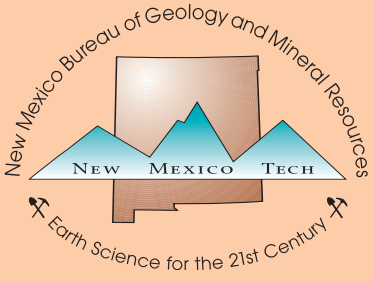
DECISION-MAKERS FIELD CONFERENCE 2007

WATER RESOURCES OF THE MIDDLE RIO GRANDE

San Acacia to Elephant Butte

L. Greer Price, Peggy S. Johnson,
and Douglas Bland, Editors



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Water Resources of the Middle Rio Grande: San Acacia to Elephant Butte
L. Greer Price, Peggy S. Johnson, and Douglas Bland, Editors

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The Rio Grande at the Bosque del Apache National Wildlife Refuge

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Preface

There is no subject of greater interest to New Mexicans than water: where we get it, how we use it, and how it is managed. Years of below-average precipitation have only increased that interest. Our focus for this volume is the Middle Rio Grande from San Acacia to Elephant Butte. This is a critical reach of the river. How water is managed in this region greatly affects water availability to the north and south, as well as our ability to meet legal obligations for water delivery. For decades we have fought and debated over the fate of water that, for some time now, has been fully appropriated. Three states and the Republic of Mexico have shared in that debate, and in the consequences of our decisions. For better or worse, we live today with a legacy of the immensely complex social and legal history of this river.

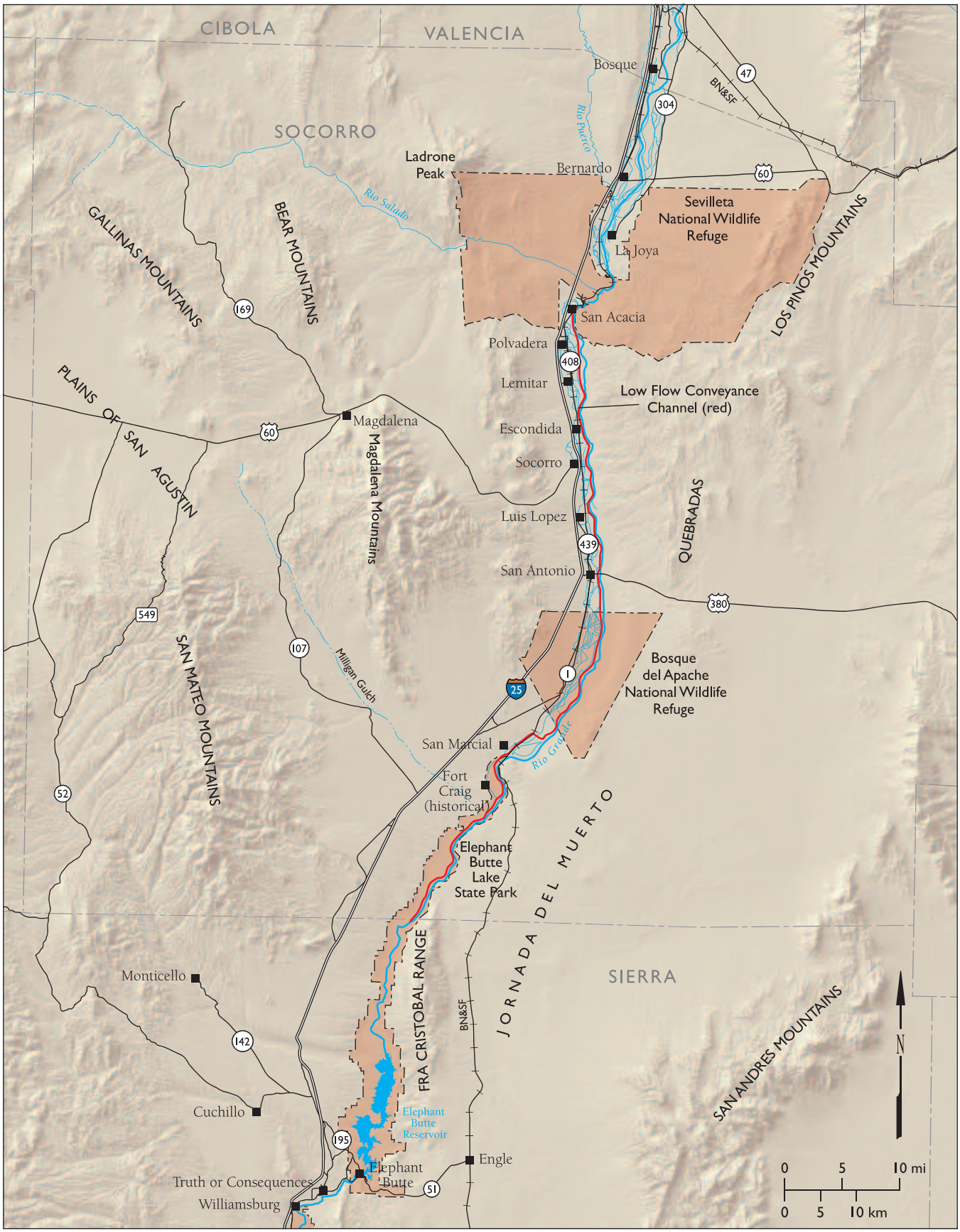
This volume is intended to provide a broad overview of these issues, including history, policy, legal framework, infrastructure, and management. The book is intended for a non-technical audience, providing information that is not otherwise easily found in a clear, understandable style and format. We hope it will serve as a reference for decision makers, policy makers, and the general public. Our authors were chosen for their ability to address these topics broadly and with authority, based on their expertise and experience.

This is the fifth volume we've produced in conjunction with our decision-makers field conferences. These conferences are designed to provide decision makers with an overview of earth science and related policy issues of interest and importance to all New Mexicans. We produced the first volume in 2001 on *Water, Watersheds, and Land Use in New Mexico*. This was followed by volumes on *New Mexico's Energy, Present and Future* in *2002*, *Water Resources of the Lower Pecos Region* in 2003, and *Mining in New Mexico* in 2005. The conferences have been a resounding success, and the guidebooks we produce to accompany them have taken on a life and significance of their own. We've tried to focus on how science can aid in the decision-making process, and to provide a balanced view rather than a comprehensive one. If we've not provided answers to all of the questions, perhaps at least we have provoked significant thought and discussion.

We asked our authors to rely on fact rather than opinion, but the papers invariably reflect to some degree the views of their authors. Those views do not necessarily represent the voice of the New Mexico Bureau of Geology and Mineral Resources or our partner agencies. Our contributors are listed in the back of the volume, along with information about who they are and what they do. They, too, are an important resource and will remain involved in shaping the future of water in New Mexico for years to come.

Whatever that future may hold, it will require tough—and informed—decisions. It is our hope that this compilation will go far toward helping to inform those decisions. Our economic health, our environmental well-being, and the quality of life that we have come to take for granted in New Mexico all depend upon it.

—*The Editors*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An Introduction from the State Geologist

Peter A. Scholle, *New Mexico Bureau of Geology and Mineral Resources*

This year's decision-makers field conference, on water issues in the Middle Rio Grande region, again deals with some of the most difficult and contentious topics in New Mexico science and politics. Although this region has a relatively small population, it brings into play all the issues that face the water-supply situation throughout our state: It suffers the impacts of upstream use and abuse of water; it has habitat, endangered species, flood hazard, and water quality issues in its own reach; and it has to cope with the downstream obligations mandated by interstate compacts and international treaties. This volume is filled with papers that realistically discuss the constraints on the all-too-finite water supply in this arid state and this specific region. All the near-surface water in New Mexico is already owned by someone and is being used (or overused) for one productive purpose or another. We may be able to stretch uses through conservation and efficiency changes; we certainly can reallocate use from one sector to another (most typically from agriculture to urban or industrial uses), but we cannot generate new water. However, such major shifts in water uses, if undertaken, will have profound impacts on the character and landscapes of this state.

In addition to those rather grim current realities, we should remember two other factors. First, there is a growing scientific consensus that global warming is an undeniable reality. Although there are disagreements about how global climate change will be reflected in New Mexico, some models show increased aridity for this region and specifically less winter precipitation (and thus less storage of moisture in snowpack). In addition, several recent studies have shown that protracted periods of drought were much more common in this region over the past millennium than previously thought. So the predominantly wet conditions of the past century, under which our state has grown (and our interstate compacts were written), may be quite anomalous, adding to unsustainability of our water supplies. Paradoxically, as part of that pattern of change, many models predict more intense weather events, including heavy rainfall events, which could increase episodic flooding despite overall drought conditions. In other words, we may be heading for what we typically call "natural disasters."

I would like to expand on what is meant by a natural disaster. Hurricane Katrina was a recent major event that certainly earned this title. Yet like most such events, although Katrina was indeed a disaster, with the loss of more than 1,800 lives and $100-200 billion in insured and uninsured damages, it was only partially a "natural" disaster. The natural part was the hurricane; the unnatural part was the human and infrastructure damage that it caused, the lack of preparedness, and the simulated shock and awe in the political, regulatory, and emergency response communities at the aftermath.

Hurricanes have struck America's Gulf and Atlantic coastlines throughout recorded history (and well before that, as well). The strength and frequency of large hurricanes may be increasing, but the basic effects of hurricanes on coastlines have not changed appreciably over the centuries. In a natural setting, hurricanes erode shorelines, flood low-lying coastal areas, and flatten vegetation in their path. Most such damages are repaired in just a few years by sediment movement and vegetative regrowth. The disaster part of natural events comes from humans putting themselves and their infrastructure in harms way. Every geologist familiar with coastal processes could have predicted the inevitability of a hurricane disaster in New Orleans—not the year or the day, but the eventual inevitability. From a geological and engineering perspective, everything that could be done wrong was done wrong on the Mississippi River, and in and around New Orleans. The Mississippi River was forced to flow through New Orleans for more than a century after it would have shifted to the course occupied by the Atchafalaya River. Engineered levees along the Mississippi have not only kept the river in place, but also have prevented annual flooding and distribution of new sediment on the natural floodplains surrounding the river or along the coastline where it would have contributed to the formation of barrier islands. Instead, the sediment is now transported into deep water where it contributes not at all to coastal protection. Natural subsidence of the area has been compounded by subsurface water and oil withdrawals. Coastal dunes and shoreline mangrove forests, the natural defensive barriers for a coast, were compromised by extensive land clearing for housing

developments. The broad wetlands and marshes that formed additional barriers along the coast were cut by networks of access channels that allowed entry, not just to drilling barges, but also to floodwaters. In short, the Mississippi delta region was the ultimate triumph of complex and incredibly expensive engineering projects over common sense and natural systems.

More than anything, government policy and public desires led to large populations and expensive infrastructure being placed in the inevitable path of storms. Subsidized federal flood insurance programs and tax incentives to spur economic growth, coupled with poor management practices, put people and structures into completely indefensible situations. Did anyone really believe that you could house hundreds of thousands of people in areas that lay 6 to 12 feet *below* sea level along a shoreline prone to hurricanes and not have a disaster some day? Did anyone really believe that walls built on mud, coupled with a series of easily floodable pump stations to remove water, were the solution to this problem? Does anyone now believe that rebuilding in the same sub-sea-level areas is any more sensible? Or that slightly higher walls will not, someday, be overtopped by slightly higher waters? Or that mandating that rebuilt houses be placed on 3 to 6-foot-high pads will solve flooding problems in still subsiding neighborhoods where people just recently drowned in their second-story attics?

Hurricane Katrina represents not only the costliest natural disaster in American history (by at least a factor of five over the next costliest event, Hurricane Andrew in 1992), it also represents what may be the nation's greatest communications failure as well. Every geoscientist who dealt with coastal processes, river systems, or even general sedimentology or oceanography understood the folly of the systems in place in New Orleans and could predict their ultimate fate. Many scientists at well-respected institutions, including the U.S. Geological Survey, most of the state geological surveys along the Gulf Coast, Louisiana State and other universities, conducted research and published scientific monographs on issues relevant to this disaster. But, for the most part, the concerns articulated by those scientists were not heard by the decision-making community. The technical jargon, the complexity of the issues, the unwillingness of most scientists to enter political frays, and the social dislocations and associated financial costs of the most rational solutions all blocked both communications and the acceptance of what was communicated. And it still does.

What does this all have to do with New Mexico and water-supply issues on the Rio Grande? I have purposely pointed my finger at a situation in which nobody here was involved to avoid the defensiveness that such accusations raise. But the parallels to what could happen in New Mexico in the future are compelling. The hydrologists, geologists, and other scientists working on climate and water supply in New Mexico are largely unified in their views that, in most areas of this state, we have reached or exceeded levels of water use that are sustainable even under current conditions. In addition, we face likely drought and climate change that will further compromise this supply. Nonetheless, in many areas we are allowing further development and are even providing substantial incentives for economic expansion. Furthermore, we are allowing a substantial part of that development to occur on the floodplains of our major rivers. How does this differ from encouraging building in coastal hazard zones or, to exaggerate ever so slightly, to zoning the top of Mount St. Helens for residential development? The natural hazards of drought and flooding in New Mexico will probably not lead to the massive deaths of Hurricane Katrina, but they could lead to huge economic losses, at personal, corporate, and governmental levels, comparable to the Katrina event. And they could lead to social disruptions and a population exodus that also compares to Katrina and New Orleans.

The use of floodplains, in particular, presents a series of problems that may put us on the very same slippery slope of engineered projects that led to the Katrina disaster. Floodplains, as the name implies, are natural overflow areas during those times when a river has to carry more water than can be accommodated by its channel. Floodplains are excellent sites for agriculture and for storage of things that can be quickly and easily moved. Once the decision is made to allow other development on floodplains, including residential housing, industry, or commerce, there are immobile infrastructure, personal property, and lives at risk. The value of those lives and properties is used to justify the construction of very expensive protective engineering structure (dams, levees, concrete-lined channels, and the like), and that puts us on a permanent path of working against nature rather than with it.

Engineered structures are designed to meet specific conditions, but conditions change with time. Construction of upstream levees funnels more water through channels and adds stress on levees in downstream areas. Urbanization upstream (read covering the land with concrete and asphalt) reduces water infiltration during rainstorms. The water is instead funneled to the river through storm drains and concrete channels. This increases the flashiness of flash

floods and again puts new stresses on levee systems. Climate change also contributes to the problem. What once were 500-year events become 100-year or even 50-year events, and thus higher levees need to be built and maintained, or people's lives and property will be in ever greater danger from flooding. The cost of such engineering is great, the structures require perpetual maintenance and upgrading, and such projects are always fraught with danger of failure during unanticipated large events. But it should be pointed out again that natural disasters are true disasters only because we allowed inappropriate land uses in the first place.

Of course, it is a legitimate role for government to provide opportunities and incentives for economic and social development, but such incentives should be applied wisely and with a view to long-term rather than short-term gains. Viewed from a long-term perspective, projects that fight nature, whether they involve coastal beach replenishment in the face of rising sea levels or building river levees in the face of increased flooding, are unsustainable. Government should have the wisdom to create solutions that make long-term sense, both economically and in terms of public safety. That requires intelligent consideration of water and zoning issues and the full incorporation of scientific and technical knowledge into such decision-making.

So my request to you as decision makers and as citizens is:

- Please read the papers in this volume, grasp the consensus on the issues discussed, and think of those issues as you help shape policy for New Mexico.
- Continue the dialog between scientists and policy makers that we hope this conference will start (and please remember: Scientists are those shy, quiet people who stood along the wall during your senior prom, so they may need a little coaxing).
- Encourage and financially support the gathering of the fundamental scientific data needed to fully understand water supply in this state as well as to create rational water plans. We have learned much in past decades, but this is a large state with much still to be learned.
- To the maximum degree possible, support natural, not engineered, systems (see the last paper in this volume, by Bill deBuys, for further reasons to do this). Engineered systems limit our flexibility and the ability of natural systems to function naturally.
- Think of water as you make decisions not just about water, but as you deal with growth and development as well. Think of water as the limiting factor on everything that happens in this Land of Enchantment, and you will help to keep New Mexico exactly that.