

MULTIPLE LAND USE

DECISION-MAKERS
FIELD CONFERENCE 2002
San Juan Basin



NEW MEXICO'S ENERGY, PRESENT AND FUTURE

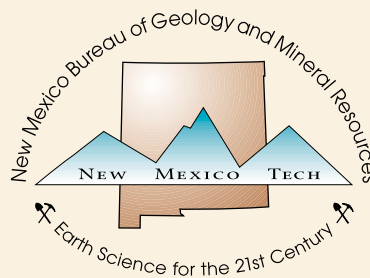
**Policy, Production, Economics,
and the Environment**

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New Mexico Bureau of Geology and Mineral Resources
A Division of New Mexico Institute of Mining and Technology
2002

Love of Land May Offer Control of Its Destiny

Frank Titus, *New Mexico Bureau of Geology and Mineral Resources*

If you love the Southwest, you'll love the San Juan Basin. Drive through this wild and desolate land. It is Jim Chee and Joe Leaphorn country. Its bigness is breathtaking. Here you learn self-reliance — or you leave. But at the human level, below its haunting geography, a tempest brews. It is about competing interests. It is about people getting along with people.

Although the land may seem boundless, its boundaries, social as well as physical, are real, embedded in hearts and minds, tradition and law. Although the land may seem timeless, its socioeconomic structure has been built on change. Grazing, the Navajo Nation, oil and gas, coal, irrigation, power generation—each has grown from a small beginning. All, except the birth of the Navajo Nation and grazing, are within the memory of someone still living. And still, the future holds change.

This is a land of rugged individualists and small tight-knit groups living within a common landscape, provided with common natural resources. Has any one yet offered a vision of how in their common arena they might work together to achieve a set of mutually beneficial goals? Cannot the puzzle pieces of a future be assembled in win-win format?

In his seminal article *The Tragedy of the Commons*¹ Garrett Hardin argues that in any commons—and the San Juan Basin is in his sense a commons—humans inevitably will tend to overtax the resources. Here are his words.

The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component. 1. The positive...[is] one animal. Since the herdsman receives all the proceeds from the sale of the additional animal the positive utility is nearly +1.

2. The negative...is...the additional overgrazing created by one more animal. Since...the effects of overgrazing are shared by all the herdsmen, the negative...for him...is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit in a world that is limited.

Hardin's several examples of "commons" in this country today include public lands (mining, overgrazing), the high seas (overfishing), national parks (overcrowding), public waters (overconsumption), and the atmosphere (polluting).

In an interesting further analysis, however, Hardin goes on to argue that an appeal to the conscience of the community to protect the commons is inevitably self-defeating. People vary, he says. Confronted with appeals to protect any commons, some people will respond to the plea more than others. By this means, those concerned with the welfare of the commons may restrain themselves for the common good, whereas those willing to focus exclusively on their own mission become the dominant players. Therefore, he concludes, protection of the common interest depends on some form of coercion. Hardin says:

To say that we mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it. Who enjoys taxes? We all grumble about them. But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless. We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons.

Well, that's one way. But must we agree that there is only one way, and it's coercion? In fact, below are examples of spontaneous, citizen-generated efforts that have worked yet conflict fundamentally with this view of Hardin's.

On January 19 of this year I attended the first annual meeting of an upstart organization named The Quivira Coalition. Some 300 people packed the grand ballroom of La Posada de Albuquerque hotel. I came away simply amazed at the coalition's success in fulfilling its audacious purpose of getting ranchers, environmentalists, and land managers to unite in deciding what would be

good for improving western range land, and then DOING IT — a ranch, a grazing allotment, a farm, a critical habitat at a time. The speakers were people who live and work outdoors, intimately knowledgeable with both the land and their topics, and to a person they spoke in rangeland idiom. They were the people on the ground. Quivira membership is equally divided among the three interest groups. But, having decided that the threat to their way of life was too great if they failed to cooperate to grow more grass on the range; if they failed to cooperate to protect the riparian vegetation along stream courses crossing their lands; if they failed to cooperate to not damage the critical habitat of threatened or endangered species, they found ways to accomplish these things and more. Nobody made them do it. Maybe it was the looming consequences of inaction that got them started; maybe it was a new generation and education. Anyway, they have done it, on their own, and they continue to do it.

Now another example: I participated for five days between Christmas last and New Years in a private, citizen-started, 30-some-person discussion group in Santa Fe that focused on the future of northern New Mexico. One of the daily discussion leaders, Carl Moore, who specializes in negotiating difficult decisions in groups of individuals with divergent opinions, talked at length about a standing committee of citizens in Catron County. They have become effective at negotiating the most difficult and stressful considerations within their own membership, and are nearly always successful in reaching a mutually acceptable stance. They simply keep talking until they can reach common ground. This seems a central reason for their success: their agreement to keep talking until they can agree on something. They've faced many issues. One of the hottest has been over reintroduction of the Mexican Gray Wolf into areas close to the ranchers' grazing land — a hot issue if ever there was one.

The third, and a final example, is a citizen committee in the Pecos River valley. The New Mexico state engineer announced a tough plan to solve the problem of the state's likely inability to deliver enough water to Texas to meet the mandate of the Pecos River Compact between New Mexico and Texas. The committee is looking for alternatives. Drought and decreased runoff in the river for more than two years have the state scrambling to comply with the compact. The only weapon that New Mexico's Interstate Stream Commission and state engineer have to assure compliance is a bludgeon called a "priority call." This procedure would shut down all water use by enough junior water-right holders that the state of New Mexico can

meet its obligations to the state of Texas.

Uncomfortably, the estimate is that water users like the city of Roswell and many of the irrigating farmers in the Roswell Artesian Basin would have to stop using water before the flow of the river at the state line could be sufficiently enhanced. The citizen committee quite recently reached a tough set of agreements that experts think will work both now and in the next decade to avoid the dreaded priority call. No one is happy with the list of actions, but all agree that these moves are necessary. And they further agree that the effect of NOT being able to devise such a list would be economically many, many times more costly.

Note that none of these three examples is directly required by regulation or law, yet each has been successful in balanced preservation of the land. The people seem in fact to have been driven by conscience — the characteristic that Hardin dismisses as inevitably self defeating.

But look deeper. All, fundamentally, are operating out of self-interest to save their own land, and to keep the control of the future of that land within their own community. Implicit in this is that the cost of failure to hang on to such control would be costly in the extreme in values important to that particular community.

So, they are in fact dealing with a their own version of a commons. And to avoid their own ultimate hellish circumstance, they agree to search until a solution to each issue is found, one that every one of them can accept. This obviously leads to solutions with which no one is entirely happy. It can be said, in fact, that every solution so found is likely to be agreed to by each party while their teeth are clenched. So be it.

I admit to a sense of gratification that these recent examples are all from the American West, that they are initiatives of self-reliant people who love their land, and that they fly in the face of any suggestion that reliance on conscience will be self defeating. What will be truly self defeating will be failure to involve stakeholders, that is, the local people, in the process. That, and being less than forthright in providing, openly and in balanced manner, all of the information that is available. Give the people that, then stand back and prepare to be amazed and pleased.

Decision makers, it is our intention on this trip to give you information, insight, and ideas about the San Juan Basin "commons." We aren't optimistic about making your decisions any easier. We hope though that you feel your participation will make them wiser.

FOOTNOTE

¹ Science, 162(1968)1243-1248

Oil and Gas Development in the Context of Multiple Land Use

Steve Henke, *Bureau of Land Management*

The New Mexico portion of the San Juan Basin lies in the northwestern corner of the state and encompasses approximately 2.6 million acres of federal mineral estate. Approximately 80% of the mineral estate in the basin is federally owned and managed by the Bureau of Land Management (BLM). The basin produces an average of 3 billion cubic feet of natural gas daily—about 8% of the national total. This resource generates federal royalties averaging \$280 million annually, half of which, by statute, go directly to the State of New Mexico. Obviously, this is a nationally significant energy resource, and President Bush's national energy plan emphasizes environmentally responsible development of domestic energy from public lands.

Oil and gas leasing and production is one of several resources and uses managed by BLM under the principles of multiple use and sustained yield. On the surface, above this valuable mineral estate, are significant cultural resources, including Chacoan archaeological sites; habitats for a variety of wildlife and plants, including some endangered species; sensitive riparian areas; recreation areas; designated Wilderness areas; a network of ranches; sites that are culturally and religiously important to Native Americans; and public lands where many go to ride, hike, bike, hunt, fish, and seek solitude and refuge from urban pressures.

Under the Mineral Leasing Act of 1920, the federal government leased 97% of the federal mineral estate in the San Juan Basin to private individuals and corporations granting exclusive rights to develop the oil and gas resources. Many of these leases date from the 1940s and 1950s, and most have active production of natural gas from one or more producing formations. Development has proceeded with approximately 19,000 producing wells today and another 10,000 wells projected to be drilled over the next 20 years.

Since the early days of oil and gas leasing in the San Juan Basin by the federal government, Congress has passed a variety of legislation affecting public land management, including: the National Environmental Policy Act; the Endangered Species Act; the Clean Water and Air Acts; the Wilderness Act; the Colorado Salinity Control Act; the National Historic

Preservation Act; and the Federal Land Policy and Management Act, among others. Legislation affecting public land management and establishing public policy typically contains language to the effect that "... Congress finds that it is in the public interest to...develop mineral resources on public lands, provide clean drinking water and air, protect cultural resources, set aside wilderness, comprehensively plan for multiple use..." and so forth. What appear to be obvious conflicts with congressional intent, are, in reality, a challenge to those agencies responsible for multiple use to act in the best interest of the public.

The Executive Branch of the federal government, of which BLM is part, promulgates regulations to implement the acts of Congress. Through various regulations, some in conflict with one another, along with agency policies and bureaucratic processes, we have arrived at a point where we often lose ourselves in the maze of the "hows" and forget the fundamental goal of what is in the public interest. The various laws, regulations, and policies by which BLM manages these public resources allow for proposals, with respect to oil and gas development, which could range from total, unlimited development to no development whatsoever. Surely there is some level of oil and gas development that meets the public interest and is both ecologically sound and socially sustainable. The question becomes how to define that level of oil and gas development in a multiple-use environment.

The Farmington Field Office of BLM is preparing a comprehensive land use plan to guide management of the resources under its care for the next 20 years. Part of the planning process is to define the projected level of oil and gas development on existing leases. The New Mexico Institute of Mining and Technology, in cooperation with the New Mexico Bureau of Geology, prepared an analysis of future development that projects approximately 10,000 additional wells on federally administered lands over the next 20 years (see article by Engler in this volume). The fundamental resource allocation decisions to be made in BLM's land use planning process for oil and gas development in undeveloped areas are: which areas to lease, what special stipulations should be attached to leases, and

what areas should be closed to leasing. Since the federal oil and gas estate in the basin is 97% leased, this question is largely moot. The new challenge becomes defining and effectively analyzing a level of oil and gas development in an Environmental Impact Statement (EIS) that is consistent with the public interest.

Defining the public interest in its broadest sense, is in the author's view analogous to a similar exercise one would undertake in an area where both the surface and mineral resources were privately owned. Assume, if you will, that as a private citizen you owned a square mile of land within the San Juan Basin. Obviously, the value of the mineral resource would have a significant bearing on your decision to allow development. The royalty from development of the oil and gas resource would likely provide significant economic opportunities for your family. You would prudently want to protect your oil and gas resource from drainage by your neighbors. One would want to consider protecting some sensitive surface areas from impact, either totally or seasonally. You would likely work closely with the oil and gas lessee to ensure that development was consistent with your expectations, minimally disrupted your other uses, and that reclamation was completed so as to promote future productivity.

In the land-use planning and Environmental Impact Statement (EIS) process, BLM takes a similar approach to the analysis of proposed levels of development and alternatives. The EIS will define areas that are non-discretionarily (Congressionally) closed to leasing: the Wilderness areas, which comprise about 1% of the area. Some areas have designations or resource values that may require discretionary closure to leasing, or they have restrictions on surface oil and gas use. Areas to be protected through special stipulations will also be identified, such as Areas of Critical Environmental Concern or Special Management Areas. Leasing and development will be controlled through stipulation that would require seasonal closure, such as the big game winter ranges, or special siting stipulations to locate operations away from key recreation areas, endangered species habitats, riparian areas, or cultural sites. Perhaps 20–25% of the surface area would have special restrictions to protect other resource values, restrictions designed to avoid or mitigate impacts from oil and gas development. For the majority of the area, oil and gas development will be permitted under a set of standard terms and conditions that are designed to ensure environmentally responsible development of the oil and gas resource.

The public interest at the local level involves managing development in a socially sustainable manner. Referring back to the private land/mineral owner example: BLM would plan site-specific development, much as any prudent private landowner would, to avoid visual intrusions on the landscape, minimize impacts to other surface uses, protect surface and ground water, and mitigate disruptions from noise, traffic, hazards, or impassable roads.

How would we measure BLM's success in planning for and managing the resources of the San Juan Basin? Indicators of a successful plan and analysis might include: support for the package of proposals and public commitment for implementation; minimal controversy concerning the data and assumptions used for the analysis; a sustainable local community, both socially and economically; orderly development of the oil and gas resource; avoidance and mitigation of impacts to other resources; and completion of reclamation requirements.

As BLM approaches completion of the draft plan/EIS, our goal is that the proposals be balanced and reasonable, and that they reflect what is in the public interest, both nationally and locally.

Oil and Gas Production In Urban Areas: Conflicts and Solutions

Frank Chavez, *New Mexico Oil Conservation Division*

In the San Juan Basin of New Mexico, the oil and gas industry has dominated the regional economy and local communities for many years. With the first discovery of oil and gas in the early part of the twentieth century, the industry was welcomed for the energy and economic benefit it brought to the area. However, in the last 20 years as communities have grown, the demographics and values of the area have changed. Although the oil and gas industry remains one of the largest single employers in the area and has the largest single impact, the economy of the region has diversified, and the oil and gas industry no longer dominates the regional economy in quite the same way as it once did.

Changes in local values and perceptions may reflect larger-scale changes in our culture. Although the sight of a well with its associated equipment was at one time a symbol of prosperity and human ingenuity, current populations are just as likely to view the same well as a pollution source and a hazard to life.

Changes in land ownership have also altered the older, more mutually beneficial relationships between landowner and driller. Most of the original oil and gas leases allowed the landowner to share in the wealth of production through royalty payments; thus, the inconvenience of having a well on one's land was partially offset by the direct financial benefit. Over time, surface rights and mineral rights have been severed for many tracts of land, and landowners today may receive no direct benefit from having a well on their land.

As communities throughout New Mexico continue to grow, we are experiencing more conflicts between the larger communities and the traditional operations of the oil and gas industry. Here are a few examples of problems associated with these conflicts:

- In a period of only a few months, two teenage boys trespassing on well sites were killed. One, in an attempt to "get high," was sniffing vapors from a tank hatch and fell to his death. The other was standing on top of a tank stealing "drip" gas when his partner struck a lighter at the hatch to see how much fluid was in the tank. One boy was propelled over 100 feet in the resulting explosion; the

other boy was badly burned.

- A local school board spent several thousand dollars in construction before they realized that they were building a school closer to an existing well than the fire code allowed.
- A land developer spent time and money designing an upscale subdivision (including a golf course) only to discover that a company, with full legal rights, had commenced drilling a well in the middle of his planned community.
- The New Mexico Oil Conservation Division, locating old "orphan" wells for plugging, found one within 3 feet of a landowner's house.

Historically, most of the local population lived in the cities; rural populations were predominantly farmers and ranchers. Increasingly, more residents are living outside of the cities, seeking the freedom, quiet, solitude, and atmosphere of rural life. Many farms are now being subdivided into home sites. For example, 10 years ago in Farmington the top of Crouch Mesa was home to a small herd of antelope and a few prairie dogs. Today portions of the mesa host over 200 site-built or modular homes, with more planned. The increasing need for housing within the communities of Aztec, Bloomfield, and Farmington is causing those communities to expand into what was once farm and ranch land. There are currently more than 200 gas wells within the city limits of these three communities, and more wells are scattered throughout the outlying areas.

General knowledge of the operations of the oil and gas industry has also declined. New landowners, oblivious to some of the inherent conflicts and concerns, are sometimes placing homes in dangerous proximity to well sites, pipelines, or other facilities. Land values have increased to the degree that a single well site can occupy land that is valued at thousands of dollars. Local real estate agents are not adequately informed about the possible impacts of existing and future oil and gas development when they market land in this area.

At the heart of these conflicts are problems related to old oil and gas leases and regional geology. The oil- and gas-bearing formations of the San Juan Basin

underlie both cities and rural areas. In order to produce these resources, an infrastructure of well sites, roads, and pipelines is needed. Wells must be evenly spaced in order to efficiently drain the oil and gas reservoirs. This creates a problem when the ideal geological locations are occupied by existing homes or other structures. Directional drilling, often suggested as a solution by those not fully familiar with the process, is not an appropriate solution to most well-site problems in the San Juan Basin, due to the depths, abnormally low pressures, and quantities of the reserves involved. Older leases give oil and gas developers almost unlimited access to and use of the land, often to the detriment of the surface owner. The responsible leaseholder has a moral obligation to work cooperatively with the surface landowner and local communities to lessen possible negative effects of such development.

Any leased land has the potential for future well drilling. A completed well requires 1–2 acres of land during the life of the well (for the site, access, and pipelines), in order to be a relatively safe distance from other uses. The well must also be served by pipeline right-of-way. This usage makes those 1–2 acres unavailable for home sites. When a well is finally plugged, a permanent steel marker is placed over the well bore. This land remains undesirable for construction because of the risk of plug failure.

Local governments have been pursuing some solutions. In the early 1980s the communities of Aztec, Bloomfield, and Farmington wrote city ordinances governing oil and gas drilling and production within their jurisdictions. Although there is serious doubt regarding to what degree cities can legally regulate the industry, companies in New Mexico have chosen not to challenge these ordinances. These companies consider themselves part of the community and want to be as cooperative as possible. Existing local ordinances and regulations place stipulations on noise, traffic, location, hours of operation, etc.

San Juan County has chosen not to address these conflicts between the oil and gas industry and other land use and not to implement new regulations. Several years ago landowners filed a lawsuit against a local oil-field waste service company, in response to hydrogen sulfide gas emanating from the waste disposal facility. One of the important questions raised was, “Who was there first?” Regardless of who was first to occupy the neighborhood, the proximity of homes and such facilities creates a serious incompatibility.

The San Juan County fire marshal has implemented

the National Uniform Fire Code standards for oil and gas industry operations. These standards are more stringent than the previous requirements. The setbacks required in the code now limit both the energy industry and other land users as to how close to each other they can conduct their activities.

The issue of community safety is increasingly important. Since the pipeline rupture and fire near Carlsbad in August 2000, we all have a heightened awareness of the potential for problems from oil and gas activities. Some of the wells within city limits are several decades old, with aging downhole and surface equipment. Maintenance and monitoring of these facilities in sensitive areas becomes much more important and increases costs. One high-pressure gas line, on the outskirts of town when it was installed, is now located in a well-populated area of Farmington as a result of the growth of the community.

The oil and gas industry has taken some initiative in finding solutions. Well locations within the cities vary in how they are “finished.” Several in Farmington are attractively fenced, with the surrounding area landscaped into a park. Those locations that are highly visible are maintained with regular painting and clean gravel arranged around the well. In order to reduce truck traffic to the well, some operators are disposing of produced water in the city sewer system at the well site and paying the city for handling and processing of industrial waste. After the tragic deaths that resulted from the Carlsbad fire in August 2000, local companies implemented an educational program that is presented to schools on a regular basis. For wells that require a public hearing before a city council, companies are making thorough educational presentations, describing the processes that will be used.

Conflicts are not limited to well development. The Crouch Mesa situation described above is further complicated by the existence of three oil field waste handling facilities that were permitted by the Oil Conservation Division and constructed before homebuilding began. Two facilities are land farms that, by their nature, generate significant odors. The other facility handles wastewater in a large pit that often generates odors from anaerobic bacteria. Normal well production operations produce odors and noise. The nuisance value of all of these is often very subjective. Several large gas-processing facilities are located in a pipeline corridor just north of Bloomfield, and a nearby residential area is growing quickly. The noise and odors from these facilities may soon become an

issue for residents.

Some possible solutions for lessening the conflict are apparent. Among them:

- Knowing that oil and gas development will continue, communities could designate certain areas for that purpose in cooperation with other governing agencies. This might limit conflicting development.
- Local realtors must be educated about oil and gas development so they can better inform potential sellers and buyers. Standardized explanatory material should be given to all buyers.
- Companies should inform surface land users and local communities about their long-term plans for development or other activities that might disrupt use of the land.
- Land abstracts and deeds should make explicit reference to existing oil and gas leases with appropriate caveats.
- Companies should thoroughly explore the safety and nuisance risks of any equipment, such as compressors and piston lifts, before installation.

There will always be conflicts in how land can and should be used. Better education of landowners and land managers is an important element in lessening this conflict. Including this development in long-term planning for communities and landowners will also help. Finding innovative and cooperative solutions to these common problems is to the mutual benefit of the oil and gas industry, the regional economy, and the residents of the San Juan Basin region.

Surface and Mineral Rights Ownership in New Mexico

Mark Hiles, *New Mexico Mining Association*

In order to develop a coal reserve into an operating mine, multiple ownership issues (for land and mineral rights) must be resolved. Capital outlay to develop a small surface mine (1 to 4 million tons per year) can easily exceed \$100 million. An economic reserve would very likely exceed 10 sections (6,400 acres), involving multiple landowners. Below is an outline of the types of land and mineral ownership that would probably be encountered, and the estimated costs and benefits of each.

PRIVATE, FEE SIMPLE, DEEDED

Records for private land are maintained at the office of the county in which the land is located. Private land owners normally negotiate a fee for allowing the disturbance of the surface. Surface and mineral rights are often separate and owned by different entities. The negotiated fee for these rights varies, from outright purchase to paying royalties on tons of coal sold. Such lands initially fell into private ownership through the Homestead Act, or were purchased from the railroad or the federal government.

An example for a mine involving surface rights and subsurface (mineral) rights: A minable section of property would likely produce 20 to 30 million tons of coal. A surface royalty (alone, excluding mineral rights) of 2% of coal sales, at a market price of \$14 per ton, would yield 28 cents per ton. Production of 20 to 30 million tons would yield \$5.6 to \$8.4 million. An owner of the mineral rights would likely negotiate a royalty rate closer to 10–12%, closer to standard state and federal royalty rates. In this example the mineral rights royalty would yield \$28 to \$50.4 million.

NEW MEXICO STATE LAND

State lands include state trust land (sometimes referred to as school sections property, designated to generate funding for public schools), state parks, and state monuments. Records for state land are held at the New Mexico State Land Office in Santa Fe. Normally if the state owns the surface rights, they own the mineral rights as well. The state land com-

missioner is responsible for management of state trust lands, with the main objective being to maintain state land and generate funding for schools. A standard royalty for state lands has been set at 12.5% for surface and mineral rights and 8% for subsurface or mineral rights.

For example: A minable section of property would likely produce 20 to 30 million tons of coal. A surface and mineral rights royalty of 12.5% of coal sales at a market price of \$14.00 would yield \$1.75 per ton. Twenty to thirty million tons would produce \$35 to \$52 million in royalties for public school funding. A royalty for subsurface or mineral rights at 8% would produce \$22.4 to \$33.6 million in funding for public schools.

State lands are often leased to individuals for grazing on long-term leases. In this case, the surface leaseholder is often paid a royalty or set sum for the loss of their grazing rights. It is common for a leaseholder to be paid a royalty of 1%. At a rate of 1%, 20 to 30 million tons at a market price of \$14.00 per ton would produce \$2.8 to \$4.2 million in royalties.

UNITED STATES GOVERNMENT (FEDERAL)

Federal land includes U.S. Forest Service land (Department of Agriculture), and land administered by the National Park Service and the Bureau of Land Management (Department of the Interior). U.S. Forest Service and National Park Service lands are generally off limits to coal mining.

Records for federal land open to coal mining are held at the state Bureau of Land Management (BLM) office in Santa Fe. Royalties paid on BLM lands are similar to those paid for state lands. As in the case with state and private lands, the surface and mineral rights are often separate. Federal lands at one time had a straight royalty rate of 17.5 cents per ton, so the market value of coal did not factor into the royalty rate. Currently the royalties are paid based on the price of coal similar to state lands. The Secretary of the Interior must approve the leasing of BLM lands for coal mining. Approval of leases on BLM land requires more extensive comment and notification than leases on state or private land.

NATIVE AMERICAN LANDS

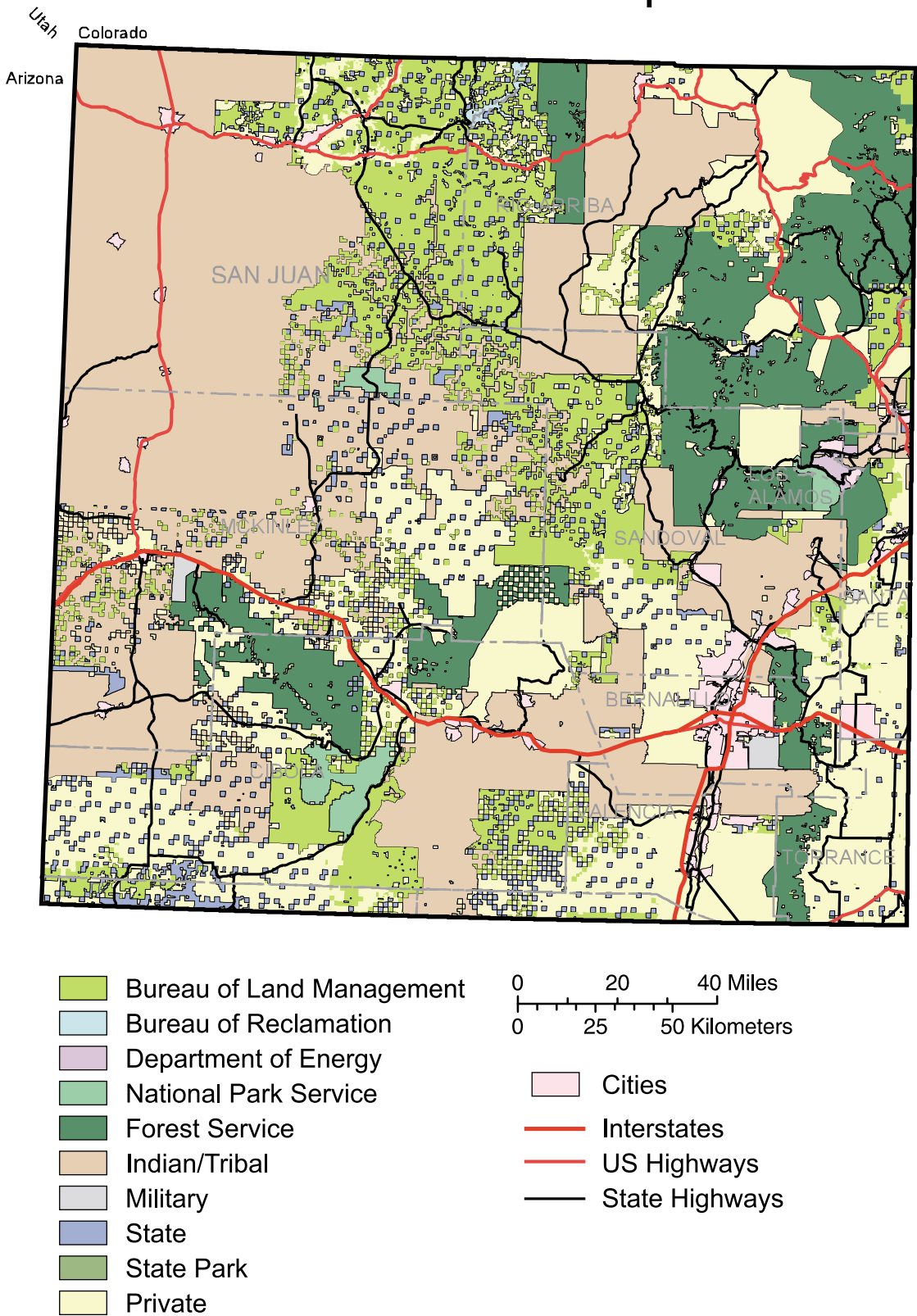
Native American lands include reservation land and allotted land. The Bureau of Indian Affairs maintains records for Native American land. Royalties paid on Native American land are usually similar to those paid on state and federal land. Allotted land is land that was deeded to individual Native Americans through the Homestead Act. Allotted Land is held in trust by the federal government. Allotted land is normally passed on to multiple heirs of the original owner. Approval by all owners is required before permitting for mining. It is often difficult to track down or contact all of the owners to obtain approval.

SPANISH LAND GRANT

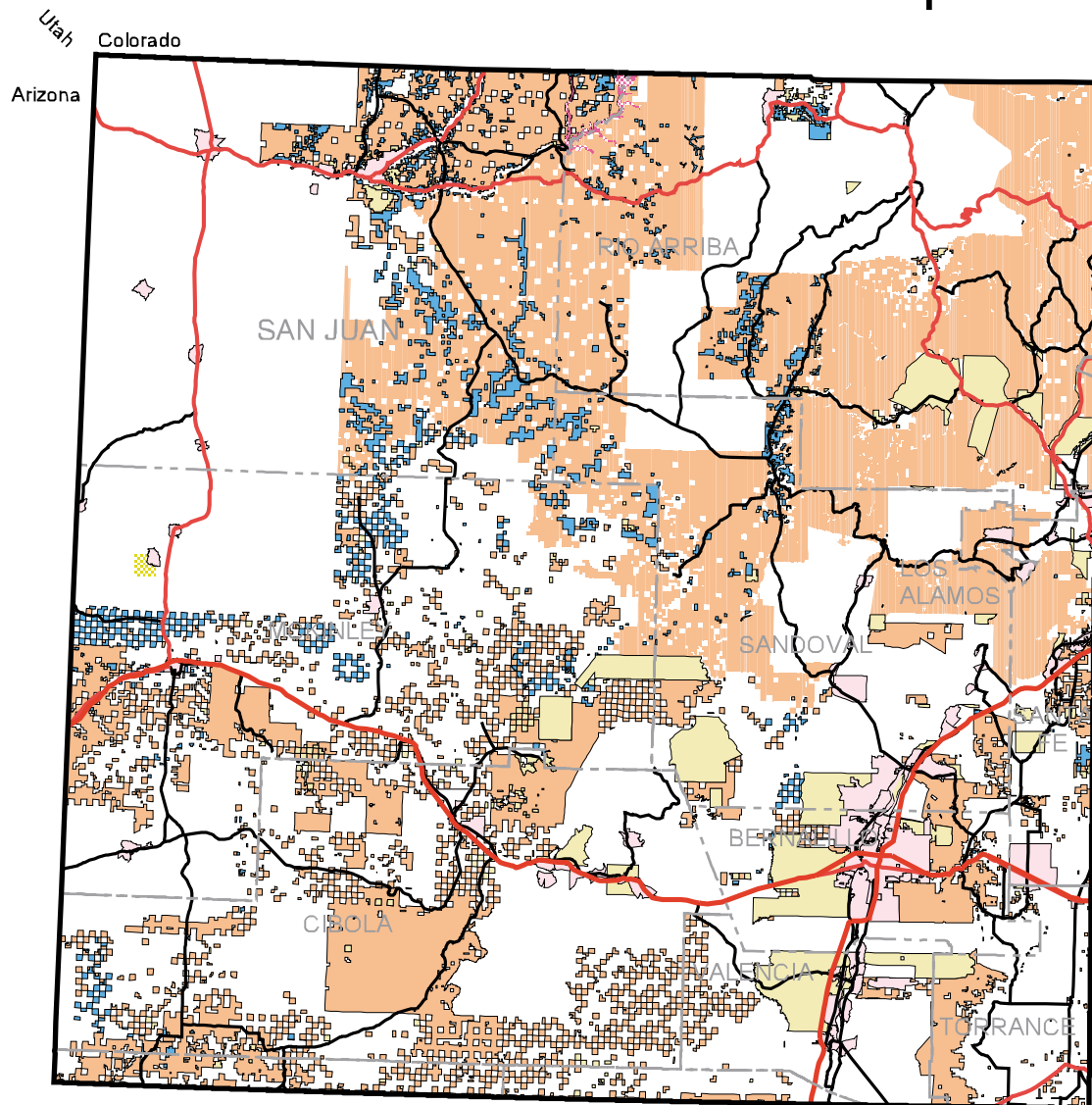
Spanish Land Grant property was granted to the original settlers from Spain when this part of the Southwest was Spanish Territory. Treaties between the United States and Spain maintained original grants after United States jurisdictional control of the territory. Ownership may vary from a community or shareholder corporation-type ownership to individual ownership. Ownership and controls are similar to those for private lands.

The checkerboard nature of land ownership in the San Juan Basin is the rule rather than the exception. It can be a major stumbling block to the development of resources, subsurface or otherwise.

Land Ownership



Federal Mineral Ownership



- All minerals
- Coal
- Other
- No minerals

0 20 40 Miles
0 25 50 Kilometers

- Cities
- Interstates
- US Highways
- State Highways

Coal and Coalbed Methane: Conflicting Development in the San Juan Basin

Bill Papich, *Bureau of Land Management*

The Bureau of Land Management's policy of maximizing resource recovery in an area of federal coal and natural gas mineral estates near Farmington has gas drillers and a mining company in a controversy neither anticipated. BHP Billiton, one of the largest mining companies in the world, has operated two open-pit coal mines (the San Juan and La Plata mines) since 1972, supplying fuel to the San Juan Generating Station. Thirty years later, both the San Juan and the La Plata mines are too deep for economical coal extraction. Plans for the future of these mining operations have changed in order to meet the ongoing needs of the San Juan Generating Station.

BHP Billiton initially made three proposals regarding how to meet future coal demands of the San Juan Generating Station. As the San Juan open-pit mine approached the depth of uneconomical coal recovery, BHP Billiton considered two other ways to supply the power plant. One was to transport coal from the company's open-pit Navajo mine on the south side of the San Juan River, which feeds the nearby Four Corners Power Plant. BHP Billiton has a long-term supply contract with Arizona Public Service Company, the operator of the Four Corners plant. The Navajo mine has so much coal available for economical pit mining that it could supply both power plants. The Navajo mine option, however, was scrapped because it included building a haul-road through a semi-residential area, a special management area for an endangered plant, and constructing bridges over the San Juan River and U.S. 64, a major four-lane highway through the area. The second option BHP Billiton considered was extending the La Plata mine northwards into Colorado. This would require a lease from the Southern Ute Tribe. The Utes declined to lease reservation land for coal mining.

The third option was to go underground at the San Juan open pit, and that is the option that was chosen. The San Juan mine is the company's first "longwall" mine in the San Juan Basin. (Longwall mining is a method of underground coal mining in which massive amounts of coal are produced.) "There are a lot of mines that never would have survived if it wasn't due to longwall mining," said Jack Kuzar, a district manager for the Denver office of Coal Mining Safety and

Health, part of the Mine Safety and Health Administration. "It's unreal what you can produce." The mine started last year and is expected to be at full production by late 2002, producing 13,500 tons of coal during every eight-hour shift.

BHP Billiton will go underground to devour and build roads through the coal seam with a machine known as a longwall shearer. A longwall shearer is a rotating drum with carbide teeth, moving back and forth along a coal seam like the carriage of a typewriter. The operators stand protected under a row of roof-supporting thick metal shields supported on 30-ton hydraulic jacks. Riding on skids, the shields are moved forward hydraulically as the machine chews through the coal seam. The roof behind the shield caves in. Longwall shearers grind away at coal seams in swaths hundreds of feet wide. The San Juan mine longwall operation will cut a face of coal 1,000 feet wide and 12 feet thick from top to bottom, for more than a mile into the seam. On this scale BHP Billiton plans to extract coal from approximately 10,000 acres of their mineral leases.

In the 1970s and 1980s the Bureau of Land Management leased the San Juan mine coal seam for both coal mining and natural gas production, a period during which BHP Billiton had not developed a plan for underground mining. During that same period, natural gas production companies had little interest in drilling the area. Methane gas production from coal seams did not take off until 1988–92, when the federal government began offering a tax credit of approximately \$1 per thousand cubic feet of coal seam gas, but only for wells drilled during that period. The tax credit was intended to encourage industry to develop unconventional sources of gas, increasing the nation's natural gas reserves. Before the tax credit, coalbed methane production in the San Juan Basin was a drop in the bucket compared to the basin's total production of natural gas. But since that time, things have changed a great deal. During the first quarter of 2001, coalbed methane production accounted for approximately half of the basin's natural gas production.

The conflict lies in the fact that methods used to extract these two important resources are not neces-

sarily compatible. BHP Billiton is concerned that if the coal seam is drilled for natural gas extraction, it will make underground mining too risky, due to cave-ins and, possibly, spontaneous combustion. Two natural gas production companies, Dugan Production Corporation of Farmington and Richardson Operating Company of Denver, have federal mineral leases that give them the right to produce gas from the coal seam. Richardson currently is drilling coalbed methane wells into the same coal seam to be mined. Dugan Production also has drilled several wells into the coal.

The drilling companies want to produce all the gas possible from their leases. A coalbed methane well can produce gas for 20–30 years. BHP Billiton telling the natural gas producers that drilling operations must be cut short does not sit well with the producers. In some areas of the coal seam, gas production would be possible for only 5–10 years before the underground

mine reaches the area being drilled for coalbed methane. The natural gas producers have talked about compensation if they are not allowed to produce all the gas possible from the coal seam. Plans for the underground longwall mine cannot be derailed if the power plant is going to continue to operate. The San Juan Generating Station, operated by Public Service Company of New Mexico and one of the largest in the United States, needs the coal, and San Juan County needs the high-paying jobs.

Underground mining began last year from an open-pit mine at a depth of 300 feet, where a 15- to 20-foot-thick coal seam slants downward at an angle of 3 degrees. The mine will stay inside the seam, leaving considerable coal for a sturdy roof and floor. After 17 years—the length of BHP Billiton's current power plant supply contract with PNM—the mine will be more than 1,000 feet deep.

Gas drillers use various means of cracking coal to increase gas flow through it. BHP Billiton says its technological studies indicate that the integrity of the mine's roof of several feet of coal will be threatened from fracturing operations of the drilling companies. Mine officials say that dewatering and degassing of the coal ahead of mining would make the mine more susceptible to spontaneous combustion. An additional safety concern the mining company has encountered is the existence of drilling pipe and well casings within the coal seam, which could set off sparks if the underground mining equipment hits them. The natural gas producers have leases to drill through the coal seam to deeper oil and gas producing formations below the coal formation.

The Bureau of Land Management (BLM) is charged with ensuring maximum recovery of natural resources from federal mineral leases on BLM land—and that includes maximum recovery of both gas and coal. The safety of miners, however, overrides energy production. In a meeting last year (2001) between BHP Billiton, gas drillers, and the BLM, Lee Otteni, the BLM Farmington field office manager, said: "I'm not going to risk a miner's life by trying to maximize production of coal and gas coming out of the same coal seam."

BHP Billiton's mining leases do not take precedence over natural gas drilling leases in this instance. If they did, the leases would give custody of the gas to the mining company, which could vent the gas so that it wouldn't interfere with mining operations. The U.S. Department of Interior Board of Land Appeals, however, has ruled that whoever has the oil and gas lease

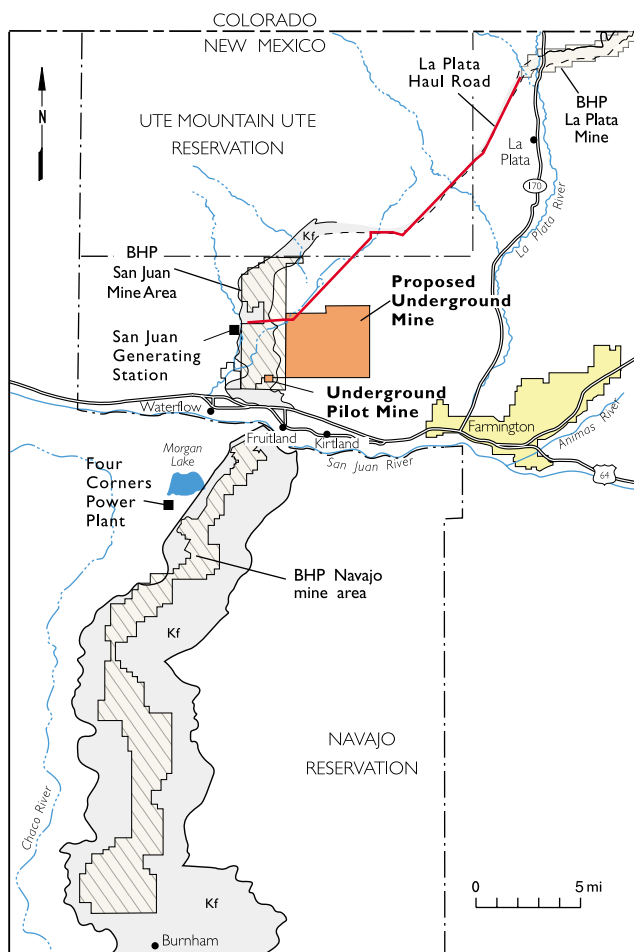


FIGURE 1 San Juan County's Fruitland Formation coal mines.

has the right to extract the coal seam gas. The BLM has provided technical information on the coal seam to BHP Billiton and the gas producers, to supplement their own information. The BLM has also hosted meetings between companies to encourage settlement negotiations. “The BLM has attempted to get all parties involved to come to some sort of protocol agreement that would lead to a resolution of the conflict,” said Shannon Hoefeler, a mining engineer at the BLM’s Farmington field office. “What BHP wants is a negotiated settlement based on sound technical and economic data.”

A Rational Approach to Solving Energy-Related Conflicts—Communication by the Jar-full

Dr. John Bartlit, *New Mexico Citizens for Clean Air & Water*

In 1998 the environmental activist-turned-governor of Oregon, Gov. John Kitzhaber, spoke to a gathering in Phoenix of some 350 ranchers, miners, farmers, and a wide mix of officials, industry folks, environmentalists, and western governors. At the end, all of us rose to our feet as one in applause. The talk's stirring finale came from Wallace Stegner's *The Sound of Mountain Water*. Those words hit home with equal force today:

"...One cannot be pessimistic about the West. This is the native home of hope. When it finally learns that cooperation, not rugged individualism, is the quality that most characterizes and preserves it, then it will have achieved itself and outlived its origins. Then it has a chance to create a society to match its scenery."

Yet such words are all too seldom heard in the field of battle. My 33 years of activism have convinced me that the use of information in public issues has more in common with a skyjacker's single-mindedness than with the shedding of light.

How can the game of advocacy be played better in the field? I do not mean played better against some yardstick of idealism; I mean done better to achieve one's goals. As Gov. Kitzhaber and Stegner preach, I, too, believe a fresh approach can help all sides get more of what they really want, and get it faster, than will more of the current methods.

For 31 years my columns have appeared in the Los Alamos Monitor every other Sunday. Many of them work on the puzzle: Can a different approach gain more for your side than the timeworn schemes? If so, how? To reply, this essay builds on my Sunday morning pieces, which are more fun than the usual harangues in public battles (however faint this praise may be). In the Albuquerque Journal, September 2, 2001, I wrote:

The Land of Enchantment harbors immense beds of coal—left by the watery reaches that settled here for some time eons ago. The result is energy companies today cast longing looks in our direction. "Power plant" fills their mind's eye like a youngster's dreams of a shiny new bike. Last

spring's power scramble in California adds hopes of getting the speedy red one with winking lights on the pedals.

How people take to this news is as varied as T-shirt mottoes. Some whoop for joy; some curse the errant waters. No matter which tune you might pick, I suggest a more equable course—one that provides news with enough perspective to yield understanding. This approach is not the usual one seen in public issues. The common way is to show a jar half full of facts—handpicked shards of the whole picture—with no background to judge against, so most of the story is hidden from view.

If I made all the rules—an idea found on no one's agenda—I would add one new rule to the long legal process of building a coal-fired power plant in New Mexico. The rule is simple, runs as swiftly as companies choose to move, and costs near nothing in the process.

My rule would require that the public be informed fairly about the plant before it is all designed. I mean, told a fair sample of the whole story: What the plant does, how it works in plain terms, the air pollutants it emits, the range of choices for their control and how well each works, the cost of each choice, and its effect on consumer bills.

Perspective is a must: A useful means is to compare the emissions, say, with those of a natural gas-fired plant, an advanced-cycle plant, and the current emissions in the area. Then the water needs of a plant can be told and put in a fair perspective. The range of technologies to reduce water use can be explained, together with the cost of each choice and its impact on a monthly electric bill.

We often hear of the local jobs created in the building and running of a power plant. Fairness gives the same praise to the added jobs, and the economic boost, from the hundreds of workers it takes to build and run modern pollution controls.

My rule amounts to no more than a call for truth in advertising. Who would fuss? It is a fair turn: a new link to the classic core of democracy—

an informed citizenry. Don't get me wrong. My idea is not to set a trap. I do not suggest a company has to put itself in the worst possible light. I am talking here about the real options available for a new coal plant: the ones known to any chief engineer worth his salt as a plant designer, the ones the engineers would consider anyway when planning a plant. The energy companies can send this knowledge to the public with the greatest of ease.

The information is already there and, in the course of things, many ads no doubt are planned. All that is needed is to put the knowledge in the ads. Ads also can send people to a company's web site that can tell more details. I see no good reason this thought should feel as unnatural as it does. The move can only build the public's trust in a power company's skill and candor—a trust modern companies prize highly and seek to gain. What is more, I suggest the move would get a company further ahead quicker than a host of the usual means used to pursue trust....

Elsewhere I go further into the failings of public communications in matters of debate. One such piece was a column done with coal people—or, as one might say, in strange company. The credits read: "This and subsequent columns express the combined views of the American Lung Association of Arizona and New Mexico, Arizona Public Service Company at the Four Corners Power Plant, Land and Water Fund of the Rockies, New Mexico Citizens for Clean Air & Water, and Public Service Company of New Mexico at the San Juan Generating Station." The piece focused on coal, but the principles go to any energy-related conflict, and even beyond. In the *Los Alamos Monitor*, July 22, 2001, I wrote:

We (who sponsor this column) all are concerned with issues about coal and its use for power production. The vital public debate about coal issues may strike you the same way it does us—awfully lumpy.

Here is the scene: Half a story comes from the "coal" side and another half from the "green" side. The two halves sound so different that we all figure somebody must be lying. So we pick our favorite team to believe—either coal or green—and trash everything the other one says. The result: Almost nobody can piece together enough of the whole story to make up his own mind.

In our great nation, too many issues seem to

go this way. Yet, far more times than not, what both sides say is true. The two sides just tell different parts of the whole story and say things so people will think the other guy is a liar or a crook, or both. This custom is in part human nature and in part the "American Way."

The problem is made worse by another part of human nature. By nature, news about lies, crooks, and conflicts rouses heightened interest. Or as Mark Twain once said: "A lie can travel half way around the world while the truth is putting on its shoes."

We, the five sponsors of this column, think a clearer story can be told—a story clear enough for the issues to be understood by all and decided by all who are concerned. Beginning with this column, and with others to follow, we set ourselves on this path: We will agree most of the time. At times, we may agree up to a point and then disagree on some aspect. We may disagree because we have different values, or because we draw different conclusions from the shared information, or because too little is known. When we disagree, we will say why we do, so you can judge things your own way....

The story of conflict has other sides, with other angles: Human instinct always shouts to tell us we will get the most of what we want by fighting the other guys about everything. The instinct may be right, but only if time doesn't matter. Fighting takes time. And much more than the time for the fight. There is also the time, cost, and paperwork to work through the enormously elaborate systems society puts in place to keep the battle civil.

Time matters to both sides. Environmentalists want dirty plants cleaned up and even better new kinds of plants. Yet it typically takes decades to get done what could be done in years. Industry wants permits so it can operate. Yet it can take years, or many months, to accomplish what could be done in months or days. The result of fighting about everything is ever the same: the price of distrust is bureaucracy.

The same message comes through again in permitting: Industry wants faster permitting, whereas environmentalists want better compliance with the air and water rules. The two needs affect each other.

Any New Mexico project that might emit air pollutants must get permits from the Air Quality Bureau before being built or operated. Within the limits of the law, the permits set down detailed project requirements, such as the maximum emission rates by pollutant type, kinds of emission controls, operating times,

monitors to be used, reports to be filed, and on and on. A typical construction permit is 16 pages long and takes about three months to get.

If a permit is granted, the project goes ahead. The operating plant then is inspected by the bureau, at some interval, to check that all permit conditions are being met. If they are not met, enforcement actions may follow. The bureau's present staff can make perhaps 250 inspections per year and check on 100 performance tests. There are 2,000 permitted projects in New Mexico, ranging in complexity from a heating unit to an oil refinery, and new and revised permits come at a rate of about 300 per year. You begin to see the challenge of ensuring compliance.

More bureau resources could go either into preparing permits, with their detailed conditions, into inspecting the projects, or into enforcing the permits in case of violations, but not all three. The resources are fixed; what goes one place cannot go to the others. Yet each one takes time, skill, and people (that is, money) to do it right.

The interests of industry and clean-air backers are not all as different as you may think. To be sure, no company likes to have rules enforced against it. But neither does any good-guy company like a bad-guy competitor to escape the rules the good guys meet; that's not fair play. For reasons as different as hats, a wide range of interests gains something from more uniform compliance.

Likewise, all sides gain from rules that are simpler in form (but not laxer), so they are better understood and enforced uniformly. In sum, the prize for everyone is to get swifter and truer permitting and compliance, thus cutting emissions through fewer violations and cleaner equipment or both, all for the same bureau dollars. Not a bad thought.

In the grand scheme of things, regulation won't work well for your side if it doesn't work well all around. The same holds true for public communication. The old use of the jar half full of facts—the handpicked shards of the whole picture—will not gain the most of what you want in the shortest amount of time. It will but leave easy targets for the opposition and soak up time and money in the fight.

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Norman Gaume has served as director of the New Mexico Interstate Stream Commission, New Mexico's water planning and development agency, since 1997. The Commission's responsibilities include investigation, development, conservation, and protection of New Mexico's water resources and stream systems; interstate stream compacts administration; resolution of interstate and federal water resources issues affecting state water resources; and management of New Mexico's regional water planning program. Previously, Mr. Gaume managed the city of Albuquerque's Water Resources Division from its creation in 1990 until 1997. Mr. Gaume is a New Mexico native and a registered professional engineer. He has a B.S. in electrical engineering and an M.S. in civil engineering from New Mexico State University.

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Pat Goodman has spent most of his career working in power plants; he has served more than 29 years at Public Service Company of New Mexico (PNM). As vice president of generation, construction, and operations, Goodman is responsible for the operation of all of PNM's power plants and also oversees the construction of its new facilities. As a part of these duties, he also directs the work of PNM's environmental services group. Pat graduated from the University of New Mexico with a degree in electrical engineering.

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Laird Graeser is currently a Fulbright scholar lecturing on tax policy and public administration at Urals State Technical University, Ekaterinburg, Russian Federation and other universities in the Urals area of Russia. From December 1986 to September 2001, he was chief economist for the New Mexico Taxation and Revenue Department, specializing in revenue estimating and tax policy development and analysis.

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Grant Hammer has worked at the Lybrook facility since 1995. He and his staff are responsible for the up-keep, accuracy, and efficiency of all process controls, rotating equipment, and emergency systems. They also operate the facility, load trucks, and do administrative paper work, and they are required to be in strict compliance with all regulatory agencies and programs such as O.S.H.A., D.O.T., and the Williams System Integrity Plan.

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Jim Hannan currently serves as the chair of the Rio Grande Chapter, Sierra Club. The chapter represents the entire state of New Mexico and El Paso, Texas. In New Mexico the club is an active participant in legislative and regulatory issues affecting the environment, including mining, energy, and water. Jim, a CPA, works at the Santa Fe Community Housing Trust, a nonprofit affordable housing provider. He has been active in the Santa Fe Area Homebuilders Association Green Building Committee, working on issues of energy efficiency, indoor air quality, and water conservation.

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Steve Henke has worked for the Bureau of Land Management (BLM) since 1976 as a range conservationist, branch chief, assistant district manager, and field office manager. From 1998 to 2001 Henke was executive director and BLM's regional coordinator for Southwest strategy in Arizona and New Mexico. He is the author of the Rio Puerco Watershed Act. Henke has a B.S. in range science from New Mexico State University.

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Mark Hiles has worked as an environmental professional in the uranium industry (for 14 years) and in the coal industry (for 10 years). He served for 8 years as environmental systems manager for Lee Ranch Coal Company, and 7 years as coal subcommittee chairman for the New Mexico Mining Association. Mark has a B.S. in agriculture from New Mexico State University.

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Gretchen Hoffman has been a coal geologist at the New Mexico Bureau of Geology and Mineral Resources for 21 years. Her work experience includes field mapping in west-central New Mexico, running a drilling program for a 3-year coal quality evaluation study in the San Juan Basin, and many coal resource evaluation studies, primarily in the San Juan Basin. Gretchen is the New Mexico Bureau of Geology's representative on the Coal Surface Mining Commission. Her other research interests include industrial minerals associated with coal, such as humates, clinker, and fly ash. She received her B.A. from Adams State College and M.S. from the University of Arizona.

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Russell Huffman is plant manager of the 1,800 megawatt San Juan Generating Station near Waterflow, New Mexico. The station is an ISO-14001 certified facility and is a charter member of the federal Environmental Protection Agency's Environmental Performance Track Program. Russell has been with PNM since 1979 and has held a variety of positions at San Juan, which is the seventh-largest coal-fired generating station in the western United States. He is a member of the Generation Council and the Target Advisors Group of the Electric Power Research Institute.

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Bob Jenks has worked for the State Land Office since 1993 when he was appointed assistant commissioner. In that capacity he has the opportunity to advance natural and cultural resource conservation on state trust land through policy development and program implementation. His responsibilities include working with the exceptional professional staff at the State Land Office to further its natural resource management, environmental reclamation, archaeological, and technology development programs in pursuit of the agency's mandate of providing financial support for education in New Mexico. He also administers its agricultural leasing, rights-of-way, and records management programs. Before joining the State Land Office, Mr. Jenks worked for the Department of Game and Fish as a conservation officer, biologist, project manager, and assistant chief for their Habitat Environment and Lands. He is a graduate of New Mexico State University with bachelor's and master's degrees in wildlife science.

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Robert Lee is director of the Petroleum Recovery Research Center (PRRC) and part-time associate professor in the petroleum and chemical engineering department where he was a full-time professor before his appointment to the PRRC and department chair from September 1994 through 1997. Since 1999 he has served as New Mexico Oil Conservation Commissioner and was last year's recipient of the New Mexico Oil and Gas Association's Pete Porter Award. Dr. Lee's specialty lies in the study of natural gas, and his research interests center on studying problems associated with water coning, produced water purification, hydrates, stress-dependent permeability, and high-velocity gas flow. He is co-author of the book *Natural Gas Engineering: Production and Storage*. He is program chair for the Roswell section of the Society of Petroleum Engineers and is a member of AIChE. Lee earned M.S. and Ph.D. degrees in chemical engineering from Oregon State University and the University of Michigan, respectively.

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Dave has been an environmental geologist at the New Mexico Bureau of Geology and Mineral Resources since 1980. His work has focused on a great variety of topics, including: impacts of surface and subsurface mining; shrinking, swelling, collapsing, and corrosive soils; behavior of arroyos; geology of archaeological sites; movement of contaminants in the shallow subsurface; faulting, earthquakes, and earthquake education. He has been involved in geology outreach for teachers and students, has worked as a geologist for Southwest Institute, as a sabbatical replacement at Washington State University (1976-1978), and as a seasonal interpreter for the National Park Service. Dave holds a B.S. from Beloit College (anthropology and geology), and an M.S. and a Ph.D. in geology from the University of New Mexico.

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Lynda M. Lovejoy was elected to a four-year term as commissioner of the newly created New Mexico Public Regulation Commission in 1999 and served as chairwoman of the commission from January to December 1999. Her previous work experience includes: 1) serving as (acting) executive director of the Navajo Skill Center located in Crownpoint, which is now known as Crownpoint Institute of Technology and is the first vocational-technical training institute of the Navajo Nation; and 2) serving as executive staff assistant to the Navajo Nation president with responsibility for coordinating issues and projects with federal, state, and local entities. Lynda is an enrolled member of the Navajo Nation. Lynda has a bachelor's degree in public administration from Northern Arizona University and an associate of arts degree in elementary education from the University of New Mexico branch campus.

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Amory Lovins, a MacArthur fellow and consultant physicist, has advised the energy and other industries for nearly three decades as well as the Departments of Energy and Defense. Lovins has published in 27 books and hundreds of papers; his work, often with co-CEO L. Hunter Lovins, has been recognized by the "Alternative Nobel"; Onassis, Nissan, Shingo, and Mitchell Prizes; the Hapgood Medal; and the Heinz, Lindbergh, Hero for the Planet, and World Technology Awards. The Lovinses founded and lead Rocky Mountain Institute (www.rmi.org), an independent, market-oriented, nonprofit applied research center, which spun off E SOURCE (www.esource.com) in 1992 and in 1999 Hypercar, Inc. (www.hypercar.com), which Amory Lovins chairs.

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Benjamin P. Luce is a physicist with Los Alamos National Laboratory and president of the New Mexico Solar Energy Association, an educational nonprofit organization. He is co-chair of the Coalition for Clean Affordable Energy, a policy-oriented nonprofit organization. Subsequent to completing a postdoctoral appointment at Los Alamos National Laboratory Luce remained in the Theoretical Division (T-7). His work at Los Alamos has been in the dynamics of nonlinear partial differential equations, with applications to nonlinear fiber optical pulse propagation, ocean circulation, microwave heating, and bioremediation. Since 1997 he has also conducted research on renewable energy, carbon sequestration, and alternative fuel synthesis. Luce received his Ph.D. in physics from Clarkson University in 1993.

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Jim Luther is currently the environmental manager for BHP Billiton, San Juan Coal Company, which includes La Plata and San Juan mines. He has been employed with BHP Billiton for 6 years. His previous employment includes 13 years as an environmental consultant for the mining industry and 5 years with the Wyoming Department of Environmental Quality (DEQ), Land Quality Division. Jim ultimately became the program manager at DEQ and was in charge of all coal and large non-coal mine permitting. Jim has 24 years experience in the mining environmental field. Jim graduated from the University of Wyoming with a bachelor of science in range management in 1978.

Martinez, Louise

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Louise Martinez currently serves as bureau chief of the Energy Efficiency Programs Bureau in the Energy Conservation and Management Division of the New Mexico Energy, Minerals and Natural Resources Department. Ms. Martinez has served as program manager for transportation programs, including infrastructure development and alternative transportation, state coordinator for Clean Cities projects, the Institutional Conservation Program, and Small Schools Program and served as the department contract officer for several years. Ms. Martinez's work experience includes over twenty years in state government mainly in governmental accounting, contracts, and project management. Her areas of expertise include procurement, project monitoring, and state and federal regulations.

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Ginger is a senior economic geologist with the New Mexico Bureau of Geology and Mineral Resources. She began work with the bureau in 1980 as a minerals geologist specializing in uranium deposits. She has published over 150 articles on the metallic mineral resources of New Mexico, including best-selling maps of the gold and silver deposits of New Mexico. Her descriptions of the geology of New Mexico's state parks have become a regular feature in *New Mexico Geology*. Ginger is an energetic researcher in the field of alkaline magmatism, carbonatites, anorthosites, and A-type granites. Recently she was elected as an editor for the American Institute of Professional Geologists. She also was elected chairman of the steering committee for the Acid Drainage Technology Initiative group, which conducts research and disseminates technologies on acid drainage. She holds B.S. and M.S. degrees in geology from New Mexico Tech and received her Ph.D. in geoscience from the University of Texas at El Paso in 1993.

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On May 1, 2001, Rory McMinn was appointed to fill a vacancy on the Public Regulation Commission representing District 2. New Mexico's voters mandated the creation of the Public Regulation Commission by merging the former Public Utility Commission and the State Corporation Commission. Commissioner McMinn is the first commissioner who was not a member of either of the two preceding agencies. District 2 includes approximately the eastern third of the state. McMinn served two consecutive terms on the Chaves County Board of Commissioners. He has been very active in community and business affairs within Roswell and New Mexico since returning to the state in 1986. He has spent most of his career in oil and gas exploration; oil, gas, and refined product transportation infrastructure construction; telecommunications infrastructure build-out; and specialty metal fabrication and manufacturing. Commissioner McMinn was educated in the Roswell, New Mexico, and Midland, Texas, public school systems and graduated from West Texas State University (now West Texas A & M) with a B.B.A.

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Dave Melton is president of Diversified Systems Manufacturing (DSM), a renewable and distributive energy consulting firm, located in Albuquerque, and he is co-owner of Sacred Power Corporation, a renewable energy manufacturing and installation firm. DSM was created in 1997 to assist the Pueblo of Laguna in its pursuit of diversification of business ventures into the renewable and energy efficiency industry. Mr. Melton was elected vice-chair of the newly created Rebuild Central New Mexico, the local energy efficiency support organization sponsored by the U.S. Department of Energy. Mr. Melton has also been appointed to the Pueblo of Laguna Utility Authority Board representing his home village of Pagate. In addition, Mr. Melton is a member of the New Mexico Solar Industry Association, the New Mexico Solar Energy Association, and the Interagency Advanced Power Group. Mr. Melton is an enrolled member of the Pueblo of Laguna. He received his B.A. in economics from the University of New Mexico and has over 30 hours of graduate study from UNM's School of Public Administration.

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Jim has lived in New Mexico since 1981. Before state service he worked in cultural resource management and conducted archaeological investigations throughout New Mexico. Between 1985 and 1994 he worked for the Historic Preservation Division, Office of Cultural Affairs on archaeological and historic preservation issues statewide. In 1994 Jim moved to the Mining and Minerals Division, Coal Reclamation Program, and he has been program manager since 1998. Jim has an M.A. in anthropology from the University of New Mexico.

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William C. Olson is a hydrologist with the New Mexico Oil Conservation Division in Santa Fe, where he is responsible for the investigation and remediation of oil field related ground-water contamination. He received his B.S. in geology and M.S. in hydrology from the New Mexico Institute of Mining and Technology.

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Bill Papich is a former newspaper reporter, television reporter, and freelance writer who last year began working as the community relations specialist for the Farmington Field Office of the Bureau of Land Management.

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John moved to New Mexico in 1981 and has worked for a number of private and government organizations whose focus is the management and protection of natural resources. John presently is a program manager for the Mining and Minerals Division and is responsible for the development of several publications relating to New Mexico's extractive minerals industry. He attended the University of Wisconsin in Madison and graduated with degrees in geology and history.

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Greer currently directs the publications program at the bureau. His experience includes seven years as a geologist working in the oil patch, ten years with the National Park Service, and four years as managing editor at Grand Canyon Association. His career has involved teaching, writing, and field work throughout North America. He is a member of the Geological Society of America and serves on the board of directors of the Publishers Association of the West. He holds a B.A. and an M.A. in geology from Washington University in St. Louis.

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James Ray has worked for Public Service Company of New Mexico (PNM) for 20 years. His work experience includes many years in human resources and labor relations. In the last 7 years, James has managed the administrative support departments for the generating facilities within PNM. These departments include safety, employee training, human resources, procurement, warehousing, accounting, and business IS systems. James received his B.B.A. in management from New Mexico State University.

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Paul Saavedra joined the Water Rights Division of the Office of the State Engineer (OSE) in 1988. He reviews and processes water-rights applications and supervises the administration of water rights throughout the state, and he acts as an expert witness in water-rights administrative and court hearings. Between 1978 and 1988 Paul worked in OSE's Design and Construction Section reviewing the plans and construction of dams and ditches, inspecting dams throughout the state, coordinating the rehabilitation of ditches, and assessing flood damage to water facilities. Paul received a bachelor of science in civil engineering in 1978 from the University of New Mexico.

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Mr. Sardella co-founded the Southwest Energy Institute in 1998 to research and promote policies that encourage investment and growth in micropower technologies. As a director of the institute, he has advised governmental and private organizations on energy policy matters, including the New Mexico Legislature, Public Regulation Commission, and State Energy Office, as well as the Santa Fe Board of County Commissioners and city council, and the New Mexico Solar Energy Industries Association. Mr. Sardella maintains an engineering practice in Santa Fe. Working under a joint program of the New Mexico Energy Office and the U.S. Department of Energy, he presently advises local businesses on energy conservation,

energy performance contracting, and on-site generation. He also serves on the IEEE Standards Coordinating Committee, which is developing a uniform standard for interconnecting micropower equipment to the electrical grid. He has designed and installed many on-site power systems for stand-alone and grid-interactive applications, including the largest NEC compliant photovoltaic power system in New Mexico. Mr. Sardella earned a bachelor's degree in mechanical engineering from Virginia Polytechnic Institute and State University in 1984.

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Patrick Scharff has been with Public Service Company of New Mexico (PNM) since 1996 where, in addition to managing PNM's distribution planning department, he has been responsible for all customer generation programs including net metering. He had PNM's lead technical responsibility for participating in the crafting of New Mexico's net metering rule. Before joining PNM Patrick was with Tucson Electric Power (TEP) where he managed the system operations and distribution services departments and created and managed TEP's energy conservation and load management department. Scharff received a B.S. and an M.S. in electrical engineering (1973) and an electrical engineering electric utility management degree (1974) from New Mexico State University.

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Peter Scholle has had a rich and diverse career in geology: 9 years with the U.S. Geological Survey, 4 years directly employed by oil companies (plus many additional years of petroleum consulting), 17 years of teaching at two universities, and now a career in state government at the New Mexico Bureau of Geology and Mineral Resources. His main areas of specialization are carbonate sedimentology and diagenesis as well as exploration for hydrocarbons in carbonate rocks throughout the world. He has worked on projects in nearly 20 countries, with major recent efforts in Greenland, New Zealand, Greece, Qatar, and the Danish and Norwegian areas of the North Sea. A major focus of his studies dealt with understanding the problems of deposition and diagenesis of chalks, a unique group of carbonate rocks that took on great interest after giant oil and gas discoveries in the North Sea. His career has also concentrated on synthesis of sedimentologic knowledge with the publication of several books on carbonate and clastic depositional models and petrographic fabrics. His wife and he have published many CD-ROMs for geology, oceanography, and environmental science instructors, and they currently are developing computer-based instructional modules and expert systems in carbonate petrography. Peter Scholle received a B.S. in geology in 1965 from Yale University. He continued his studies at the University of Munich on Fulbright/DAAD Fellowships and at the University of Texas at Austin. Scholle received M.S. and Ph.D. degrees in geology in 1969 and 1970 from Princeton University.

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Dipen Sinha has worked at Los Alamos National Laboratory since 1980. Sinha is presently leader of the ultrasonics applications team. His current interests are in the following areas: 1) ultrasonic-resonance-based material (fluid) characterization; 2) nondestructive characterization and evaluation of materials; 3) ultrasonics based sensors for a variety of applications; 4) biomedical instrumentation, sensors, and techniques; and 5) novel ultrasonic imaging technique for biomedical and geological applications. Sinha has been granted 12 patents and has six pending. He has over 60 publications in refereed journals on low-temperature physics, nondestructive testing, solid state physics, and instrumentation, and he is senior editor of *Handbook of Elastic Properties of Solids, Liquids, and Gases*, Volume IV, Academic Press (2001). Dipen Sinha received a B.Sc. degree in physics in 1970 from St. Xavier's College, Ranchi, India. He earned an M.Sc. degree in physics and a post-graduate diploma in industrial physics from the Indian Institute of Technology, Kharagpur, India, in 1972 and 1973. Sinha received a Ph.D. in physics from Portland State University, Oregon, in 1980.

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Wendy Soll's technical focus is in ground-water hydrology. Dr. Soll is involved in program development for energy and sustainable systems at the laboratory. Wendy is active in community outreach and education, and she is an associate editor of *Water Resources Research*. Wendy Soll has a B.S.E. degree in mechanical engineering from Princeton University and an M.S.M.E. in mechanical engineering and a Sc.D. in civil engineering from the Massachusetts Institute of Technology. She also received an M.B.A. from the University of New Mexico.

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Bill Standley came to Farmington in 1989 by way of Santa Barbara, California. In his 12 years of living in Farmington Bill has been actively involved in the community. Having retired after 31 years with Sears Roebuck & Company, Bill accepted the position of advertising director with the Farmington Daily Times. Bill was then hired as the general manager for Construction Supply Company, remaining there until he decided to run for public office. He was elected to the office of mayor in March 1998. He currently serves as Treasurer on the New Mexico Municipal League Board. He has also been appointed to the Community and Economic Development Steering Committee and the Information Technology and Communications Policy Committee for the National League of Cities. Bill was named the "Man of the Year" in 2000 at the Four Corners Conference for Professional Development in Farmington, and more recently he received the "Citizen of the Year" Award for 2001 from the Farmington Chamber of Commerce. Bill is a graduate from Stockton College.

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William J. Stone has 30 years of academic, industrial, and government-agency experience in various aspects of hydrology. This has included positions with the New Mexico Bureau of Mines and Mineral Resources, Newmont Gold Company, and the New Mexico Environment Department. He is currently hydrology task leader for the regional well program at Los Alamos National Laboratory. His research interests include geologic controls of hydrologic phenomena and the hydrologic cycle in arid lands. Dr. Stone is the author of many professional papers and the book *Hydrogeology in Practice—a Guide to Characterizing Ground-Water Systems*. William Stone holds B.S., M.S., and Ph.D. degrees in geology.

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Ken Stroh has worked as a mechanical engineer for nearly 25 years at Los Alamos National Laboratory on energy systems design, analysis, and testing, focusing in the last few years on fuel cells. Ken ventured outside the laboratory in 1982–84, as the supervisor for nuclear fuel and analysis at the Fort St. Vrain Nuclear Generating Station, a high-temperature gas-cooled reactor owned and operated by Public Service Company of Colorado. He currently works in the Energy and Sustainable Systems Program office at Los Alamos, and he manages the laboratory's research and development programs on fuel cells, hydrogen, and transportation technologies. He is the Department of Energy's Hydrogen Program laboratory technical management team leader for hydrogen utilization core R&D and for renewable/hydrogen energy systems technical validation nationwide. He is also a member of the fuel cell tech team for the government/industry partnership for a new generation of vehicles. Ken received B.S., M.S., and Ph.D. degrees from Colorado State University.

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In 1956 Frank hired on as a "ground-water geologist" with the U.S. Geological Survey in Albuquerque—he was fresh out of graduate school, Steve Reynolds was the new state engineer, and the '50's drought was in full swing. Since then he has taught hydrogeology and geology at New Mexico Tech; managed Environmental Impact Statement projects across the U.S. and Canada; been manager of hydrology on DOE's Uranium Mill Tailings Remedial Action Project; provided expert testimony on a half dozen Superfund hazardous-waste cases; been science advisor to State Engineer Tom Turney; been an instigator of, and active in, the Middle Rio Grande Water Assembly; and is now a senior outreach geologist/hydrologist with the New Mexico Bureau of Geology and Mineral Resources. He wants New Mexico to grow, but to keep looking like New Mexico—and

he is convinced that he's smarter about that now than when he first got here. Frank holds a Ph.D. in geology from the University of New Mexico.

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Arvin Trujillo is currently the chief of staff for President Kelsey A. Begaye of the Navajo Nation. Before this position, he was the executive director for the Navajo Division of Natural Resources. Mr. Trujillo has been in tribal government service since 1999. Before joining the Begaye/McKenzie administration, Mr. Trujillo was a mining engineer for Broken Hills Propriety, Inc. (BHP), in the Four Corners area and for Mobil Coal Producing, Inc., in the Powder River basin area in Wyoming. Mr. Trujillo did his undergraduate work in biochemistry at Oral Roberts University, and he did graduate work in mineral processing at Pennsylvania State University.

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