the states. The reason that I like to show this is that this comes from thirty years ago. What we are looking at here is the number of water transfer applications. This is fairly consistent with the more recent data on transfers, although California was fairly low at that time. Colorado, New Mexico, and Utah were all quite high. The real purpose of this is to look at the administrative process. This is the length of time to approve the transfer of rights. You will see that it goes from just under six months to over eighteen months. That is a lot of time when you are paying lawyers and engineers and others to work on the transfer of your right. The administrative process used really makes a difference.

Western Water Markets and Price Diversity

Table 6. Results from another study using water strategist data

State	Volume (thousand acre-feet)				Price (\$/acre-foot, in 2004 dollars)	
	Lease	Sale	Total	Lease/sale ratio	Lease	Sale
AZ	1,371	24	1,395	53	73	894
CA	3,127	227	3,354	14	80	1,207
CO	74	242	316	0.3	22	3,451 ^a
ID	692	1	693	692	10	201
KS	4	0.2	4.2	20	51	—
MT	5	—	5	—	5	—
NM	338	10	348	34	66	1,233
NV	—	49	49	—	—	2,572
OK	10	—	10	—	59	—
OR	532	38	570	14	283	1,045
TX	877	322	1,199	3	81	864
UT	6	3	9	2	6	870
WA	68	13	81	5	53	513
WY	105	—	105	—	40	—
Total	7,211	929	8,140	8	86	1,299

^a CBT sales omitted. If included the average sale price is \$7,801.

Source: Data from the Water Strategist. The authors acknowledge Adams, Crews and Cummings (Georgia State University) for generously providing us with their database of Water Strategist transactions; and Alex Lombardi for assistance.

SEVER AND TRANSFER APPLICATIONS BY STATE (1975-84)				
<i>State</i>	<i>Number of Applications</i>	<i>Percent Approved</i>	<i>Mean Months to Decision</i>	<i>Percent Protested</i>
Arizona	30	93	8.2	17
California	3	83	N/A	48
Colorado	858	80	19.5	61
New Mexico	1,133	96	5.8	6
Utah	3,853	90	9.4	9
Wyoming	41	75	17.7	32

Lawrence MacDonnell. 1990. The Water Transfer Process as a Management Option for Meeting Changing Water Demands. Vol. 2. Natural Resources Law Center, University of Colorado.

Table 7. An Earlier Report on Market Activity by State, 1975-1984 (MacDonnell et al.)

Table 8 is from a study that was published in a book by Bonnie Colby in 1987. Again, it shows a select number of markets and the prices that existed then. It illustrates how thin these markets really are. If you look at Avra Valley, it has prives starting in the low 400s going up to \$870 in 1984, but many years with no trades or no data. It is similar to many other markets. The one that has the most consistent data is the

Colorado Big Thompson. You can see that starting in 1961 water right shares were at about \$130 in constant dollars up to over \$1,000. Colorado Big Thompson unit prices right now are about \$12,000 per unit. A unit provides about .7 acre-feet on average. That market had been up to \$15,000-\$20,000 per unit. It has had several peaks during its history. What is going on? Is this an unstable market for water?

Table 8. Representative Prices for Sales of Perpetual Water Rights (1986 dollars per acre-foot)

Year	Arizona ^a		Colorado ^b		Nevada ^c	New Mexico ^d			Utah ^e
	Avra Valley	Type II	C-BT	Twin Lakes	Truckee River	Gilla	San Francisco	DMAD	Ground-water
1961			130		150				
1962			150		140				
1963			220		170				
1964			370		150				
1965			440		130				
1966			530		160	1,790			
1967			560		160	ND			
1968			600		150	1,300			
1969			850		140	ND			
1970			920	900	140	ND			
1971	430		860	1,400	130	1,630			
1972	420		860	2,400	120	ND			
1973	NT		930	2,400	120	ND			
1974	NT		1,050	ND	110	1,240		330	
1975	570		1,090	ND	100	ND		ND	
1976	570		1,330	2,300	90	1,150		300	
1977	630		2,540	ND	90	1,420	510	550	
1978	NT		2,590	ND	80	3,210	480	550	
1979	700		3,050	ND	70	2,070	440	ND	
1980	NT		3,600	11,820	ND	3,270	ND	2,440	2,440
1981	NT		2,990	10,950	ND	2,090	1,110	1,200	1,150
1982	NT		1,880	ND	470	1,780	510 ^f	750	680
1983	NT		1,600	ND	1,730	1,460	ND	430	ND
1984	870	560	1,460	ND	1,570	2,520	1,460	430	740
1985	NT	920	1,080	ND	1,450	ND	1,250	350	710
1986	630	1,430	ND	ND	NF	ND	1,210	ND	
1987	NT	1,000	ND	8,180	1,750	1,810	1,110	ND	

NT indicates no transactions occurred in this market during the year indicated.
 ND indicates no price data was obtainable for transactions occurring during the year indicated.

Source: Bonnie Colby Saliba and David Bush. 1987. Water Markets in Theory and Practice. Table 5.2.

I am going to look briefly at some of the more specific trades of the Colorado Big Thompson. As I mentioned, in most of the other studies, these were excluded. What I am reporting on here is based on almost 2,700 individual transactions, that is every transaction that occurred within the CBT over a 15-year period. The market is in northeast Colorado. These are individual farmers selling water.

Who are they selling it to? The lime green on Figure 11 are municipalities and water providers. What is interesting in this market though is that individual farmers and irrigation companies are also very active in the market. Why is that? Should they be active in the market? Is that water really worth it to them in terms of agricultural production, alfalfa, corn, and other products? We will get to that very briefly.

Figure 12 indicates what the water prices looked like between 1961 and 1991 for the CBT. These cost about \$100 per acre foot in 1961. I would have liked to have invested back then. Now, look at the spike, but look at what happened later, too. The top axis here is \$6,500. Prices more than doubled in just a few years. Does this look like a stable market? What would be driving this? That is part of what we tried to look at.

What drives water right prices? We looked at transfers, the activity in the market similar to stock markets, but that does not explain the fluctuations. We looked at growth. Figure 13 refers to the area along the Colorado Front Range. Is urban growth driving this? It did not appear to be. It certainly was not when we looked at things like agricultural production, debt of farms, and other issues. Very little can describe the fluctuations.

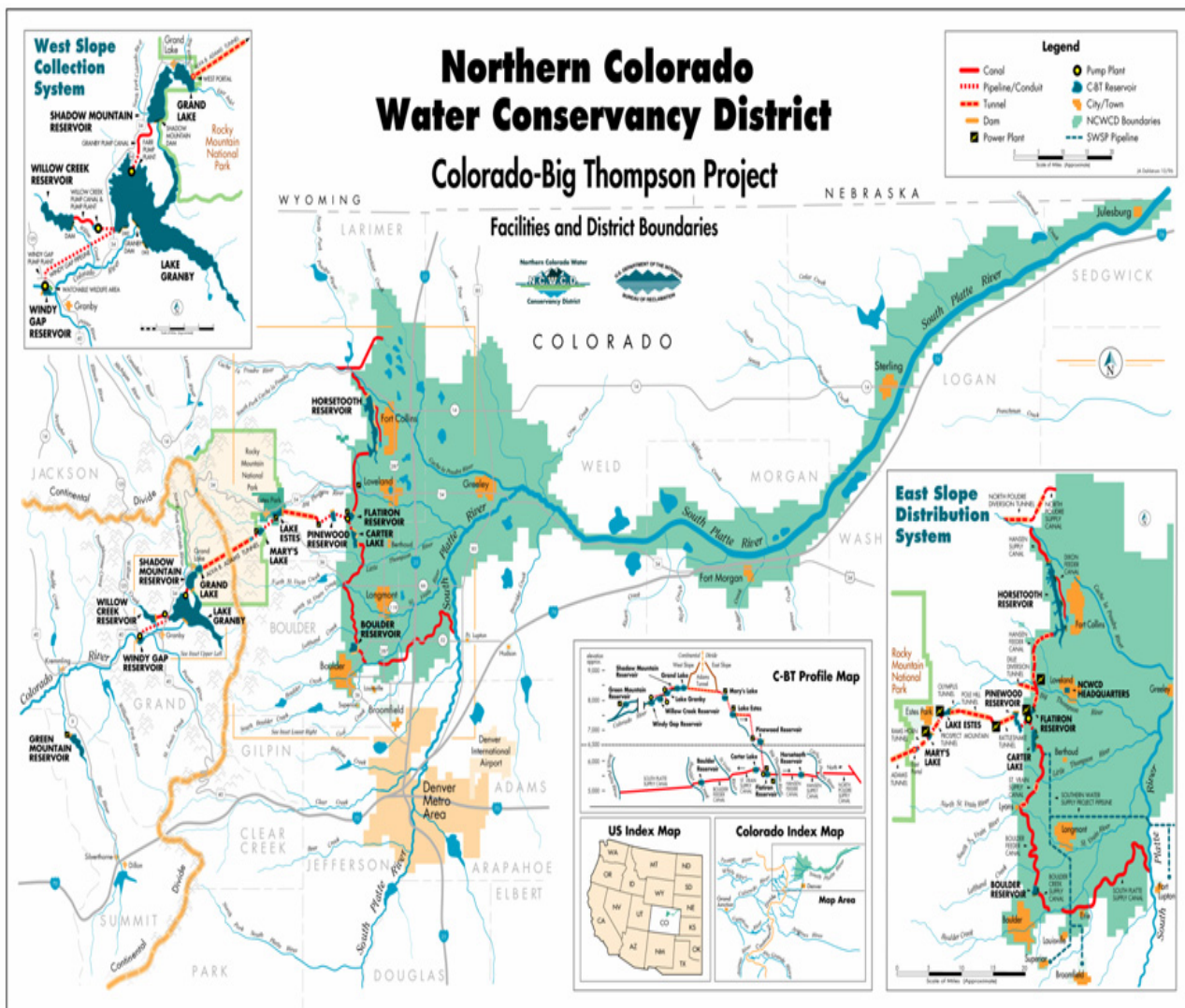


Figure 11.



Figure 12. CBT Price & Local Housing Starts

Amazingly, what did prices track best? Talk about speculation. The grey in Figure 13 is silver prices. The red is water right prices. Water rights by their nature, by their laws and institutions are not supposed to be speculative. They have large transaction costs. It is difficult to transfer them. What is happening in this market? One of the things that distinguishes this market is it is very easy to transfer. It is easy to get in and out of this market, which facilitates trades and speculation.



Figure 13. CBT Water Right and Silver Prices

Figure 14 looks at CBT prices compared with oil prices over time. What I like to note about this, and unfortunately economists are not rich, is that CBT prices preceded the peak in oil prices. I wish I had known. I would have invested. Speculation is a very important facet in some water markets. Figure 15 shows CBT water rights price movement and possible causes.

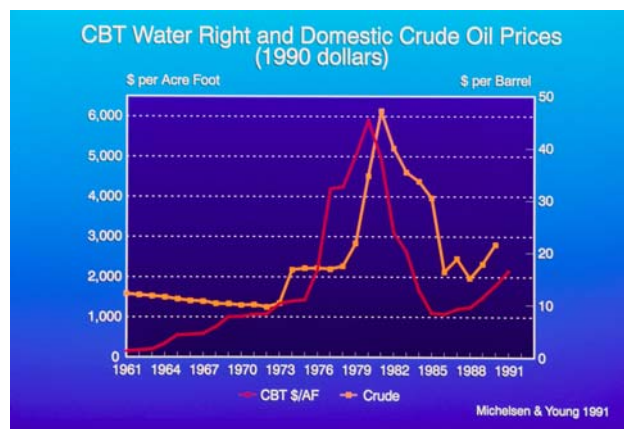


Figure 14. CBT Water Right and Domestic Crude Oil Prices



Figure 15. CBT and North Poudre Irrigation Company Water Right Prices (1961-1991)

In summary, market activity is really concentrated in a few areas. Most of the water is traded on short term leases. Most of the water is traded, big surprise, from farmers or agriculture to urban uses. However, the overall price trend is unclear. With municipalities, it looks fairly stable from the reported data. With environmental prices, they are growing and increasing rapidly. These markets are spatially and location user specific.

One of the important points is the lack of information. We have individual studies, and you have individual brokers that know the market in their specific areas. On the conference program that John Shoemaker is putting on in the spring, if you look at the people speaking, a number are local real estate appraisers. They know that local market. It is very difficult to get a gauge on markets overall.

The hydrology is important. Have you already built the infrastructure for transfers? Down in this area, we have the Rio Grande Project with Elephant Butte and Caballo reservoirs. We have capacity and the institutions. The length of time, the ease, and the cost are major drivers; the supply and demand or scarcity in that area. We do not really have that type of trade in this area right now, although we do have El Paso Water Utilities purchasing water leases for 75 years at \$4,500 per acre for urban acres. That will get them 2.8 acre-feet. On top of that, they pay the tax for the assessment. That is not terribly expensive. In this area, Chuck DuMars talked about prices starting in negotiation at \$6,500 an acre-foot. But before the sale was complete, it was \$8,500 an acre-foot. After Chuck's talk, I spoke with two or three others, and they talked about prices approaching \$10,000 to \$13,000 an acre-foot for Middle Rio Grande rights. Those are pretty steep and are very rapid changes.

In summary:

- 1) market activity is concentrated in a few areas;
- 2) most water is traded in short-term (lease) transactions;
- 3) most common trade is from farmer to city;
- 4) overall price trend is not clear, however, some markets and water uses show clear trends; and
- 5) water markets are spatially and user heterogeneous, that is, they are location and user specific.

Speculation is really driving prices. And there are barriers to market transfers. We have these throughout the western United States, but particularly here in New Mexico and Texas. We are dealing with compacts. We are dealing with how we are going to operate between the two states. Can we transfer? Frank Ward and I and another colleague, Jim Booker, did a recent study looking at if we relax some of the institutional constraints, or barriers, what would be the hydrologic and economic impacts. We estimated that the economic impacts of drought could be reduced by 20-30 percent by allowing some of this water to move through water market transfers.

References

- Brown, Thomas C. 2004. The Marginal Economic Value of Streamflow from National Forests. Rocky Mountain Research Station, U.S. Forest Service, Fort Collins, CO. DP-04-1, RMRS-4851.
- Colby, B.G., K. Crandall, and D.B. Bush. 1991. Water Right Transactions: Market Values and Price Dispersion. *Water Resources Research*. 29:1565-1572.
- Howitt, Richard and Kristiana Hansen. 2005. "The Evolving Western Water Markets". *Choices*. American Agricultural Economics Association. First Quarter: 20(1).
- MacDonnell, Larry J. 1990. The Water Transfer Process as a Management Option for Meeting Changing Water Demands. Project Completion Report, U.S. Geological Survey, Grant Award #14-08-0001-G1538. Volume I.
- Michelsen, A.M., J.F. Booker and P. Person. 2000. "Expectations in Water Right Prices." *International Journal of Water Resources Development*. 16(2):209-219.
- Michelsen, A.M. 1994. "Administrative, Institutional and Structural Characteristics of an Active Water Market." *Water Resources Bulletin*, American Water Resources Association. Vol. 30(6):971-982.
- Michelsen, A.M. 1997. Water Markets in the West: Transaction Activity and Institutional and Economic Conditions. 4th Annual Sinking Creek Water Law Symposium on Reallocation of Water Rights. Center for Law and Environmental Policy. Seattle, WA.
- Person, P. and A.M. Michelsen. 1994. Determinants and Trends in Water Right Prices: An Econometric Analysis. WWRC-94-06, Technical Report, U.S. DOI Geological Survey and Wyoming Water Resources Center, University of Wyoming, Laramie, WY. pp. 172.
- Saliba, B.C. and D.B. Bush. 1987. Water Markets in Theory and Practice. *Studies in Water Policy and Management*, No. 12. Westview Press, Boulder, CO.
- Ward, F.A. and A.M. Michelsen. 2002. "The Economic Value of Water in Agriculture: Concepts and Policy Applications." *Water Policy*. 4:423-446.
- Yoskowitz, D.W. 2002. "Price Dispersion and Price Discrimination: Empirical Evidence from a Spot Market for Water. *Review of Industrial Organization*. 20:283-289.

Mike Hightower is a Distinguished Member of the Technical staff in the Energy Security Center at Sandia National Laboratories. He is a civil and environmental engineer with more than 25 years experience with research and development projects, including structural and geomechanics research in support of space and weapons systems, research and evaluation of innovative environmental technologies for industrial and nuclear waste treatment and cleanup, and security and protection of critical infrastructures. Currently, Mike supports research and development projects addressing water and energy resource sustainability and water and energy infrastructure security and protection. These efforts include developing new water treatment and water monitoring technologies, developing models and techniques to improve water resource use and management, desalination and produced water treatment, impact of water availability on energy security and reliability, and water, electric power, and natural gas infrastructure security and protection. Mike holds bachelor's and master's degrees in civil engineering from NMSU.



Richard Kottenstette is a Member of The Technical Staff in the Geochemistry Department at Sandia National Laboratories. He is an analytical chemist who has over 25 years experience in fossil fuel, environmental, and homeland security research. His current position is project leader for the Sandia Advanced Concepts for Desalination Program. Specifically, he is responsible for the Desalination Jumpstart Project, a new effort aimed at selecting and developing emerging technologies that will enhance our ability to desalinate water. The Jumpstart Program will work closely with the Tularosa Basin National Desalination Research Facility in Alamogordo, New Mexico.



Larry Webb has a bachelor's degree in environmental management from University of Houston-Clear Lake. He worked for 17 years with League City, Texas as Director of Utilities. Larry has been with the City of Rio Rancho for eight years as the Director of Utilities. He is the Past-President of the New Mexico Environmental Quality Association and currently Vice Chair for the NM Municipal League Domestic Well Task Force. Larry is on the New Mexico Environment Department's Water Reuse Regulations Task Group and is an active member of the American Water Works Association and the Water Environment Federation.



REGIONAL TRENDS IN THE USE AND REUSE OF IMPAIRED WATERS

Mike Hightower

Energy Systems Analysis Department
Sandia National Laboratories
Albuquerque, NM 87185-0701

Richard Kottenstette

Geochemistry Department
Sandia National Laboratories
Albuquerque, NM 87123-0750

Larry Webb

City of Rio Rancho, PO Box 15550
Rio Rancho, NM 87124

Background

Access to fresh water is an increasingly critical national and international issue, especially since demand for fresh water in many regions of the world has already outstripped fresh water supplies. Based on the latest figures from the United Nation's "World Water Development Report," more than 50 percent of the nations in the world will face water stress or water shortages by 2025, and by 2050, as much as 75 percent of the world's population could face water scarcity (United Nations 2003). Like so much of the world,

access to fresh water is an increasingly critical issue in the southwestern United States.

The Southwest is one of the fastest growing regions of the United States. Estimated growth rates exceed 35 percent over the next 25 years in many states in the Southwest. This growth will continue to increase the demand and competition for water resources in a region that already has limited and stressed fresh water supplies. While fresh water conservation has been implemented to help reduce future water demands, current planning efforts in many Southwestern states recognize the emerging need to utilize "nontraditional"

water resources to help meet expected future water demands. Desalination, indirect wastewater reuse, and direct wastewater reuse will be relied upon to supply 20 percent, and in some areas as much as 35 percent, of the future water supplies in regions of California, Arizona, New Mexico, and Texas.

Unfortunately, the policy and regulatory framework needed to enable the utilization of these “nontraditional” water resources is currently not in place in most of these states. Current water rights and water utilization and storage regulations were not developed to address the issues and needs required to fully and appropriately utilize brackish water, wastewater, and other “nontraditional” water resources. Unfortunately, many communities in the Southwest are being forced to move forward in developing and utilizing nontraditional water supplies, even in the face of inadequate regulations and policies, because of the lack of alternative fresh water supplies.

This paper provides an overview of emerging trends in using “nontraditional” and impaired waters across the Southwest, identifies current efforts to use these supplies, and outlines some of the regulatory and policy issues that need to be addressed to insure that these “nontraditional” water resources can be effectively and cost efficiently utilized to meet our emerging water needs.

Traditional and “Nontraditional” or Impaired Water Resources

Traditional water resources development is focused on the utilization of fresh water supplies. Commonly, “traditional” water resource options include the storage and use of surface fresh water, the development and use of fresh groundwater, water conservation and water reuse, and watershed management to improve the quality of surface water resources. The development and use of “nontraditional” or impaired water resources is commonly considered to include indirect wastewater reuse, such as irrigation of parks or for industrial applications, and direct wastewater reuse, such as direct use of waste water for drinking water, often unaffectionately referred to as “toilet to tap.” Another option currently considered “nontraditional” is aquifer storage and recovery (ASR) of treated wastewater. This approach tries to add subsurface filtration, dilution, and possibly in situ treatment before the treated wastewater is extracted for reuse. ASR is also being considered for future fresh water storage as a way to reduce the need for additional

surface water reservoirs (McCarthy 2005). Desalination of brackish groundwater and surface water and desalination of sea water round out what are commonly considered “nontraditional” or impaired water resources.

Trends in the Use of Impaired Waters

From Virginia and Florida to New Mexico and California, impaired waters are being used to supplement fresh water supplies for a wide range of industrial and domestic needs. The growing interest in the Southwest and other inland areas to use impaired waters include initiatives in a number of states that show a significant increase in the reliance on the use of impaired water to meet future water demands. Some examples include:

Texas

- 10 of 16 regional water plans expect from 20-34 percent of their future water supplies to come from wastewater reuse by 2050.
- Desalination has also been identified as a major water supply strategy in many of these water planning regions.

Arizona

- Fresh surface water supplies have been almost fully allocated since 1990.
- Statewide over 20 percent of future water supplies by 2025 will be from impaired waters.

California

- By 2030, California will need an additional four million acre-feet of fresh water to meet growing demands.
- Over half of this amount is expected to come from nontraditional resources, including wastewater reuse and desalination.

For example, desalination and water reuse applications are being evaluated and pursued by municipalities and industries across the Southwest. Las Vegas, Phoenix, and Tucson are considering desalination plant options to supplement or improve water supplies. Cities such as Scottsdale, Abilene, Ft. Stockton, and Galveston have already built moderate size desalination facilities. El Paso is currently constructing the largest inland desalination plant in the U.S., approximately 30 million gallons per day (mgd).

A good indicator of the interest in the use of impaired water is the number of membrane-based desalination and water reuse plants constructed in the

U.S. in the past 20 years. As shown in Figure 1, there has been a significant increase in the number of plants being built since 1995 (Mickley 2001). While many of these systems have been built in coastal areas for sea water desalination, many of the newer systems are being used in inland areas for both brackish water desalination and water and wastewater reuse applications. The data suggest that the use of impaired waters is not something that will occur in the future; it has been a widespread trend for almost 10 years.

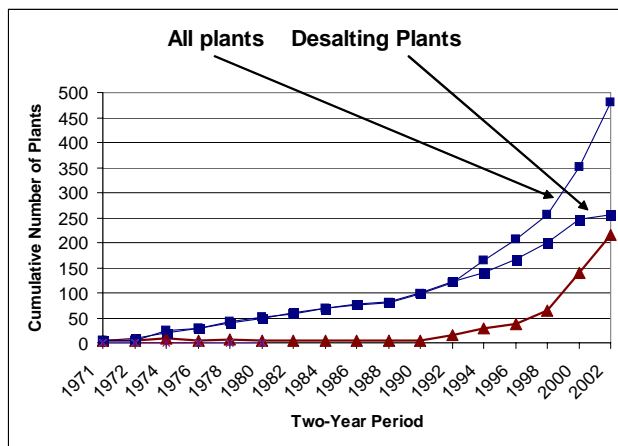


Figure 1. Construction of membrane treatment plants in the U.S.

Trends in the Use of Impaired Waters in New Mexico

Many cities in New Mexico are considering desalination or wastewater reuse to supplement fresh water supplies. Use of brackish groundwater resources is being considered in a number of cities including Albuquerque, Santa Fe, Las Cruces, and Santa Teresa, New Mexico. Cities, like Alamogordo, are already planning construction of approximately 10 mgd desalination plants to help supplement their fresh surface and groundwater resources to meet future growth.

Additional desalination applications, especially treatment of oil and gas produced water, are being evaluated throughout the west and in New Mexico. Several studies on the treatment and utilization of brackish produced water are currently underway in the San Juan Basin of northwestern New Mexico and in the Permian Basin in southeastern New Mexico.

Another impaired water application is to treat wastewater for either indirect or direct reuse. While water recycling is currently done in many cities in New Mexico, most of the recycled water is used indirectly

to irrigate parks and turf areas and for use in construction. In the future, as cities continue to grow and fresh water supplies continue to diminish, cities may need to implement treatment of wastewater and reuse it as drinking water to fully utilize water resources. For example, Rio Rancho, New Mexico is currently testing and evaluating a combination of technologies for wastewater treatment and reuse (MWH 2005). Rio Rancho is planning in the future to rely on the reuse of treated wastewater to meet as much as 30 percent of their water demands in 20 years. Figure 2 shows an example of the influent treated wastewater and the final effluent water quality from a recent pilot testing program using a membrane bio reactor to remove much of the suspended solids and a reverse osmosis system to remove bacteria, viruses, and dissolved solids. Other cities, such as Cloudcroft, are implementing similar treatment systems to help extend limited fresh water supplies.



(a) (b) (c)

Figure 2. Example of Rio Rancho Wastewater Reuse Pilot Effluent Quality

- (a) Treated wastewater influent,
- (b) Membrane bioreactor effluent and
- (c) Final reverse osmosis effluent (MWH 2005)

Lack of Adequate Policies for Impaired Water Use

While many areas in the Southwest and other areas of the country move into utilizing impaired waters as major elements of their water supplies, the policies and regulations to help support that move and insure adequate public health are lacking. While many of the states are moving forward, they have as yet not addressed all the major issues with the reuse of impaired waters. For example, while Texas has legislation covering indirect reuse of wastewater, they currently have no regulations on the direct reuse of wastewater. While Arizona has policies on some aspects of aquifer storage and recovery, they have no policies on direct

water reuse, nor do they have any policies to allow desalination concentrate injection disposal options. Additionally, California currently has 24 desalination plants under permitting or construction, but their concentrate discharge regulations are being reevaluated and may cause a number of delays in plant construction.

These issues suggest that the use of impaired waters to supplement fresh water resources is not adequately understood nor is it being addressed appropriately or quickly enough by water management organizations and agencies. The following issues will need to be addressed quickly in order to allow cities and communities to assess adequately the use of impaired water resources to help them better address their emerging shortfall of fresh water supplies.

Several major issues really impact use of impaired water resources. These include:

- Policies to better address and support water treatment residuals management
 - o Residuals are often classified as hazardous waste, which they often are not
 - o This designation often forces the application of residuals handling and disposal that is neither cost effective nor environmentally sound
- Policies for ASR that are economically sound and protect public health
 - o Need graded standards for ASR depending on water reuse applications, such as management approach developed by Florida
 - o Need to address the water rights issues of reinjected water, such as the approach adopted by Texas
- Reduce disincentives for impaired water use
 - o Current policies often do not encourage fresh surface water or groundwater conservation
 - o Treatment requirements and overlapping jurisdictions often prevent impaired water treatment and reuse
- Address the “water rights” of nontraditional water resources
 - o Currently there are overlapping jurisdictions on the use, treatment, and residuals management of impaired water resources
 - o Currently water rights for the development, treatment, and storage or use of impaired water resources is poorly defined and understood

- A better understanding of impaired water resource availability
 - o The extent and yield of brackish groundwater
 - o Extent of the recoverability and transport of ASR

Overall, the policy and regulatory framework needed to better utilize impaired or “nontraditional” water resources is currently not in place. Still, because of the lack of alternative fresh water supplies, many communities in the Southwest are being forced to move forward in developing and utilizing nontraditional water supplies. In the face of inadequate regulations and policies, many of these communities are developing approaches that are overly costly and moving forward slowly. Water rights and water utilization and storage regulations will need to be reworked in order to fully and appropriately utilize brackish water, reuse wastewater, and other “nontraditional” water resources. These regulatory and policy issues should be addressed over the next five years to insure that “nontraditional” water resources can be effectively and cost efficiently utilized to meet our growing water needs.

References

- Mickley, M.C. 2001. Membrane Concentrate Disposal Practices and Regulations. *Desalination and Water Purification Research and Development*. Report No. 69, U.S. Bureau of Reclamation, Denver, CO, September 2001.
- McCarthy, Jr., E.R., S.L. Gilkerson, and J.C. Dwyer. 2005. Aquifer Storage and Recovery. *The Water Report*, Eugene, OR, Issue 19:1-13, September 2005.
- MWH. 2005. Water Reuse Program Pilot-scale Evaluation for an Integrated Membrane System. MWH Americas, Albuquerque, NM, August 2005.
- United Nations. 2003. *World Water Development Report*. March 2003.

David O. Ornelas, P.E., is the Environmental Compliance Manager with El Paso Water Utilities. He graduated in 1987 with a B.S. in civil engineering from the University of Texas at Austin and from NMSU with an M.S. in civil engineering in 1999. David has 15 years of experience in the water and environmental fields working with utilities, state agencies, and private consulting firms. David has been with El Paso Water Utilities for the last seven years as Environmental Compliance Manager on reclaimed water, biosolids, pretreatment, air, and other environmental projects.



EL PASO'S MUNICIPAL RECLAIMED WATER PROGRAM

David Ornelas
El Paso Water Utilities
PO Box 511
El Paso, TX 79961-0001

Thank you for the introduction. I would like to provide you with an overview of El Paso's Municipal Reclaimed Water Program.

El Paso's Priorities for Water Supplies

First allow me to give you a brief view of El Paso's "water supply portfolio." Conservation is at the top of our list and has been since the early 1990s. Our aggressive public education and conservation programs have led the way in reducing both indoor and outdoor water use. Up until about 1988, El Paso's per capita water use was 200 gallons per person per day. Last year, it was down to 139 gallons per person per day.

Reclaimed water, which I will describe further later, is also very high on our priority list. One of the big advantages of both conservation and reclaimed water is that they do not require any "new water." Reclaimed water can be a little more complicated than conservation, since reclaimed water is wastewater that would normally be discharged back into a receiving stream. In the case of El Paso, some of our wastewater discharged into the Rio Grande is already committed in the form of a contract with the local irrigation district, El Paso County Water Improvement District #1.

As most of you are probably aware, El Paso uses surface water at two plants during the irrigation season

lasting typically from mid-February to mid-October. We also have year round supply from wells in the Hueco and Mesilla aquifers. If the trend of El Paso's water use had continued since 1970, El Paso would today be pumping 194,000 acre feet per year from the Hueco Bolson aquifer. Fortunately, pumping from the Hueco peaked in 1990 at about 80,000 acre feet per year and today, and hopefully into the future, we will stay down at 40,000 acre feet per year.

For the past few years, both Fort Bliss and El Paso Water Utilities have been planning to build desalination plants. The effort was combined into one plant and as many of you already know, construction on a 27.5 million gallon per day desalination plant has begun in El Paso with a completion date in 2007.

Importation of groundwater has been planned from three ranches located in adjoining counties to the east of us from 80 to 150 miles away.

El Paso Water Utilities Cost Per Acre Foot Comparison

In order to compare the cost of our water supplies, we need to look at the cost of El Paso's water supplies with capital and operational costs (Figure 1). Groundwater is the least expensive source of supply at \$163/acre foot, followed by surface water at \$300. Desalination cost is next at \$508/acre foot and would have been much more expensive even a few years ago, but the cost of membrane technology has come down significantly. Reclaimed water cost is \$706/acre foot. The most expensive option will be groundwater importation at a cost of \$1,400/acre foot. Thus, importation is going to be delayed as a water supply for as long as possible.

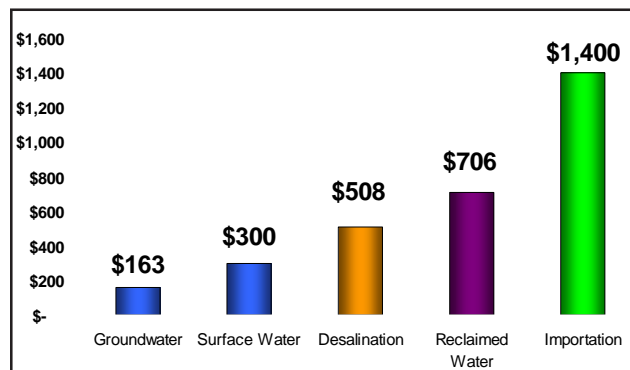


Figure 1. El Paso Water Utilities Cost Per Acre Foot Comparison

Reclaimed Water Use in El Paso

The primary benefit of using reclaimed water is obviously a direct savings on your potable supply. There are some very good secondary benefits to the use of reclaimed water. I won't go through them all but they are significant.

Concerning quantities of reclaimed water, in 2004 we reused 3.3 billion gallons from our four wastewater plants and produced 21.2 billion gallons of wastewater effluent. Of these 3.3 billion gallons, we sold about half, or 1.6 billion gallons, directly to customers. We are able to reclaim and sell about 7.7 percent of our wastewater effluent for use in the city. The City's 2004 Strategic Plan calls for doubling our reclaimed water use to 7.0 billion gallons over the next ten years.

The State has authorized the City to use reclaimed water for irrigation of golf courses, schools, parks, apartment complexes, commercial properties, home lawns, cemeteries, road medians, and for industrial uses, construction, fire protection, commercial laundries, automatic car washing, concrete mixing, cattle watering and toilet water uses. We also have the authorization to recharge groundwater with effluent from the Fred Hervey plant, which produces water of drinking quality.

As you can see from the pie chart in Figure 2, industrial uses, groundwater recharge, and irrigation account for the bulk of our uses. We also have some minor uses in ranching and construction.

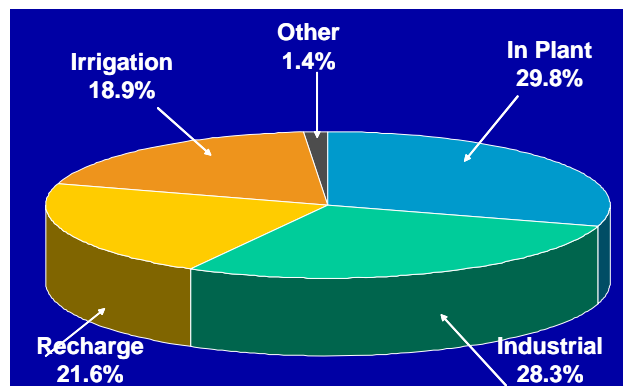


Figure 2. Reclaimed Water Uses in El Paso

Texas Reclaimed Water Standards

In Texas, there are two types of reclaimed water. Type I water can be used to irrigate at unrestricted sites such as parks, schools, and golf courses. Type II water is of lesser quality and can be used to irrigate only when access is controlled to the sites.

We produce water at all four of our wastewater plants that meets Type I, so we can use it to supply any irrigation or industrial customer. This quality of water is produced from advanced secondary wastewater treatment facilities that use sand filters to polish the water. Two of our plants use chlorination to disinfect the water. One plant uses ultraviolet light, and the advanced plant uses ozone. Chlorine is also added to the reclaimed water in our distribution system as an added safety practice even though it is not mandated by the state regulation.

Water Quality for Various Sources

Table 1 shows the salinity content of our various sources of water. Across the top it shows the TDS (total dissolved solids) and other indicators of salinity. Keep in mind that in Texas the drinking water standard for potable water in terms of TDS is 1,000 ppm. Our City's potable water, which is a combination of groundwater and Rio Grande water, has an average salinity of 640 parts per million. Some private wells with highly brackish water contain salinity levels that exceed 2,000 ppm. As a comparison, our four wastewater plants produce reclaimed water with salinity ranging from 670 ppm to 1,083 ppm. Later I will talk a little more about salinity problems at one of our wastewater plants and how we have controlled increases.

Table 1. Water Quality for Various Sources

	TDS ppm	EC dS m ⁻¹	SAR	Na ppm	Cl ppm
City water	640	1.0	5.3	150	140
Valley well	2580	3.5	13	540	550
Fred Hervey	670	1.2	5.1	160	200
Bustamante	1083	1.8	7.5	265	332
Haskell	877	1.5	6.7	215	231
Northwest	1052	1.7	9.0	280	233

Most golf courses will frown upon salinity levels that exceed 1,000 ppm TDS. Salinity control is an issue when providing reclaimed water especially to golf courses. But as I will explain later, salinity is only one factor in reclaimed water.

Northeast System (1985)

Now I would like to talk about our four wastewater treatment plants and the customers served. In northeast El Paso, the Fred Hervey Reclamation Plant went

online in 1985. This plant is a 10 million gallon per day wastewater treatment plant that produces drinking water quality reclaimed water. All of the effluent from this plant is used by El Paso Electric's Newman Power plant for cooling water or to irrigate the Painted Dunes Golf Course or used to recharge the Hueco Bolson aquifer.

Northwest System (1998)

The Northwest Wastewater Treatment Plant serves most of the westside of El Paso. It provides secondary activated sludge treatment and has ultraviolet light for disinfection and sand filters for the entire plant's effluent. This plant provides service to the largest diversity of customers consisting of multiple parks, schools, one golf course, several apartments, town homes, commercial customers, and five residential customers. We have about 25 miles of distribution lines and five reservoirs to provide services to these customers.

Lower Valley (2000)

The Roberto Bustamante plant has the ability to discharge to either the Riverside Canal or the Riverside Drain. Discharges to the Riverside Canal are used chiefly for irrigation purposes. Discharges to the Riverside Drain go mainly to the Rio Bosque Wetlands Preserve where they help maintain and sustain the aquatic habitat required by the diverse animal and plant species present. The plant also has a distribution system and an elevated tank that provides reclaimed water to the City's Tree Farm located in the Riverside Industrial Park. This reclaimed water system is being expanded to serve a cemetery, park, and two schools.

Central (2003)

Construction of the first phase of the Central El Paso Reclaimed Water Project was completed in 2003 and included building a 1 million gallon elevated storage tank, pumping station, treatment filters, and pipelines. This project provides reclaimed water services to seven parks, three schools, the zoo's exhibit moats, one golf course, and two cemeteries.

Haskell North Central Project

In addition to the joint desalination plant project with Fort Bliss, the City is also planning to serve Fort Bliss with reclaimed water for irrigation purposes. The city is planning a 100 acre soccer complex on Fort Bliss property, and the lines are being extended from

the Haskell plant in central El Paso to supply reclaimed water for irrigation.

Soil Map of El Paso

In planning which sites to serve, we have also considered the soil types at each particular site. Soil types should be an important consideration in landscape planning and in planning reclaimed water projects. With reclaimed water, the salinity is elevated and soils without adequate drainage may not be able to handle additional salinity loads. We have eliminated schools and parks from service to reclaimed water in the upper and lower valleys due to the high clay content of the soils.

Irrigation Modifications

Another consideration with reclaimed water is whether the sodium and chloride levels impact salt sensitive trees and shrubs by causing foliar damage to leaves. In the case of one golf course irrigated with reclaimed water, the problem of foliar damage due to salts is being addressed through the lowering of sprinkler head spray angles to avoid spraying salt sensitive trees. This golf course participated in a demonstration project where many sprinkler heads were reduced from about 25 degrees down to 12 degrees by simply replacing a nozzle inside the sprinkler head.

Infiltration Reduction Program

The El Paso Water Utilities has also made improvements to the wastewater collection system in order to reduce groundwater infiltration into the system. In about 1992, the salinity of the wastewater influent at our Northwest Plant was averaging around 1,700 ppm. A program to identify where groundwater infiltration was occurring and replacement or repair of those areas from 1992 to 2000 eliminated 2.5 mgd of infiltration at a cost of \$4.2 million and reduced the TDS concentration from 1,700 down to 1,100 ppm currently. This investment helped greatly to convince irrigation customers to switch to the reclaimed water system.

Thank you for your attention.

Sterling Grogan is the Biologist/Planner of the Middle Rio Grande Conservancy District. As an ecologist with more than 30 years of experience in land and water management, his responsibilities encompass irrigation efficiency, co-management of the 150-mile-long middle Rio Grande riparian bosque, participation in multi-party collaborative programs for watershed rehabilitation and protection of endangered species, regional water planning, co-management of Rio Grande Valley State Park, and preservation of agriculture in the middle Rio Grande valley. A specialist in the rehabilitation of severely disturbed land and water, Sterling holds M.S. degrees in ecology and soil conservation and a B.A. in political science. From 1974 to 1997 he managed ecosystem rehabilitation at surface mines in the U.S. and Chile; consulted on landscape ecology for the World Conservation Union and others in Costa Rica, Mexico, Venezuela, and the U.S.; and delivered invited papers on landscape ecology in Spanish and English at scientific meetings in Costa Rica, Israel, and Mexico. Sterling was Chair of the Albuquerque/Bernalillo County Air Quality Control Board from 1999 to 2000, and currently serves as a member of the New Mexico Chihuahua Commission and on the boards of the Quivira Coalition and the Rio Grande Nature Center State Park. He is a private pilot, speaks fluent Spanish and Portuguese, and served as a Peace Corps volunteer in Brazil and an Army interpreter/translator in Viet Nam.



ENVIRONMENTAL AND ECOLOGICAL ISSUES: HISTORY AND FUTURE OF ESA, NEPA, AND THE CLEAN WATER ACT

Sterling Grogan
Middle Rio Grande Conservancy District
PO Box 581
Albuquerque, NM 87103

I don't feel uncomfortable speaking last, being a pitcher I'm used to batting last. So I'm going to talk about a slightly different title but the subject matter is the same. I will be talking to you about the Ecology of Environmental Policy. I'm going to come at this from the perspective of the "radical center," but first I want

to thank Karl Wood and the organizers of the conference this year. I think they did a great job selecting the name. It stimulated me to google "Lawyers, Guns, and Money" and I got the actual words, lyrics from Warren Zevon, from his album *Excitable Boy*:

*Now I'm hiding in Honduras
I'm a desperate man
Send lawyers, guns and money
The s—t has hit the fan*

I would suggest to you that the theme of this conference, and the content, clearly demonstrate the s—t has in fact hit the fan. I want to give you a perspective from the Middle Rio Grande Conservancy District of national environmental policies – specifically, three of those: 1) I'll talk about what's changed, 2) what it means to be looking at these policies from the perspective of the radical center, 3) and then give you a few examples.

First of all, I have to give you this disclaimer. You cannot blame me if your analytical faculties are diminished by this presentation. NASA has determined that at least one cause of the last space shuttle disaster was the over use of the PowerPoint by engineers. I'm neither an engineer nor have any connection with the space program. So you cannot blame me for this use of PowerPoint.

The Middle Rio Grande Conservancy District was created by State District Court in 1925 to accomplish three things. First, to drain tens of thousands of acres of waterlogged farmland – the picture on the left of Figure 1 shows what is now the intersection of Interstate 40 and Rio Grande Boulevard. Second is flood control. The center picture is of downtown Socorro around 1921 and third (the picture to the right), depicts the improvement in the efficiency of 70 acequia systems that operated in the Rio Grande Valley.



Figure 1.

Today we serve approximately 11,000 water users on about 62,000 acres of irrigated farmland, and our service area includes six pueblos. One of the most controversial issues associated with water use in the Middle Rio Grande is exactly how much water we do use. In fact, unlike much of the rest of New Mexico, agricultural water use in the middle Rio Grande valley (according to the regional water plan) amounts to about 1/3 of total surface water use, 1/3 of the water is used by the riparian forest which we call the “bosque,” and 1/3 is accounted for by reservoir evaporation (primarily from Elephant Butte) and minor urban uses.

In order to address some of the environmental controversy associated with water use in the middle Rio Grande we've installed new gages. Since about 1996 we have been engaged in a very serious program of increasing the efficiency of our water use. We've automated diversion gates and canals, and we are conducting studies on canal lining. So far we've discovered through our preliminary results that lining irrigation canals will result in no net savings. But this is only preliminary; the studies are not complete. We are also working with Colorado State University on the development of a decision support system for irrigation and scheduling, and we have begun the process, with the good work of Dr. Phil King, of looking at the question of forbearance to get more water for endangered species. Our diversions have been reduced by 44 percent since 1996. Consumptive use we estimate in 2004 was about 2.5 acre ft. per acre, total diversions from the river in 2004 amounted to about 5.3 acre ft. per acre, and we are very proud of those numbers. They are down a significant amount.

I was asked to talk about the past, the present, and the future of national environmental policies. I picked three that in my opinion are most relevant to water in New Mexico along the Rio Grande. These are: NEPA – the National Environmental Policy Act, CWA – the Clean Water Act, and ESA, the Endangered Species Act. In the 1960s and the early 70s when these national policies were enacted, I think it's fair to say that they were considered to be groundbreaking, widely seen as effective, and very widely supported by the public. And we know that today the public overwhelmingly supports strict environmental enforcement. In the polls, environmental controls consistently get 60 to 80 percent of the public's support.

However, the fundamental error of all the environmental policies in the late 60s and early 70s was that they were based on a highly punitive view of

the world. Now, we are talking about policies that are over 30 years old. My hero Abby Hoffman told me not to trust anyone over thirty. I've taken this to heart for this presentation.

What has changed over the last thirty years? Well, for one, we all know that the federal agencies are major players for us on the Rio Grande and elsewhere in New Mexico. We see them today primarily forced to manage paper instead of lands and water. I'm engaged in the Middle Rio Grande Endangered Species Collaborative Program, which Estevan Lopez spoke of earlier today. This Program consists of, I think, 22 signatory agencies and entities. We sit around and talk, and we've been talking since January 2000 about how to protect, preserve, and eventually recover endangered species in the middle Rio Grande. In our interim committee meetings that are general held monthly, somewhere between 20 to 30 people are sitting around a room and talking.

Four years ago the Bureau of Reclamation and the Corp of Engineers decided that we needed an environmental impact statement for this collaborative program. Not on the work that the collaborative program is doing on the ground. Not on the new habitat that I will show you in a minute, looking at water quality and such, no. This environmental impact statement only covers the program. What it covers is only 30 people sitting around the table talking. So we are going to do a complete environmental impact statement because some one decided that NEPA, the National Environmental Policy Act, requires it, and it's going to take how long to do it? Well, last month we were told that it's not going to be a year, or two years, which has already been invested. Instead, it's going to be four years to get an environmental impact statement completed on 30 people sitting around a room talking.

In any discussion on the Endangered Species Act that you've seen lately on TV or in the papers, Congressman Pombo has recently attempted to amend the Endangered Species Act. Relatively speaking, there are very few species that have been recovered to date, and very little habitat has been protected. There are thousands of candidate species or species listed and relatively speaking, little habitat is protected for these species.

The most disturbing thing to me, with more than 30 years in the ecology business as a 'biocrat,' is that there are no effective controls today for non-point source pollution other than irrigated agriculture.

Studies on this subject have shown that, generally speaking, irrigated agriculture does the best job of any "treatment" technology in cleaning up non-point source pollution. You won't hear this from the EPA because the politically correct dogma from the EPA is that agriculture is a problem. In fact irrigated agriculture nationwide is overwhelmingly a solution, but an inadequate solution. We don't have controls for non-point source pollution, and it's a huge problem.

The context of this disturbing scenario that I'm painting for you is of course that we live in a desert. We can reconstruct 2000 years of climate history (Figure 2). It shows as this slide indicates that the 1950s drought was not a very big deal on the 2 millennia time scale, and we need to get used to the fact that we live in a desert and that we are going to have dry times to come – drier than we've seen.

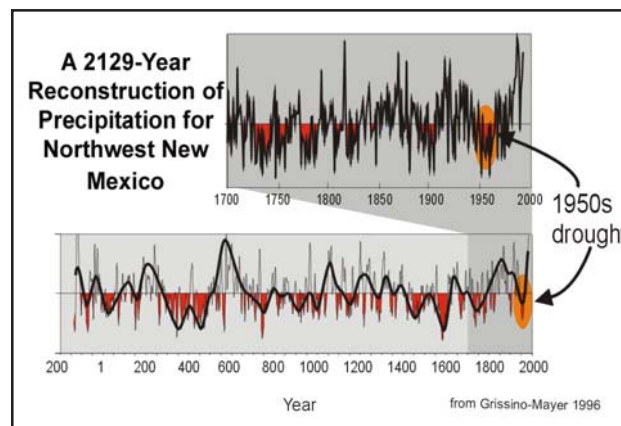


Figure 2. *from Grissino-Mayer 1996*

The Quivira Coalition was created about six years ago by a cattle rancher and a couple of Sierra Club activists. Quivira came up with the notion of The Radical Center. It represents a different way of thinking about environmental protection that appeals to me. It involves first, active stewardship of working landscapes for biological diversity. Now what is all of that? Well in essence it means instead of (as Bruce Babbitt would have you believe) buying farm or ranch land to put into natural parks or protected areas, supporting the efforts of private ranchers and farmers to do a better job of land stewardship. From my perspective, the federal agencies are full of wonderful, dedicated, hardworking, devoted people who cannot do an adequate job of managing natural resources because they are overwhelmed by paper. Instead of putting land into federal agencies, the notions of the radical center are that we should protect and support

private land owners who are working for biological diversity, creating wildlife habitat. The radical center looks at ecosystem rehabilitation through restoration of working landscapes, instead of “preservation.” The radical center supports not only private land owners, but the public agencies that are doing rehabilitation and restoration. And most important of all, the radical center supports relationships, because relationships are the basis of ecology. Relationships are the key to looking at the world from the perspective of the radical center, and an example of that is active stewardship of working landscapes for biological diversity. I can take you to many ranches in New Mexico where biological diversity is high and getting better all the time.

If you look at the work of Rick Knight, you find his research from a few years ago conducted on a large working cattle ranch that borders the Rocky Mountain National Park, on the Park itself, and on a nearby development of 40-acre ranchettes. He found over several years of monitoring that biological diversity was higher on the cattle ranch than on the Rocky Mountain National Park, or of course, than on any of the ranchettes. (His email address is knight@cnr.colostate.edu; he would actually respond to your email, if you are interested in contacting him)

Another example: If you went to the Bosque del Apache National Wildlife Refuge as I did in the early 1990s, you would have seen a little brochure that you can’t get now because they stopped printing them. That brochure talked about how important irrigated farms are along the Rio Grande valley to the birds, the tens of thousands of birds that use the Rio Grande flyway every year. That brochure said at the time (it is not politically correct to say anymore) that private irrigated farms are a key part of the strategy that avian biologist use to support the tens of thousands of migratory birds. You can find evidence of this in the Bosque Biological Management Plan that the Fish and Wildlife Services still produces.

Our agency is building new silvery minnow habitat, an effort that would have been unthinkable a few years ago, but it is an important part of what we do now. The City of Albuquerque has built a multi-million dollar facility to propagate endangered species as a part of their BioPark.

Here is a little bit of the silvery minnow habitat that we built a couple of years ago. It is simple. What does the habitat consist of? Anchoring whole cottonwood trees in the river so that the wood in the

river becomes a part of the habitat for the fish. It works and is really amazing. The picture shows Dr. Tom Wesche, the premier fish habitat builder in the west.

Habitat for the Endangered Rio Grande Silvery Minnow



Figure 3. Dr. Thomas A. Wesche supervising construction of new silvery minnow habitat in Albuquerque.

The Conservancy District looks at things from a watershed perspective these days. Although we constitute only about 1 percent of the total Rio Grande watershed, we are forced to consider the whole watershed in our decision making, and this is exactly what we are doing. Looking at environmental protection from the radical center also requires that you get into bed with a lot of people that you might not have thought about having a relationship with before. Figure 4 provides a list from the MRG Endangered Species Collaborative Program and is probably inaccurate in a couple of respects. I’m not entirely sure that I have everyone there, and it may be that a couple of those are no longer active, but notice that we have multiple state agencies, multiple federal agencies, several local governments, several Indian Pueblos, a couple of environmental organizations, and a couple of organizations of private farmers. There is quite a bit of diversity here, and it has been working rather well.

We look for active stewardship; we look for active rehabilitation and restoration, and we look most importantly of all for relationships. Those are the fundamental elements of the radical center.

Thanks very much.

Relationships

e.g. the MRG Endangered Species Collaborative Program

<ul style="list-style-type: none">● MRGCD● Interstate Stream Comm.● City of Albuquerque● Bureau of Reclamation● Corps of Engineers● Fish & Wildlife Service● Isleta Pueblo● Sandia Pueblo● Game & Fish Dept.● Environment Dept.● Dept. of Agriculture● Attorney General	<ul style="list-style-type: none">● Bureau of Indian Affairs● Alliance for the Rio Grande● Rocky Mtn. Research Station● UNM, NMSU● NAIOP● Rio Grande Restoration● Santo Domingo Pueblo● Santa Ana Pueblo● A/BC Water Utility Authority● Rio Grande Water Rights● Assessment Payers Assn.
--	---



Figure 4.

Question:

You were quoted somewhere that there are tens of millions of silvery minnow in the Rio Grande. Is this right?

Answer:

Is it right? Nobody knows. That number is based on my speculation. In 2004 the Fish and Wildlife found 13,000 silvery minnows, and this year they have found a little over 600,000. I just scaled that up from past studies of how many fish you would expect to find based on how many you do find. That's where my tens of millions number came from.

Question:

(inaudible)

Answer:

Silvery minnows are a desert fish, and if you look at the literature on desert fish there is something called the Desert Fishes Council. Google the Desert Fishes

Council sometime, and you will find that there are good ecological studies of various species of desert fish and other animals, critters that live in deserts and they all have a singular characteristic and that is that their population numbers boom and bust periodically. I happen to believe that the silvery minnow is not endangered. That in fact we happen to be looking at it at a time when its population, aided by a lot of dumb river management on our part, was in decline. Now we are doing better at river management, and its population is booming.

Question: How is the refugium concept working?

Answer:

Most folks involved in the Middle Rio Grande would say that the refugium concept is an essential part of the recovery strategy. Fish biologists say that you can't have fish in the river unless you have fish in the river, and to produce a lot of fish in the river, you need to

grow them somewhere that is ideal. This is what the refugia are doing. Everyone involved that I know of in the refugia program sees it as a temporary measure to build up the size of the population. Regarding the idea of recreating a natural hydrograph: We just finished a study of the so called historical hydrograph on the Rio Grande using, strangely enough, a model created by the Nature Conservancy for evaluating western rivers. What we found was that the current hydrograph is not very different from the historical hydrograph on the Rio Grande, but there are a couple of significant things that are different. The peaks are cut off and the timing of the maximum flood flows in the spring is slightly different. Other than that there are no differences.

So from my perspective, the idea of recreating the historical hydrograph is a smoke screen, and it's not realistic to discard the concept of refugia out of hand unless there is some other reason not to consider it. We see it as a valuable tool.

Question:

What is the concept of refugia?

Answer:

The fundamental idea is that you have an endangered species, and you don't have enough critters out there where there ought to be more. To create more, if the habitat is degraded, you might have a situation where the existing population cannot produce enough females to produce enough offspring. Therefore, you create refugia either in the habitat or outside the habitat. Right now on the Rio Grande it's all outside the habitat, it is essentially tanks. In those tanks you can produce lots of fish. They are essentially hatcheries. Although they are operated differently from conventional fish hatcheries, they use the same technology.

Question:

Just a couple of comments...600,000 silvery minnows were found this year as part of the rescue effort when the river dried. Agency staff went out and collected eggs during the high flood flows and brought them back to rear them in the bio-park and in the Fish and Wildlife Services facilities. They tagged them, grew them to adults, then put them in the Bernalillo/Albuquerque area. They put in tens of thousands of fish with positive results.

Answer:

Right, that is part of the refugia issue.

PARTICIPANT LIST

Cynthia Abeyta
U.S. Fish and Wildlife Service
2105 Osuna Rd. NE
Albuquerque, NM 87111
505-761-4715
Cyndie_Abeyta@fws.gov

Rasool Ahadi
NM Office of the State Engineer
1680 Hickory Loop, Suite J
Las Cruces, NM 88005
505-524-6330
rasool.ahadi@state.nm.us

Ramon (Dosi) Alvarez
Elephant Butte Irrigation District
PO Drawer 1509
Las Cruces, NM 88004-1509
505-526-4699

Cindy Ardito
INTERA
6501 Americas Parkway NE
Albuquerque, NM 87110
505-246-1600
cardito@intera.com

Myron Armijo
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87507
505-827-6102
myron.armijo@state.nm.us

Robert G. Armstrong
Pecos River Compact Commission
PO Box 1973
Roswell, NM 88202
505-625-2222
rga@zianet.com

Tom Bahr
3135 Southwind Rd
Las Cruces, NM 88005
505-526-7822
tbahr@theonlynet.net

Aron Balok
New Mexico Farm and
Livestock Bureau
89 Las Flores Drive
Roswell, NM 88203
505-623-0030
abalok@netzero.com

Mike Barajas
NM Office of the State Engineer
1900 W. Second Street
Roswell, NM 88201
505-622-6521
mike.barajas@state.nm.us

Beth Bardwell
World Wildlife Fund
100 E. Hadley
Las Cruces, NM 88001
505-525-9532
bethbardwell@zianet.com

Tom Bates
City of Deming
PO Box 706
Deming, NM 88031
505-546-8848
tombates@cityofdeming.org

Darryl Beckmann
U.S. Bureau of Reclamation
125 S. State Street, Rm 6107
Salt Lake City, UT 84138
801-524-3618
DBeckmann@uc.usbr.gov

Jesse Berryhill
WERC
New Mexico State University
636 King Edward Ave.
Las Cruces, NM 88007
505-927-6223
jesseb@nmsu.edu

Eric Biggs
8D Villa Escondido
Placitas, NM 87043
505-771-2824
eric.biggs01@comcast.net

David F. Blanchard
Blanchard Engineering, Inc.
PO Box 16395
Las Cruces, NM 88004
505-523-9222
BEI@zianet.com

Wiebke Boeing
Fishery and Wildlife Sciences
MSC 4901
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
505-646-1707
wboeing@nmsu.edu

David Bollschweiler
OSF Engineering MSC 3545
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
505-646-7844
dabollsc@nmsu.edu

Mike Bowen
New Mexico Mining Association
1470 St. Francis Drive
Santa Fe, NM 87505
505-820-6662
nmma@worldnet.att.net

Scott Boyd
8220 East Bonnie Rose
Scottsdale, AZ 85250
480-209-8246
riobutt1@aol.com

50th Annual New Mexico Water Conference

Brent Bullock
Pecos Valley Artesian
Conservancy District
PO Box 1346
Roswell, NM 88201
505-622-7000
bb@pvacd.com

John Burkstaller
Daniel B. Stephens &
Associates, Inc.
6020 Academy Road NE
Suite 100
Albuquerque, NM 87109-3315
505-822-9400
jburkstaller@dbstephens.com

Connie Callan
NETS, LLC
1524 Eubank NE, Suite 3
Albuquerque, NM 87112
505-350-1433
ccallan@netsamerica.com

Christopher Canavan
NM Environment Dept.
1170 N Solano Drive, Suite M
Las Cruces, NM 88001
505-647-7926
chris.canavan@state.nm.us

Rick Carpenter
Sangre de Cristo Water Division
City of Santa Fe
801 West San Mateo
Santa Fe, NM 87504
505-955-4206
rrcarpenter@santafenm.gov

Melinda Caskey
Agricultural Economics
Graduate Student
New Mexico State University
1601 Luna Street
Las Cruces, NM 88001
505-526-6283
mcaskey@nmsu.edu

Craig Cathey
NM Office of the State Engineer
1680 Hickory Loop
Las Cruces, NM 88004
505-524-6161
greg.lewis@state.nm.us

Lowell Catlett
Dean, Agriculture and Home
Economics College, MSC 3AG
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
lcatlett@nmsu.edu

John Cawley
U.S. Bureau of Indian Affairs
PO Box 26567
Albuquerque, NM 87125-6567
505-563-3405

Janie M. Chermak
Dept. of Economics
MSC 05 3060
University of New Mexico
1 University of New Mexico
Albuquerque, NM 87131-0001
505-277-4906
jchermak@unm.edu

Bonnie Colby
Agricultural and Resource
Economics, Chavez Bldg.
University of Arizona
1110 East North Campus Drive
Tucson, AZ 85721
520-621-4775
bcolby@ag.arizona.edu

Jackie Cooper
AARP
17 Quedo Road
Santa Fe, NM 87508
505-466-3512
jjinnewmexico@msn.com

Jerry L. Cooper
Eldorado Water and Sanitation
District
17 Quedo Road
Santa Fe, NM 87508
505-466-3512
jjinnewmexico@msn.com

Filiberto Cortez
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
fcortez@uc.usbr.gov

Anthony Cox
U.S. Geological Survey
5338 Montgomery NE
Suite 400/300
Albuquerque, NM 87109
505-830-7911
arcox@usgs.gov

Roy Cruz
Sutron Corporation
6301 Winchester NW
Albuquerque, NM 87120
505-553-0817
rcruz@sutron.com

Kacey Cubine
WERC
New Mexico State University
1035 Alumni Ave.
Las Cruces, NM 88003
505-645-1595
enibuc@hotmail.com

Wayne Cunningham
Arch Hurley Conservancy
District
PO Box 1167
Tucumcari, NM 88401
505-461-2351
ahcd@plateautel.net

Participant List

Ron Curry
NM Environment Dept.
1190 St. Francis Drive, RM-N405
Santa Fe, NM 87502
505-827-2855
ron.curry@state.nm.us

John D'Antonio, Jr.
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504-5102
505-827-6091
john.dantonio@state.nm.us

Tim Darden
Agricultural Programs &
Resources, MSC APR
NM Dept. of Agriculture
PO Box 30005
Las Cruces, NM 88003-8005
505-646-2670
tdarden@nmda.nmsu.edu

Tom Davis
Carlsbad Irrigation District
201 S. Canal Street
Carlsbad, NM 88220
505-885-3203
cid@plateautel.net

Donald Dayton
Water Resource Committee
AARP
3 Manzano Court
Santa Fe, NM 87508
505-466-4348
nad.dad@att.net

Nancy Dayton
Water Resource Committee
AARP
3 Manzano Court
Santa Fe, NM 87508
505-466-4348
nad.dad@att.net

Cesar De Santiago
NM Office of the State Engineer
121 Tijeras NE
Albuquerque, NM 87105
505-764-3887
cesar.desantiago@state.nm.us

Tim De Young
Modrall Sperling Law Firm
PO Box 2168
Albuquerque, NM 87103-2168
505-848-1842
tjd@modrall.com

Leeann DeMouche
Extension Plant Sciences
MSC 3AE
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
505-646-3973
ldemouch@nmsu.edu

Richard B. Dinwiddie
PO Box 121
Cliff, NM 88028
505-535-2854

Dale Doremus
Surface Water Quality Bureau
NM Environment Dept.
1190 St. Francis Dr.
Santa Fe, NM 87502
505-476-3026
dale.doremus@state.nm.us

Chuck DuMars
Law & Resource Planning
Associates, P.C.
201 Third Street NW, Suite 1370
Albuquerque, NM 87102
505-346-0998
ctd@lrpa-usa.com

Kaye Dunnahoo
Dairy Producers of New Mexico
PO Box 6299
Roswell, NM 88202
505-622-1646
dpm2@juno.com

Douglas Earp
Albuquerque Environmental
Health Department
City of Albuquerque
PO Box 1293
Albuquerque, NM 87103
505-768-2633
dearp@cabq.gov

Robert Esqueda
Town of Silver City
1211 N Hudson St.
Silver City, NM 88061
505-534-6355
rme@zianet.com

Gary Esslinger
Elephant Butte Irrigation District
PO Drawer 1509
Las Cruces, NM 88004-1509
505-586-6671
gesslinger@ebid-nm.gov

Michael Fahy
El Paso Water Utilities
PO Box 511
El Paso, TX 79961-0001
915-594-5681
mpfahy@epwu.org

Timothy Farmer
NM Office of the State Engineer
216 South Silver Street
Deming, NM 88030
505-546-2851
tim.farmer@state.nm.us

Robert Faubion
Elephant Butte Irrigation District
PO Drawer 1509
Las Cruces, NM 88004-1509
505-526-4699
rfaubion@zianet.com

50th Annual New Mexico Water Conference

Rodger F. Ferreira
NM Water Science Center
U.S. Geological Survey
5338 Montgomery Blvd. NE
Suite 400
Albuquerque, NM 87109
505-830-7902
ferreira@usgs.gov

Charles Fischer
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
cfischer@uc.usbr.gov

Deborah Foley
U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109
505-342-3428
deborah.a.foley@spa02.usace.army.mil

Mary Helen Follingstad
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
505-827-6167
maryhelen.follingstad@state.nm.us

Erek Fuchs
NM Office of the State Engineer
1680 Hickory Loop, Suite J
Las Cruces, NM 88005
505-524-6161
erek.fuchs@state.nm.us

Hollis Fuchs
USDA - NRCS
PO Box 457
Carrizozo, NM 88301
505-648-2941
hollis.fuchs@nm.usda.gov

Michael Gabaldon
U.S. Bureau of Reclamation
PO Box 25007
Denver, CO 80225
303-445-3750
mgalbaldon@do.usbr.gov

Chris Garcia
SAHRA
PO Box 141
Villanueva, NM 87583
505-421-2856
chrisgarcia@plateautel.net

Jorge A. Garcia
Utilities Division
City of Las Cruces
PO Box 20000
Las Cruces, NM 88004
505-528-3511
jgarcia@las-cruces.org

Robert Gold
U.S. Geological Survey
5338 Montgomery Blvd. NE
Albuquerque, NM 87109
505-830-7930
beisbol@usgs.gov

Chris Gorbach
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
cgorbach@uc.usbr.gov

Linda I. Gordan
Water Rights District 6
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504-5102
505-827-6120
linda.gordan@state.nm.us

Rhea Graham
Pueblo of Sandia
418 Sandia Loop Road
Bernalillo, NM 87004
505-771-5048
rgraham@sandiapueblo.nsn.us

Gilbert Grijalva
Village of Santa Clara
PO Box 316
Santa Clara, NM 88026
505-537-2443
santaclara3@zianet.com

Sterling Grogan
Middle Rio Grande Conservancy
District
PO Box 581
Albuquerque, NM 87103
505-247-0234
grogan@mrgcd.us

Daniel Guevara
SWQB
NM Environment Department
PO Box 26110
Santa Fe, NM 87502
505-476-3086
daniel.guevara@state.nm.us

Em Hall
UNM School of Law
1117 Stanford NE
Albuquerque, NM 87131-1431
505-277-2866
hall@law.unm.edu

Deborah Hartell
49 CES/CEV
U.S. Air Force - Holloman AFB
550 Tabosa Ave.
Holloman AFB, NM 88330-8459
505-572-3931
deborah.hartell@holloman.af.mil

John Hawley
Hawley Geomatters
PO Box 4370
Albuquerque, NM 87196-4370
505-255-4847
hgeomatters@qwest.net

Elaine Hebard
1513 Escalante SW
Albuquerque, NM 87104
505-247-8767
emhebard@unm.edu

Participant List

Lisa Henne
Water Research Technical
Assistance Office
Los Alamos National Laboratory
PO Box 840
Chimayo, NM 87522
505-231-0821
henne@lanl.gov

Fred H. Hennighausen
Hennighausen & Olsen, L.L.P.
PO Box 1415
Roswell, NM 88202-1415
505-624-2463
fhennighausen@nmproattorneys.com

John Hernandez
NMWRRRI
New Mexico State University
PO Box 3196
Las Cruces, NM 88003
505-524-2980
hernandez0025@att.net

Steven L. Hernandez
Hubert & Hernandez, P.A.
PO Box 2857
Las Cruces, NM 88004
505-526-2101
slh@lclaw-nm.com

Mike Hightower
MS 0755
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185-0701
505-844-5499
mmhight@sandia.gov

Walter Hines
CH2M HILL
12504 Mountain Ridge Place NE
Albuquerque, NM 87112
505-298-8408
whines@ch2m.com

Craig Hipple
NM Office of the State Engineer
1900 W. Second Street
Roswell, NM 88201
505-622-6521
iowarocket@hotmail.com

Matt Holmes
NM Rural Water Association
3413 Carlisle Blvd. NE
Albuquerque, NM 87110
505-884-1031
matt@nmrwa.org

Bruce Hooper
Dept. of Geography &
Environmental Resources
Mail Code 4514
Southern Illinois University
Carbondale, IL 62901
618-351-9943
bhooper@siu.edu

G.F. (Rick) Huff
U.S. Geological Survey
MSC 3ARP
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
505-646-7950
gf Huff@usgs.gov

Bill Hume
Director of Policy and
Strategic Planning
Office of the Governor
State Capitol Building, Suite 400
Santa Fe, NM 87501
505-476-2206
william.hume@state.nm.us

Mary Humphrey
Humphrey & Ode P.C.
PO Box 1574
El Prado, NM 87529
505-758-2203
humphrey@newmex.com

Fen Hunt
CSREES/ECS
U.S. Department of Agriculture
800 9th Street SW, Rm 4449
Washington, DC 20024
202-720-5633
sporter@csrees.usda.gov

Brian Hurd
Ag. Economics/Ag. Business
MSC 3169
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
505-646-2674
bhhurd@nmsu.edu

Woody Irving
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
wirving@uc.usbr.gov

Win Jacobs
League of Woman Voters of
Greater Las Cruces
1103 N. Alameda Blvd.
Las Cruces, NM 88005
505-523-1829
winjacobs@zianet.com

Janet Jarratt
Middle Rio Grande Conservancy
District, Farmer
2520 Los Lentos Rd. SE
Los Lunas, NM 87031
jj@jj2people.com

Louis Jenkins
City of Deming
PO Box 706
Deming, NM 88031
505-546-8848
ljenkins@cityofdeming.org

50th Annual New Mexico Water Conference

Randy Johnson
PO Box 61
Corrales, NM 87048
505-463-7740

Stephanie Johnson
Zia Engineering
755 S Telshor Blvd., Suite F-201
Las Cruces, NM 88011
505-532-1526
sljohnson@ziaeec.com

Alvin F. Jones
Hennighausen & Olsen, L.L.P.
PO Box 1415
Roswell, NM 88202-1415
505-624-2463
ddavis@nmproattorneys.com

Timothy Jones
PNM
2401 Aztec NE
Albuquerque, NM 87107
505-241-4464
tjones@pnm.com

David Jordan
INTERA
6501 Americas Pkwy NE
Suite 820
Albuquerque, NM 87110
505-246-1600
djorda@intera.com

John Kay
Daniel B. Stephens & Associates
6020 Academy Road NE, Suite
200
Albuquerque, NM 87109-3315
505-822-9400
jkay@dbstephens.com

Todd Kelly
U.S. Geological Survey
5338 Montgomery Blvd NE
Suite 400
Albuquerque, NM 87109
505-830-7916
tmkelly@usgs.gov

Susan Kery
Sheehan, Sheehan & Stelzner
PO Box 271
Albuquerque, NM 87013
505-247-0411
sck@ssslawfirm.com

Conrad G. Keyes, Jr.
PO Box 1499
Mesilla Park, NM 88047
505-523-7233
cgkeyesjr@zianet.com

J. Phillip King
Civil and Geological Engineering
MSC 3CE
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
505-646-5377
jpking@nmsu.edu

Randy Kirkpatrick
San Juan Water Commission
7450 East Main Street, Suite B
Farmington, NM 87402
505-564-8969
randyswc@sjwc.org

Marilyn Koch
Sheehan, Sheehan & Stelzner
PO Box 271
Albuquerque, NM 87103
505-247-0411
mjk@ssslawfirm.com

Richard Kottenstette
Geochemistry MS 0750
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87123-0750
505-845-3270
rkotten@sandia.gov

Jeff Langman
U.S. Geological Survey
800 Mississippi Ave
El Paso, TX 79902
505-463-5109
jlangman@usgs.gov

Jennifer Lankford
WERC
New Mexico State University
2330 E. Nevada, Apt. 402
Las Cruces, NM 88001
505-491-9527
jenjoe@nmsu.edu

Andrea LeFevre
Jicarilla Apache Nation
PO Box 231
Dulce, NM 87528
505-759-1198

William Little
5640 Real del Norte
Las Cruces, NM 88012
505-678-2853
wmlittle@zianet.com

Beiling Liu
NM Interstate Stream
Commission
121 Tijeras NE, Suite 2000
Albuquerque, NM 87102
505-765-2005
beiling.liu@state.nm.us

Owen Lockwood
Blanchard Engineering
PO Box 16395
Las Cruces, NM 88004
505-523-9222
bei@zianet.com

Edna Loehman
Agricultural Economics
Purdue University
West Lafayette, IN 47907
765-494-4303
loehman@purdue.edu

John Longworth
Water Use & Conservation
Bureau
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504
505-827-6121
john.longworth@state.nm.us

Participant List

Estevan Lopez
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504
505-827-6106
estevan.lopez@state.nm.us

Tiffany Lovato
WERC
New Mexico State University
PO Box 4133
Las Cruces, NM 88003
505-642-9135
tiff2mocs@yahoo.com

Luis C. Madrid
U.S. Geological Survey
MSC 3ARP
New Mexico State University
PO Box 30001
Las Cruces, NM 88003-8001
505-646-8129
lcmadrid@usgs.gov

Aous Manshad
WERC
New Mexico State University
1754 Royal Dr.
Las Cruces, NM 88011
505-635-7966
aous@nmsu.edu

Sean Marquez
WERC
New Mexico State University
560 MacLeod Rd.
Las Cruces, NM 88001
505-621-5266
dobleo7@hotmail.com

Karl Martin
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3608
kmartin@uc.usbr.gov

Denette Martinez
WERC
New Mexico State University
2200 Corley Dr., Apt. 2D
Las Cruces, NM 88001
505-429-9320
denette@nmsu.edu

Mike Matush
SWQB
NM Environment Dept.
910 East 32nd St.
Silver City, NM 88061
505-388-0599
mike.matush@state.nm.us

Doug McAda
U.S. Geological Survey
5338 Montgomery Blvd. NE
Suite 400
Albuquerque, NM 87109
505-830-7943
dpmcada@usgs.gov

Karen McAda
Montrose Consulting, Inc.
410 Green Acres Lane
Bosque Farms, NM 87068
505-480-4380
ksmcada@comcast.net

Robert McBreen
U.S. Geological Survey
5338 Montgomery Blvd., NE
Albuquerque, NM 87109
505-830-7915
breen@usgs.gov

Ari Michelsen
Agricultural Research and
Extension Center
Texas A & M University
1380 A & M Circle
El Paso, TX 79927
915-859-9111
a-michelsen@tamu.edu

Jennifer Montoya
World Wildlife Fund
100 E. Hadley
Las Cruces, NM 88001
505-525-9532
jatchley@zianet.com

Stephanie J. Moore
Daniel B. Stephens & Associates
6020 Academy Road NE
Suite 100
Albuquerque, NM 87109
505-822-9400
smoore@dbstephens.com

Joe Muniz
Jicarilla Apache Nation
PO Box 231
Dulce, NM 87528
505-759-1575

Mary Murnane
Bernalillo County Public Works
2400 Broadway SE, Building N
Albuquerque, NM 87102
505-848-1507
mmurnane@mercury.bernco.gov

Cindy Murray
MS Z150
PNM
2401 Aztec Rd. NE
Albuquerque, NM 87107
505-241-4952
cmurray@pnm.com

Hiram S. Muse
9 Tumbleweed Trail
La Luz, NM 88337
505-430-6828
hmuse@zianet.com

Nathan Myers
U.S. Geological Survey
5338 Montgomery NE
Albuquerque, NM 87109
505-830-7942
nmyers@usgs.gov

50th Annual New Mexico Water Conference

Robert G. Myers
IMSW-WSM-ES-ES
White Sands Missile Range
U.S. Army
WSMR, NM 88002
505-678-8751
robert.g.myers@us.army.mil

Brian Nichols
Modrall Sperling Law Firm
PO Box 2168
Albuquerque, NM 87103-2168
505-848-1852
bnichols@modrall.com

Karen Nichols
Desert Sands MDWCA
PO Box 1864
Anthony, NM 88021
505-882-0313
dsmdwca@zianet.com

Edward Nickerson
U.S. Geological Survey
MSC 3ARP
New Mexico State University
PO Box 30001
Las Cruces, NM 88003-8001
505-646-7618
nickerso@usgs.gov

Marisol Oakley
Waters Project
NM Office of the State Engineer
121 Tijeras Avenue NE
Albuquerque, NM 87102
505-764-3878
marisol.oakley@state.nm.us

Connie Ode
Humphrey & Ode P.C.
PO Box 1574
El Prado, NM 87529
505-758-2203
code@newmex.com

Adrian Oglesby
2103 Los Luceros NW
Albuquerque, NM 87104
505-280-7958
adrian@swcp.com

Marilyn O'Leary
Utton Center MSC 11-6070
UNM School of Law
1 University of New Mexico
Albuquerque, NM 87131-0001
505-277-3253
oleary@law.unm.edu

A.J. Olsen
Hennighausen & Olsen, L.L.P.
PO Box 1415
Roswell, NM 88202-1415
505-624-2463
ajolsen@nmproattorneys.com

Dennis Olson
U.S. Bureau of Indian Affairs
PO Box 26567
Albuquerque, NM 87125-6567
505-563-3415

David Ornelas
El Paso Water Utilities
PO Box 511
El Paso, TX 79961-0001
915-533-7581
dornelas@epwu.org

Sue Padilla
Dona Ana County
180 W. Amador
Las Cruces, NM 88001
505-647-7145
suep@co.dona-ana.nm.us

Roger Patrick
23 Camino del Monte
Santa Fe, NM 87508
215-801-7975
rogerpatrick@competitiveadvantage.us

Gene Paulk
City of Las Cruces
680 N. Motel Blvd.
Las Cruces, NM 88007
505-528-3527
gpaulk@las-cruces.org

Jim Peach
Economics and International
Business
MSC 3CQ
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
505-646-3113
jpeach@nmsu.edu

Tony Perelli-Minetti
Hangover Farms
2815-A Lafayette Avenue
Newport Beach, CA 92663
949-675-5800

Deanna Perez
De Baca SWCD
NMACD Board
PO Drawer P
Ft. Sumner, NM 88119
505-355-7527
deecole@plateautel.net

Lee Peters
Hubert & Hernandez, P.A.
PO Box 2857
Las Cruces, NM 88004
505-526-2101
lep@lclaw-nm.com

Tom Phillips
Las Cruces District Office
U.S. Bureau of Land
Management
1800 Marquess Street
Las Cruces, NM 88005
505-525-4377
tom_phillips@nm.blm.gov

Participant List

Phil Pohl
MS 720
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185
505-844-2992
pipohl@sandia.gov

Stanley M. Pollack
Water Rights Unit
Navajo Nation Department
of Justice
PO Box 2010
Window Rock, AZ 86515
928-871-7510
spollack@navajo.org

Bhasker Rao
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504
505-827-6105
bhasker.rao@state.nm.us

Mary Raynard
Eldorado Area Water and
Sanitation District
Board of Directors
15 Moya Loop
Santa Fe, NM 87508
505-466-6325
mcharlotte@comcast.net

John Reid
City of Las Cruces
680 N. Motel Blvd.
Las Cruces, NM 88007
505-528-3525
john.reid@las-cruces.org

Beth Richards
IPER / Stanford University
Sandia Labs & Stanford University
397 Panama Mall
Stanford, CA 93405-2210
650-450-0154
ehricha@stanford.edu

Gary Richardson
METRIC Corporation
PO Box 1591
Los Lunas, NM 87031
505-866-1602
metenviroll@aol.com

Rob Richardson
Bohannon Huston Inc.
425 Telshor Blvd., Suite C-103
Las Cruces, NM 88011
505-532-8670
rrichardson@bhinc.com

Bill Rinne
MS 7060
U.S. Bureau of Reclamation
1849 C. Street, NW
Washington, DC 20240
202-513-0683
mcollier@usbr.gov

James Rivera
Pueblo of Pojoaque
78 City of Gold Road
Santa Fe, NM 87506
505-455-3901
jrivera@cnsf.com

Rebecca Rizzuti
Office of Senator Bingaman
148 Loretto Towne Centre
505 South Main
Las Cruces, NM 88001
505-523-6561

Woody Robert
671 Tumbleweed
Chaparral, NM 88081
915-203-2966
rwoody3333@aol.com

John T. Romero
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504-5102
505-827-4187
john.romero2@state.nm.us

Garret Ross
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3580
gross@uc.usbr.gov

Craig Runyan
Extension Plant Sciences
MSC 3AE
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
505-646-1131
crunyan@nmsu.edu

George Sabol
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ 85044
602-707-4635
gsabol@stantec.com

James Salopek
Elephant Butte Irrigation District
PO Drawer 1509
Las Cruces, NM 88004-1509
505-586-6671

Blane M. Sanchez
NM Interstate Stream Commission
4 Tribal Rd. 7
Bosque Farms, NM
87068-8003

Kerri Sandoval
Water Rights Division
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504-5102
505-827-6399
kerri.sandoval@state.nm.us

Rolf Schmidt-Petersen
NM Interstate Stream Commission
121 Tijeras NE, Suite 2000
Albuquerque, NM 87102
505-764-3880
rolf.schmidt@state.nm.us

50th Annual New Mexico Water Conference

Gerald Schultz
Black Range RCJD
PO Box 637
Tyrone, NM 88065
505-538-0792
gkltz@yahoo.com

Herman Settemeyer
Texas Commission on
Environmental Quality
PO Box 13087
Austin, TX 78711
512-239-4707
hsetteme@tceq.state.tx.us

Subhas Shah
Middle Rio Grande Conservancy
District
PO Box 581
Albuquerque, NM 87103
505-247-0234
shah@mrgcd.com

Susan Shampine
USACE - Operations Division
U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109
505-342-3602
susan.shampine@usace.army.mil

John Shomaker
John Shomaker & Associates, Inc.
2703 Broadbent Parkway NE
Suite B
Albuquerque, NM 87107
505-345-3407
jshomaker@shomaker.com

Sigmund Silber
The New Mexico Weather
Modification Association, Inc.
22B San Marcos Road East
Santa Fe, NM 87508
505-473-7006
ssilber1@juno.com

John Skaggs
Sutron Corporation
2783 Grandoak Circle
Bountiful, UT 84010
801-558-7051
jskaggs@sutron.com

Coleman Smith
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504
505-827-4124
coleman.smith@state.nm.us

James Smith
9904 Academy Knolls NE
Albuquerque, NM 87111-1733
505-292-2946
takajts@aol.com

Mara Smith
Water Use & Conservation Bureau
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504
505-827-4273
mara.smith@state.nm.us

John Sorrell
Pueblo of Isleta
PO Box 1290
Isleta, NM 87022
505-869-9623

Allen Sparks
Fort Sumner Irrigation District
Rt. 1, Box 137A
Fort Sumner, NM 88119
505-355-8811
FSCDC_1@plateautel.net

Karin Stangl
NM Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504
505-827-6139
karin.stangl@state.nm.us

Melanie Stansbury
Cornell University
116 Penny Lane
Ithaca, NY 14850
607-342-2388
mas297@cornell.edu

Gary Stansifer
NM Office of the State Engineer
121 Tijeras NE, Suite 2000
Albuquerque, NM 87102
505-764-3855
gary.stansifer@state.nm.us

Robert Stearley
Mayor, Town of Edgewood
PO Box 415
Edgewood, NM 87015
505-286-4518
stearley@edgewood-nm.gov

David Steinborn
Steinborn Inc., Realty
PO Box 936
Las Cruces, NM 88004
505-526-4491
david@steinborn.com

Joe Stell
District 54 - Eddy
22 Colwell Ranch Rd.
Carlsbad, NM 88220
505-785-2188

Karyn Stockdale
Western Region- Santa Fe Office
The Trust for Public Land
418 Montezuma Avenue
Santa Fe, NM 87501
505-988-5922
karyn.stockdale@tpl.org

John Stomp
Albuquerque Public Works Dept.
PO Box 1293
Albuquerque, NM 87103
505-768-3650
jstomp@cabq.gov

Participant List

Gail H. Stucky
2549 Orchard Lane
White Bear Lake, MN 55110
651-773-9143

John T. Stucky
2549 Orchard Lane
White Bear Lake, MN 55110
651-773-9143

Creta Stucky McGuire
4912 Verulum Place NW
Calgary, Alberta T3A 0K1
CANADA
403-288-7238
cretandbob@shaw.com

Elizabeth Swastiwari
Russell Apartments
Rutgers University
720 Bevier Road
Piscataway, NJ 08854
732-648-7613
swastiwari@yahoo.com

Marvin Tessneer
Las Cruces Bulletin
840 N. Telshore Suite E
Las Cruces, NM 88011
505-524-8061

Cheryl S. Thacker
NM Office of the State Engineer
1680 Hickory Loop, Suite J
Las Cruces, NM 88005
505-524-6161
cheryl.thacker@state.nm.us

J.W. Thrasher
Pecos River Compact
Commissioner for Texas
PO Box 340
Monahans, TX 79756
432-940-1753
j.thrasher@sbcglobal.net

Wayne Treers
Water Operations
El Paso Field Division
U.S. Bureau of Reclamation
700 E. San Antonio Ave.
Suite 710
El Paso, TX 79901
915-534-6321
wtreers@uc.usbr.gov

T.J. Trujillo
Gallagher & Kennedy, P.A.
1233 Paseo de Peralta
Santa Fe, NM 87501
505-982-9523
AJT@gknet.com

Lois Turnage
Waters Project
NM Office of the State Engineer
121 Tijeras Avenue NE
Albuquerque, NM 87102
505-765-2001
lois.turnage@state.nm.us

Bill Turner
Middle Rio Grande Conservancy
District
610 Gold Avenue SW, Suite 111
Albuquerque, NM 87102
505-843-7643
wturner@waterbank.com

John Tysseling
Energy, Economic &
Environmental Consultants
5600 Wyoming Blvd. NE
Suite 225
Albuquerque, NM 87109
505-822-9760
jct@e3c.com

Nancy Umbreit
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
numbreit@uc.usbr.gov

Leonard Utter
Middle Rio Grande Conservancy
District
PO Box 581
Albuquerque, NM 87103
505-247-0234
leonardu@mrgcd.us

John Utton
Sheehan, Sheehan & Stelzner
PO Box 271
Albuquerque, NM 87103
505-247-0411
jwu@ssslawfirm.com

Jerald A. Valentine
Third Judicial District Court
201 W. Picacho Ave., Suite A
Las Cruces, NM 88005
505-523-8235
lcrd1gb@nmcourts.com

Art Valverde
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102
505-462-3540
avalverde@uc.usbr.gov

Scott Verhines
GC Engineering
10010 Indian School NE
Albuquerque, NM 87112
505-275-0022
sverhines@gc-engineering.com

Max Vigil
Jicarilla Apache Tribe
PO Box 507
Dulce, NM 87528
505-759-3242

Cliff Waide
Town of Hagerman
PO Box 247
Hagerman, NM 88232
505-752-3204
hagerman@leaco.net

50th Annual New Mexico Water Conference

Cody Walker
Pueblo of Isleta
PO Box 1270
Isleta, NM 87022
505-869-9623

Erin Ward
Southwest Center for
Environmental Research & Policy
MSC 3CR
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
erinward@nmsu.edu

Frank Ward
Agricultural Economics & Business
MSC 3169
New Mexico State University
PO Box 30003
Las Cruces, NM 88003
505-646-1220
fward@nmsu.edu

Anne Watkins
NM Office of the State Engineer
121 Tijeras NE
Albuquerque, NM 87102
505-764-3883
anne.watkins@state.nm.us

Kathy Watson
CDM
4110 Rio Bravo, Suite 201
El Paso, TX 79902
915-544-2340
watsonkm@cdm.com

Larry Webb
City of Rio Rancho
PO Box 15550
Rio Rancho, NM 87174-0550
505-896-8715
lwebb@ci.rio-rancho.nm.us

Tom Whatley
NM Office of the State Engineer
216 South Silver Street
Deming, NM 88030
505-546-2851
tom.whatley@state.nm.us

Jim Whiteker
LandLogic/Sandia Laboratories
HC72 Box 135
Leyba, NM 87560
505-421-2255
landlogic@direcway.com

Peter Wilkinson
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504
505-827-5801
peter.wilkinson@state.nm.us

Betsy Woodhouse
Southwest Hydrology
University of Arizona - SAHRA
PO Box 210158-B
Tucson, AZ 85721-0158
520-626-1805
mail@swhydro.arizona.edu

Ben Woods
Office of Facilities and Services
MSC 3545
New Mexico State University
PO Box 30001
Las Cruces, NM 88003
505-646-2356
bwoods@nmsu.edu

Janelle Woodward
CCW Farms
2452 El Dorado Ct.
Las Cruces, NM 88011
505-532-0934
ajwoodward@zianet.com

Stephen Wust
Santa Fe County
205 Montezuma
Santa Fe, NM 87501
505-992-9876
swust@co.santa-fe.nm.us

Mark Yuska
USACE
Reservoir Control Branch
Ops Division
U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109
505-342-3608
mark.e.yuska@usace.army.mil

Elizabeth Zeiler
NM Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
505-827-6189
elizabeth.zeiler@state.nm.us