New Mexico Water Basics

and

An Introduction to Water Markets

The Business Water Task Force
2010

Introduction

New Mexico faces serious water issues. Understanding these issues is important for all interested parties. Problems aren't insurmountable. Solutions lie in protecting, conserving, augmenting and managing the state's limited water resources and in creative approaches to allocation.

Surface water is spoken for. In many places we're using groundwater faster than it can be replenished. And competition for water is increasing among cities, agriculture, industry, recreation, and environmental uses.

Until the mid-1990s, experts assured us we had plenty of water. Then, with new data, we began to understand the limits to our state's water resources and the challenges of sustaining current and future supplies.

Decision making about solutions and new alternatives requires a grasp of how the state administers water, how our water laws evolved, and even the basics of supplies, use and allocation.

"New Mexico Water Basics" offers information about New Mexico water and a discussion of the most pressing water issues – briefly and in familiar terms.

The first section, Background, summarizes such fundamentals as sources, uses and law. The second section, Issues, ranges from adjudication to Native American rights to endangered species. In these two sections, we take an objective approach. The third section, Water Markets, invites the reader to consider different ways to reallocate the water we have.

"New Mexico Water Basics" was prepared to inform public discussions, bring newcomers and new legislators up to speed, and serve as a handy reference. We hope you find it useful.

Business Water Task Force

Executive Summary

New Mexico must take control of its future.

Policy makers and planners need to accommodate the water needs of a growing population and still meet the state's legal obligations. Improved conservation, new sources, changes in use, different management roles and new kinds of water markets can meet demand, provide more options during drought and reward farmers for conservation.

This publication discusses these options and also provides the reader with the fundamentals of New Mexico's water history, use and laws.

New Mexico can look to other western states for ideas, but we can't just borrow their solutions. We have a long and unique history and cultural tradition rooted in the earliest community irrigation ditches of Pueblo Native American people and the Spanish colonists who arrived in 1598.

The present water code, established before statehood, embraced tribal uses and community acequias (ditches).

New Mexico law has five basic tenets:

- All the water in the state belongs to the public. Only those with water rights may legally use water, and those rights are considered private property.
- Older, or senior, water rights have priority. During dry years, senior rights holders would receive their full allotment of water, and junior owners' use would be curtailed, although this has rarely been invoked.
- Water must be put to "beneficial use," which generally means irrigation or domestic, commercial and industrial uses.
- Water-right holders can change the purpose of use or divert water from a different place if the State Engineer or a court determines it won't impair other water rights, harm public welfare, or run counter to water conservation.
- Owners can forfeit their water rights for non-use, under certain conditions, or for wasting water.

The water code didn't spell out who, exactly, owns water rights and in what quantity. The state has in some areas pursued adjudication – a lengthy and expensive legal determination of who owns water rights, what amount they're entitled to use, and where that right stands in the pecking order of priority use.

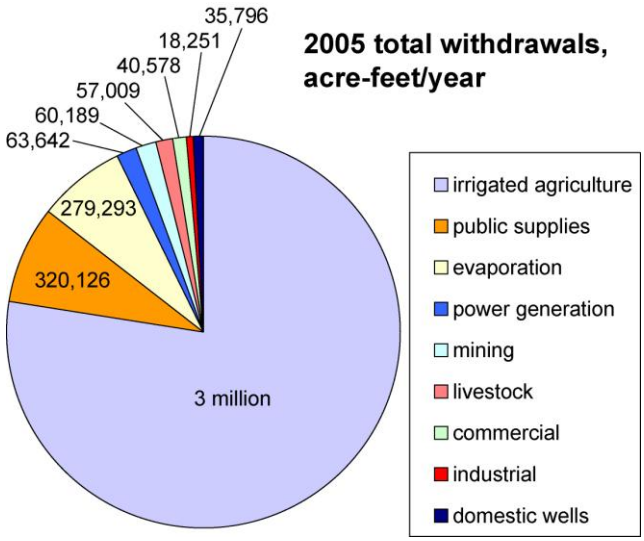
The State Engineer's Office estimates that some 65,000 New Mexicans who have claims to water rights will become defendants in adjudication lawsuits brought by the state and that it will take 15 years, and many millions of dollars, to complete. Quantification of Native American water rights has become one of the state's biggest challenges, and lawsuits to resolve them have lasted decades.

The State Engineer has the authority to license water rights. This could be a viable intermediate alternative to adjudication that provides assurance to rights holders while paving the way for adjudication.

With or without adjudication, planners must still balance supply and demand.

Here is a picture of supply: Most of New Mexico receives less than 10 inches of precipitation a year, and scientists say we now face a period of even lower annual precipitation. We rely on about 3.9 million acre feet of surface water and groundwater (aquifers) to supply our

needs. Aquifers, natural underground reservoirs, provide nearly 87 percent of public water supplies, but most areas are pumping water faster than it can be replenished.



Agriculture uses the lion's share of water (78 percent). The public uses 8 percent, and evaporation from reservoirs consumes another 7 percent. Other uses represent a small slice of the pie: Power generation, 1.61 percent; mining, 1.52 percent; livestock, 1.4 percent; commercial, 1 percent; domestic wells, 0.9 percent; and industrial, 0.46 percent.

The demand side of the picture includes these uses plus the state's obligations under two international treaties and eight interstate compacts, plus the use of New Mexico's 22 Native American pueblos and reservations and requirements to protect endangered species.

What options do we have to increase supplies? Consider conservation, new sources, water markets, leased water, water banks, and water management.

Conservation: New Mexico loses 7 percent of its water in evaporation from reservoirs, streams and lakes – nearly the equivalent of all human use in the state. In some basins, aquifer storage and recovery could replace surface reservoirs and reduce evaporative losses. And because of agriculture's large use, even a 10 percent savings could supply nearly a doubling of population. However, the state's prior-use laws and low costs of water don't necessarily reward conservation and may even discourage it.

New Sources: New Mexico has an estimated 15 billion acre-feet of brackish or saline water, most of it at great depths, but desalination is costly. Other new sources include unexplored basins and cloud-seeding.

Water Markets: Organized water exchanges can support sales of water rights or leases of water from rights holders. They're currently informal and limited.

Many agricultural users don't like the idea of transferring water from rural to urban uses, but the fact remains that some rural owners do want to sell their water rights, and buyers aren't hard to find. However, buyers and sellers presently have no public source of information about the going price.

Market prices should be a measure of scarcity. Rising water prices support conservation, encourage us to find new water, and smooth the transfer from one use to another.

The legal process is another obstacle. It takes years and costs upwards of $20,000 in legal and experts' fees for routine, unprotested transfers of water rights from one owner and use to another. Months pass before buyers and sellers can learn if the proposed transfer is even possible.

Leased Water: Potentially, a lot of water could be available if the state had a more organized leasing program. If water-rights owners, including tribes and farmers, don't want to sell their water rights, they could still lease them for periods of time, such as dry years, at a prevailing market price. Increasingly, farmers seem more open to leasing their water rights.

Water Banks: These organizations allow farmers to buy and sell water on a short-term basis at prices set administratively by the water bank. An owner who is conserving water or not using it could deposit that water for use by a borrower without being subject to the state's forfeiture rules. Conservation and irrigation districts and acequias could establish their own water banks for members. The Middle Rio Grande Conservancy District has already established such a bank for its members.

Water Management: The State Engineer has initiated an Active Water Resources Management program aimed at increased metering, monitoring, marketing and management of water, tailored to individual basins. This program should be accelerated and expanded.

Winston Churchill once said, "A man can't stand in a bucket and expect to lift himself up by the handle." For some time, New Mexico has tried to develop water policy by standing in that bucket and pulling.

New Mexico needs to think outside the bucket.

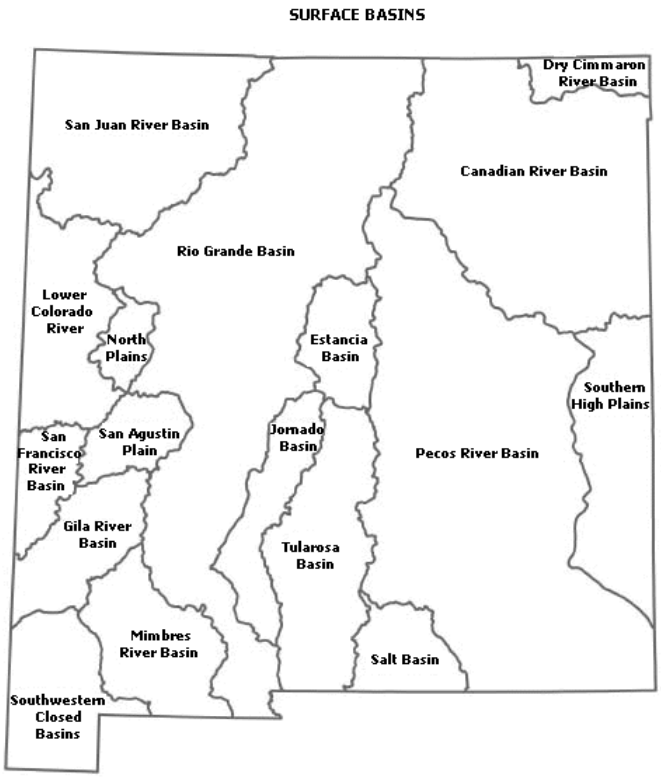
Background

New Mexico's water supplies and demands are complex and changing. Its laws reflect a unique history and tradition. To understand both, it helps to have a grasp of water basics. What follows are the building blocks of water knowledge.

Supply

Water Sources

Most of New Mexico receives less than 10 inches of precipitation a year. We rely on surface water and groundwater (aquifers), in roughly equal measures, to supply our needs.



Surface water refers to rivers, lakes and streams, fed by rain or melting snow in a water **basin**, which is the land area drained by a river and its tributaries. River flows vary by season, weather and drought patterns.

In all basins, claimed water rights exceed water available.

New Mexico's six major river basins are the:

- Canadian
- Lower Colorado
- Pecos
- Rio Grande
- Southern High Plains/Ogallala
- San Juan (Upper Colorado).

Aquifers, which are natural underground reservoirs, hold a majority of the state's fresh water. A substantial portion of groundwater is not renewable or is replenished (recharged) very slowly through a complex underground network; it can take a few years or thousands of years to recharge.

Surface water and groundwater are linked; withdrawals from one affect the other, and a rainy season benefits both. For this reason, wells pumping from aquifers can reduce nearby stream flows.

Units of measure

New Mexico and other western states measure volumes of water in **acre feet**, a term that originated with farmers describing the water per acre needed to grow a crop. One acre foot is the volume of water covering one acre with 12 inches of water, or 325,851 gallons.

Most of the state's basins measure water by acre-feet of use per year. In the Lower Pecos and Gila basins, the measure is in **water-right acres**, or the number of irrigated acres to which a property owner holds water rights. This is measure of water rights rather than water and is often converted to acre-feet for the sake of comparison.

Facilities

To store and distribute surface water, New Mexico relies on 15 major reservoirs, along with complex systems of levees, canals and ditches. The U.S. Bureau of Reclamation and the Army Corps of Engineers own and operate most reservoirs and irrigation or flood-control works. However, legal ownership of some systems, including the Middle Rio Grande Conservancy District's flood-control works, is in dispute.

Providers

Most of the state's water for non-agricultural uses comes from municipalities, mutual domestics, co-ops and small privately held water companies. Many industrial users and mining operations supply their own water.

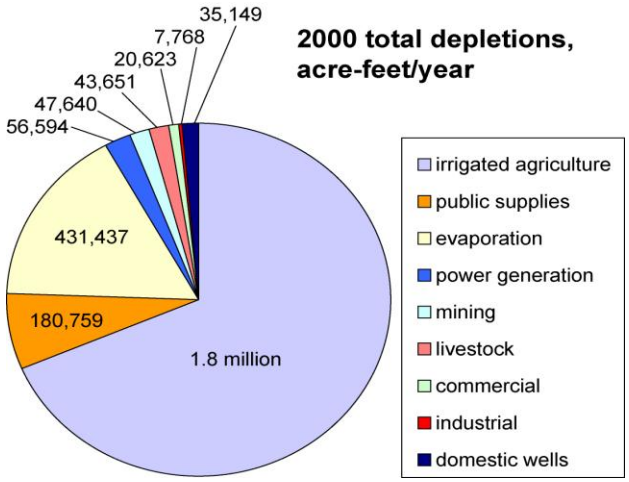
Domestic Wells

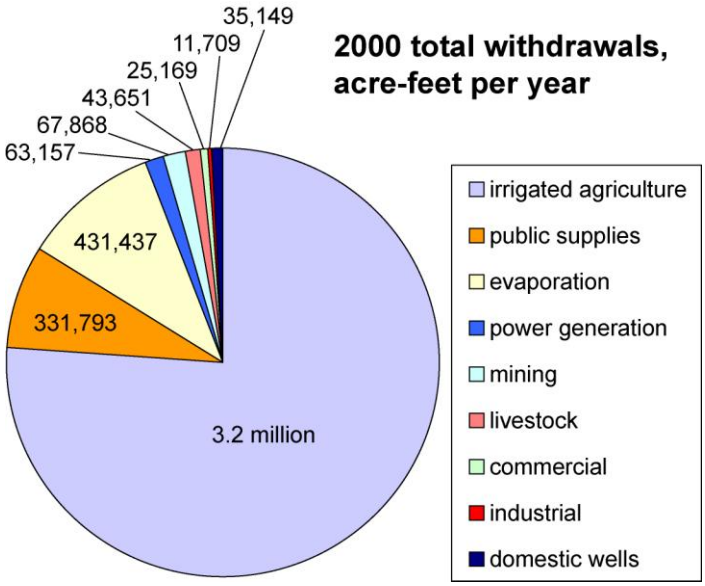
In the 1950s homeowners gained the right to drill a domestic water well and use up to 3 acre feet a year, or nearly a million gallons. Most households use less than 100,000 gallons a year. About 7,000 to 8,000 water wells are drilled every year, generally in suburban and rural areas. Individually, they pump relatively small quantities of groundwater for household and business use, livestock watering, non-commercial irrigation (less than one acre), mining and construction. Collectively, however, they can adversely affect local water systems. Water managers and users disagree on the extent of monitoring and regulation wells should receive.

Water Use

Water use in the state is measured in two different ways, which are often confused and used interchangeably. It's important to understand the difference.

Water **consumed** or **depleted** is the volume *permanently* removed from the local system -- water humans or livestock drink, plus water that's evaporated, transpired by plants, or incorporated into products.





Water **withdrawn** or **diverted** is the total amount taken from a stream or pumped from the ground to provide for consumption. It totaled 3.9 million acre feet in 2005. About half of diverted water returns to the system for further use, and this is **return flow**.

After providing both measures for many years, the State Engineer's Office, citing a lack of resources, used only the measure of water withdrawn (diverted) in 2005. Because this single measure doesn't describe water returned to the system, this report includes data for 2000, which includes both withdrawals and depletions.

This table displays water use by both measures for 2000 and just for withdrawals for 2005.

Category	**2000 Withdrawals** (acre feet)	**% Total Withd.**	**2000 Depletions** (acre feet)	**% Total Depl.**	**2005 Withdrawals** (acre feet)	**% Total Withdr.**
Irrigated Agriculture	3.2 million	76.14	1.8 million	68	3 million	78
Public Supplies	331,793	7.84	180,759	6.96	320,126	8
Evaporation	431,437	10.19	431,437	16	279,293	7
Power Generation	63,157	1.49	56,594	2.18	63,642	1.61
Mining	67,868	1.6	47,640	1.85	60,189	1.52
Livestock	43,651	1.03	43,651	1.68	57,009	1.44
Commercial	25,169	0.6	20,623	0.79	40,578	1
Industrial	11,709	0.28	7,768	0.3	18,251	0.46
Domestic Wells	35,149	0.83	35,149	1.35	35,796	0.9

When you think about usage, here are some points to keep in mind:

- By any measure, agriculture is the state's biggest water user by far.
- Riparian (stream bank) usage is significant. In the Middle Rio Grande, for example, irrigated acreage and riparian acreage are nearly equal.
- Industrial and commercial use draw occasional criticism, but they represent a small fraction of use.
- If you compare withdrawal and consumption data, you see that a considerable amount of water returns to the system.

Prices

Recent prices for water rights have ranged as high as $35,000 to $45,000 per right to consume an acre-foot each year in the Santa Fe area to $9,000 to $35,000 in the Middle Rio Grande to $2,400 in the Roswell Artesian Basin.

Generally, prices of tributary rights farther up the watershed are higher than rights farther down because tributary rights can be transferred to the main stem but not the reverse. Private buyers who want to transfer water rights to the Santa Fe area are paying a premium. That, in turn, has driven up values in Sandoval County, because buyers face fewer hurdles in the approval process than they would in an agricultural county farther down the Middle Rio Grande Basin.

Prices in the Middle Rio Grande rose dramatically with growth in the area, but in 2008 and 2009, average prices fell somewhat because of the recession's impact on the development industry.

Law

Overview

Laws and regulations, administered by the State Engineer's Office, strictly control use of the state's water.

All the water in the state belongs to the public, according to the New Mexico Constitution. The right to use it is called a **water right**. The water-rights holder doesn't own the water, but the rights themselves are considered private property that may be sold or leased, with permission from the State Engineer.

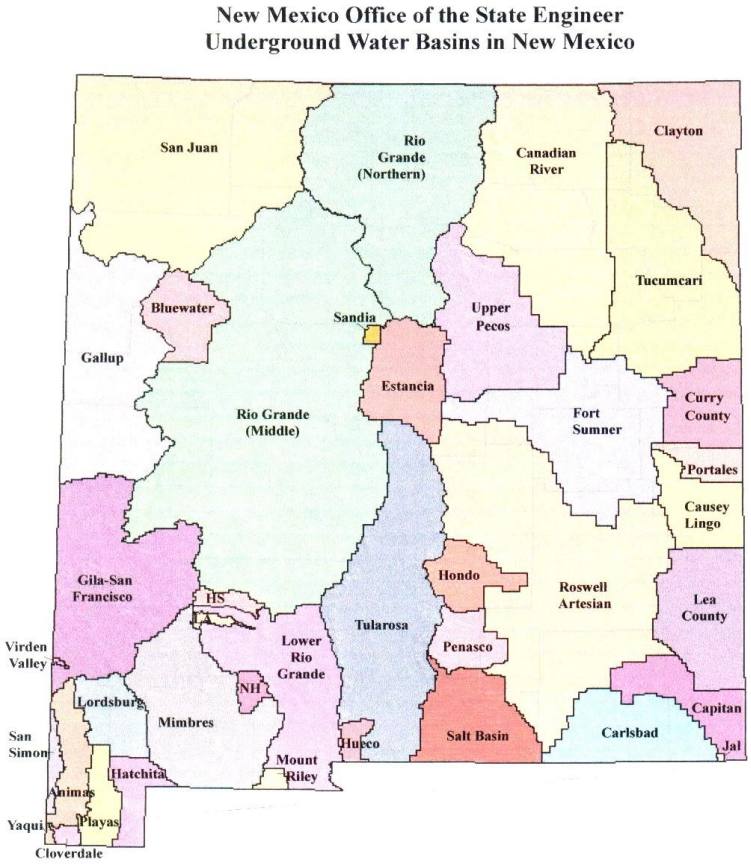
New Mexico is a **prior appropriation** state. Simply put, it means that whoever got there first to divert and use water has a better right than those who follow. In water parlance, the **senior water right** has priority over the **junior water right**. One of the State Engineer's most important duties is to protect existing water rights from the effects of later appropriations.

In theory, prior appropriation would come into play during dry years; senior rights holders would receive their full allotment of water, but junior owners' use would be curtailed. In practice, the State Engineer has rarely exercised priority administration, unlike his peers in other western states.

The federal government owns water rights to lands reserved by Congress or the president: national parks and forests, wildlife refuges, wilderness areas, military bases and Native American reservations. These are considered senior rights.

State law requires **beneficial use** by rights holders. "Beneficial use" isn't specifically defined, but historically it's meant irrigation or domestic, commercial and industrial uses. A 1998 opinion from the Attorney General established rights for in-stream uses (stream-flow

maintenance for endangered species, aesthetic considerations, navigation and recreation). Wasting water is not a beneficial use. Maintaining a water right requires adherence to applicable New Mexico laws and regulations or one may be required to forfeit all or a portion of that right. Hence the phrase "use it or lose it" applied to New Mexico water rights.



Once the State Engineer's Office declares a basin, groundwater rights are also established by appropriation or by diverting water and putting it to beneficial use under a permit from the State Engineer. The entire state is now included in declared basins for ground-water administration.

Water-right holders can change the purpose of use or divert it from a different place if the State Engineer determines it won't impair other water rights, harm public welfare, or run counter to water conservation.

Owners can forfeit their water rights for non-use, with some exceptions, or for wasting water. In that case, it returns to the public domain. However, municipalities can hold water rights up to 40 years without beneficial use if they expect to use the water within that period.

History

When the first Spanish explorers reached the Middle Rio Grande in 1540, they found Pueblo Native American people irrigating fields of corn, beans and squash from community ditches carrying water from the river.

Spanish colonists during the 17th and 18th centuries combined their irrigation experience, developed during the Moorish occupation of Spain, with the customs and knowledge of the pueblos. The result was community **acequia** (ditch) systems governed by law – the oldest European-style water management institutions in the United States.

In 1851, the first legislative assembly of New Mexico Territory confirmed that water was primarily to be used for agriculture and recognized the community ditch, or acequia. Users shared available surface and spring water.

The present water code has been in force since 1907, before New Mexico was a state. After that, the state Constitution recognized pre-1907 surface water rights. The code grandfathered in tribal uses and acequias but didn't specify who owned water rights and in what quantity.

In 1931 the state adopted groundwater laws and declared that the public owned underground water.

Compacts

New Mexico shares river systems with other states and Mexico. Historic disputes over upstream use led to the negotiation of eight compacts that prescribe how much water we can take and how much we must deliver downstream.

Each compact, approved by Congress, has the force of federal law; the U.S. Supreme Court has determined that the compact is the leading water right on the river. States that don't comply with compact requirements face serious economic and legal consequences.

The compacts are the:

- Colorado River Compact of 1922 between Colorado, New Mexico, Utah, Wyoming, Arizona, California and Nevada;
- La Plata River Compact of 1922 between Colorado and New Mexico;
- Rio Grande Compact of 1938 between Colorado, New Mexico and Texas;
- Costilla Creek Compact of 1944 between New Mexico and Colorado;
- Upper Colorado River Basin Compact of 1948 between Colorado, Utah, New Mexico, Wyoming and Arizona;
- Pecos River Compact of 1948 between New Mexico and Texas;
- Canadian River Compact of 1950 between New Mexico, Oklahoma and Texas;
- Animas-La Plata Project Compact of 1968 between Colorado and New Mexico.

In addition, the United States has obligations to Mexico under two treaties: the Convention of 1906 on the Rio Grande above Ft. Quitman, Texas, and a 1944 treaty on the Colorado River and Lower Rio Grande.

Regulation

The **State Engineer's Office** administers the state's water resources and enforces water law. The State Engineer has authority over the measurement, appropriation, and distribution of all surface and groundwater in New Mexico, including streams and rivers that cross state boundaries.

The nine-member **Interstate Stream Commission** protects New Mexico's right to water under interstate compacts, ensures the state's compliance with compacts and is responsible for planning. It has broad powers to investigate, protect, conserve and develop the stream systems in New Mexico. The State Engineer is secretary of the Interstate Stream Commission and oversees its staff.

Native American Water Rights

New Mexico's 22 Native American pueblos and tribes have senior water rights, which fall into two categories:

1. **Federal reserved rights** (sometimes called **Winters Doctrine** rights after a 1907 court case), under which the government reserved public lands along with water for "reasonable future development." A tribe, not state law, determines beneficial use. A tribe can't forfeit its rights because of non-use and can legally claim water from a system to irrigate all of its "practicably irrigable land." Federal reserved rights are unaffected by interstate compacts.

2. **Pueblo water rights** were given to them by the Spanish and Mexican governments and confirmed by the United States when it acquired New Mexico in 1848. Pueblo water rights have yet to be quantified.

Acequias

The community **acequia** is a ditch conveying irrigation water. It's also an institution established by early Spanish settlers and continued by the Territorial Legislature in 1851.

The *mayordomo* manages the ditch and settles disputes. Members of the acequia, called *parciantes*, share whatever water is available. However, if several acequias are on the same water system, prior appropriation allows the oldest acequia to use all the water it needs before the next acequia gets water; in times of shortage, the others won't get water. However, the mayordomos may have informal agreements among themselves to relieve shortages.

About 100 acequias still operate under this system.

State law recognizes acequias as special districts, and they have their own commission in state government.

When a parciante sells water rights to an owner not on the acequia, fewer parciantes are left to shoulder the burden of maintaining the ditch, and the tradition weakens.
Recent legislation gave the acequia veto power over the sale of water by individual parciantes. It's now being challenged in court.

Tribes and Pueblos

When Congress amended the Clean Water Act in 1987, it added a provision that allowed federally recognized tribes to be considered states for the purpose of developing and implementing water-quality standards.

In 1993 Isleta Pueblo became the first tribe in the country to meet EPA requirements and have its standards approved. The pueblo, downstream from Albuquerque, effectively receives the same quality water as upstream users.

Environment

States control their own water, but federal environmental laws have an impact.

The **Clean Water Act** regulates water quality by regulating discharge. Programs and provisions include:

- **National Pollution Discharge Elimination System** (NPDES) permits, which govern discharges into surface water from specific sources and indirect discharges through storm-water runoff;
- Section 404 Permits, which govern activities that might disturb wetlands;
- The **Safe Drinking Water Act**, which regulates water quality in public water systems.

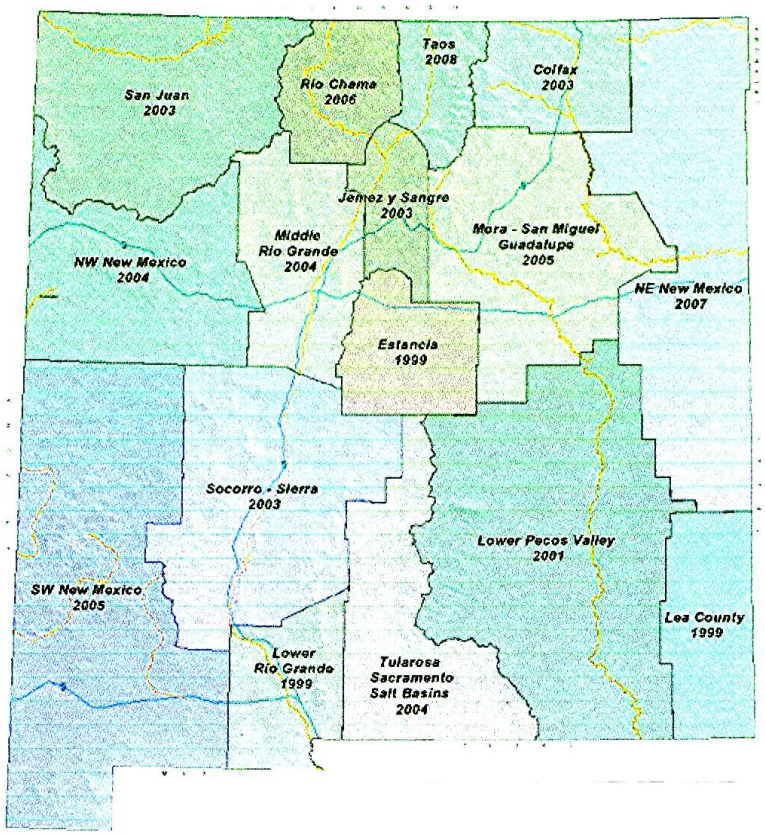
The **Endangered Species Act** protects species of plants and animals designated as threatened or endangered by the U.S. Fish and Wildlife Service. This involves formal listing, defining critical habitat, and devising a recovery plan.

The **New Mexico Water Quality Control Commission** sets water quality standards for all streams and lakes in New Mexico. The pueblos establish stream standards for sections of the river that flow across their lands.

Water Planning

Every five years, beginning in 1987, the Interstate Stream Commission has written a state water plan that assesses water resources, evaluates stream-flow measurement, and monitors groundwater.

The same year, the Legislature established 16 water regions and encouraged them to do studies of their resources and needs. Each region has completed a water plan for use in a statewide water plan.



Active Water Resource Management (AWRM)

In 2004 the State Engineer's Office launched Active Water Resource Management (AWRM) in response to drought.

AWRM is a statewide action plan, with rules and regulations, that allows the State Engineer to actively manage the state's limited water resources during such emergencies as droughts. Activities include permitting transfers, monitoring and metering diversions, and limiting diversion to the amount authorized by existing water rights within the prior appropriation system.

Several of the program's tools are nearly in place. This includes water masters and districts, WATERS (Water Administration Technical Engineering Resource System) Database, metering, and measuring. The database provides well reports and well permits.

Stream systems identified as high priority for AWRM are the Lower Pecos, Lower Rio Grande, San Juan, Upper Mimbres, Rio Gallinas, Nambe-Pojoaque-Tesuque Basin, and Rio Chama.

Each stream system has been assigned its own team.

Issues

Except for drought years, New Mexico for centuries had enough water for all its needs. In recent times, we've started reaching the limits of our resources, but in many ways those limits are defined by current laws, regulations, custom and precedent.

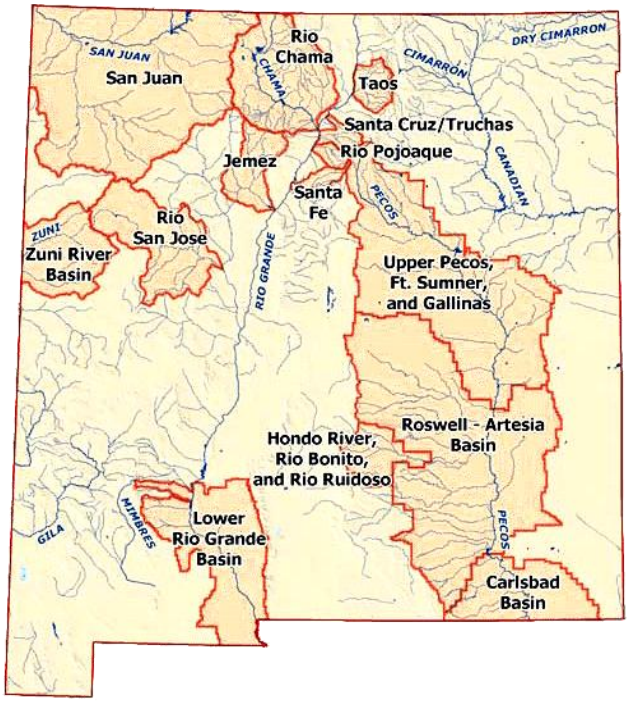
The population has grown, some aquifers are being depleted, and climatologists project declining surface flow. And yet the state must still meet the demands of interstate compacts, tribes, economic development and environmental requirements. Management and distribution were never more challenging – or more important.

We discuss issues here in four categories: Law, Supply, Regulation and New Sources.

Law

Adjudication

The state's early water codes didn't say who owns the right to use what water. It requires **adjudication** – a legal determination of who owns water rights, what quantity they're entitled to use, and how that right stands in the pecking order of priority use – but adjudication wasn't enforced.



New Mexico is the only western state that hasn't completed the adjudication of its water rights. To speed things up, the Legislature is considering how to reform the process and in 2009 asked UNM's Institute of Public Law to hold meetings and take public comment.

Adjudication requires the State Engineer's staff to search documents and verify priority dates and use; study crop patterns, irrigation water requirements, other water uses, and land ownership; visit the site to examine use; produce maps; and conduct hydrographic surveys to identify, map and report the ownership of water rights in a stream system or groundwater basin.

Then the State Engineer files a lawsuit against all rights holders in a given basin and submits a report describing known uses of water in it. Without complications, the court will issue an order formally adjudicating water rights. The process often takes many years, but it establishes and protects individual title to water rights.

The 12 active regional adjudications (see map, above) currently in federal court and state court could take 15 years to complete. In many basins, including the Middle Rio Grande, the process hasn't yet begun.

However, some de facto adjudication is taking place through sales of water rights in non-adjudicated areas. For example, the Town of Taos has purchased water rights, and the State Engineer has researched and approved the sales. It's likely that such approvals would be accepted by the court in an adjudication; they have been accepted in a settlement agreement pending before Congress.

The Legislature could mandate quick adjudications and provide legal alternatives based on modern techniques – GIS systems, aerial photo surveys, water courts and mediation instead of litigation. There are successful models in the Mesilla Valley, the Carlsbad Irrigation District and other states. The Legislature in 2007 considered an alternative process for the Middle Rio Grande that would give the lead role to the courts and may take it up again in the future.

Other states put the burden of proof on the rights holders and gave them a deadline.

Licensing

The State Engineer has the authority to license water rights but doesn't often exercise it because some rights holders have never used all the water they're entitled to, so they're reluctant to ask for a license because they can't prove beneficial use.

However, licensing could be a viable intermediate alternative to the lengthy, expensive adjudication process. It would provide the greatest assurance, next to adjudication, to the rights holders, and it would smooth the way toward eventual adjudication.

Native American rights

Neither the state's water code nor federal law quantified the amount of water New Mexico's tribes and pueblos are entitled to use, and quantification of Native American water rights has become one of the state's biggest challenges. Lawsuits have lasted decades. Water experts suggest that negotiation and compromise will be more effective than continued litigation.

Settlements have been successfully concluded with the Jicarilla Apache Tribe and, tentatively, with Taos Pueblo. Legislation enacted in 2009 acknowledges the Navajo Nation's right to 342,384 acre feet per year (56 percent) of water from the San Juan River's anticipated 669,400 acre feet annual flow. The bill ratified an agreement between the tribe and the state intended to end uncertainty. The tribe agreed to limit its water use and share shortages. The legislation also provides for a new pipeline that will provide drinking water to much of the reservation and the City of Gallup, at an estimated cost of more than $1 billion.

State, pueblo and local governments also reached an agreement on the 40-year-old Aamodt case, intended to settle the water claims of Nambé, Pojoaque, Tesuque and San Ildefonso pueblos and non-Native Americans in the Pojoaque Valley. Under a settlement forged in 2006, pueblo water rights would be preserved without compromising the rights of non-pueblo users, including Santa Fe, and non-pueblo users would stop pumping from wells and receive water from a water system and pipeline. Both the Taos and Aamodt agreements are, at this writing, before Congress.

Compacts

The **Colorado River Compact** was negotiated during a wet cycle, when annual flow was assumed to be at least 15 million acre feet per year, split between upper and lower basin states. Flow is actually closer to 13 million; lower basin states (Arizona, California and Nevada) are entitled to receive their full allotment of 7.5 million acre feet before upper basin states like New Mexico receive theirs.

The **Rio Grande Compact** reflects water use during the 1930s, when the compact was negotiated. New Mexico must meet its compact obligations regardless of water allotted to Native American tribes and evaporation losses at Elephant Butte Reservoir. Historically, the state has over-delivered at times and under-delivered at times, depending on weather patterns. At present levels of water use from the Rio Grande, the state is barely meeting its compact delivery obligations, and a recent analysis projects that the situation will get worse.

The **Pecos River Compact** essentially requires New Mexico to limit its uses so Texas receives its share. In 1974 Texas sued New Mexico for under-delivering Pecos River water and won. The U.S. Supreme Court awarded Texas $14 million in damages (Texas sought $1 billion) and ordered New Mexico to meet its required deliveries with no exceptions. The court also ordered New Mexico to treat Texas as a senior water rights holder. If New Mexico doesn't live up to its obligations, the State Engineer would have to issue a priority call and limit or eliminate use by junior rights holders.

However, junior rights are largely ground-water rights. Even if those users stop pumping, the effects would be realized too slowly, and the State Engineer would have to curtail senior rights. The financial impact in local communities would be devastating. Since 2005, at a cost of more than $64 million**,** the state has acquired nearly 5,000 acres and water rights associated with 8,248 acres and developed two well fields to help meet deliveries to Texas. New Mexico parties to a Lower Pecos settlement agreement now believe the state has met settlement conditions.

Endangered Species

Efforts to protect the Rio Grande silvery minnow, the Pecos bluntnose shiner and the Colorado pike minnow have generated controversy and forced water managers to balance the needs of both fish and people as they maintain sufficient flow in certain rivers to sustain endangered species.

The three major factors affecting endangered fish species are:

- Reductions in flow and channel dewatering, especially during drought;
- Habitat fragmentation and barriers to movement caused by dams;
- Habitat loss due to channel narrowing and degradation.

In 1994 the U.S. Fish and Wildlife Service invoked the Endangered Species Act to protect the Rio Grande silvery minnow. After several lawsuits, the agency identified as critical habitat the Rio Grande and its banks for 157 miles between Cochiti Dam and a point north of Elephant Butte Reservoir, excluding Pueblo lands and some developed lands. It also issued a recovery plan that called for maintaining physical habitat.

During the drought in 2002, when the U.S. Bureau of Reclamation sought some relief to allow greater drying in the river, environmentalists prevailed in court to keep the river flowing. In a controversial ruling, a federal judge declared that water from the San Juan-Chama Project could be used to keep the river wet, although a later congressional rider neutralized the decision. Subsequently, the City of Albuquerque leased about 50,000 acre feet a year to the Bureau of Reclamation. With the San Juan-Chama project now providing drinking water to the city, it may need all its water.

One effective solution has been the **refugium**, a facility developed to breed and rear endangered fish in captivity. There are now four of these facilities to maintain the silvery minnow.

On the Pecos River, reopening a dry oxbow in the Bitter Lake National Wildlife Refuge in 2009 is expected to expand habitat of the bluntnose shiner. The Bureau of Reclamation has leased water rights and the Interstate Stream Commission has taken other steps to supplement the flow in critical reaches.

Supply

Water mining

In New Mexico, groundwater provides nearly 87 percent of public water supplies.

Many areas have been "mining" their water – pumping so much that water tables are dropping. As a result, shallow wells dry up, the quality of water in deeper wells deteriorates, less water is available for vegetation and habitat, and subsidence can damage buildings and roads.

Current water prices don't reflect the replacement cost of that water. Possible remedies include public subsidies, privatization, stronger regulation, water banking, and local-option severance taxes on mined water.

Problems are worse on the high plains and in Gallup, the Estancia Basin, and the Middle and Lower Rio Grande.

Eastern New Mexico and Texas have seen the Ogallala Aquifer diminish. And because Texas doesn't regulate groundwater pumping (its regional conservation districts do), that too affects New Mexico's supply. Southern New Mexico, El Paso and Juarez all compete in pumping the Mesilla Bolson.

Another kind of pumping war occurs when junior rights holders with wells circumvent the law by continuing to pump even though senior owners of surface-water rights may not be fully supplied.

Domestic wells

Since the 1950s, 7,000 to 8,000 domestic water wells have been drilled every year. Water experts have warned for years that the state couldn't allow unlimited well-drilling without serious consequences.

In 2006 the State Engineer's Office enacted new rules to reduce existing domestic-well use to 1 acre foot a year; new domestic well are limited to one-fourth acre foot in certain areas. And the State Engineer can create domestic-well management areas in places where new wells could threaten existing water rights or the state's ability to meet compact deliveries.

Also in 2006, the City of Santa Fe won a court case allowing it to prohibit domestic-well drilling in order to preserve its aquifer.

In 2008 a District Court judge ruled that the state's domestic water well rules were unconstitutional because they conflict with the state's priority-use rights. This decision is under appeal.

Brackish or Saline Water

New Mexico has an estimated 15 billion acre feet of brackish and saline water in aquifers at depths usually below 3,000 feet. "Brackish" and "saline" are not interchangeable terms.

Brackish water is a mixture of fresh water and salt water – not quite salt water, but not drinkable either. **Saline** water is salt water. Scientists determine the difference based on total dissolved solids, or TDS.

Fresh water contains less than 1,000 milligrams per liter (mg/L), saline contains 10,000 or more mg/L, and brackish is in between. Sea water TDS is over 30,000 mg/L, and oilfield **brines** are even saltier.

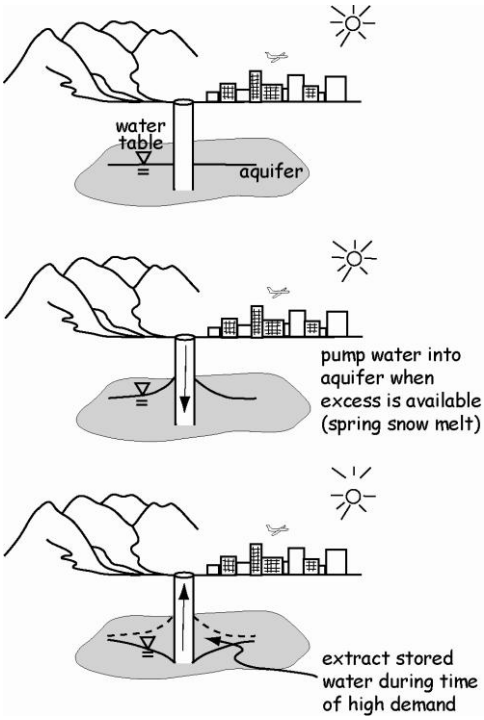
Desalination is costly, although the costs will vary from place to place depending on water quality. Most of the brackish and saline waters being considered for desalination range from TDS levels of a few thousand to as much as 15,000 mg/L.

Sandoval County's recently discovered deep groundwater, for example, is about one-third as salty as sea water. To make it potable will take 14 times the electricity presently used to clean river water and cost more than three times as much as other locally provided drinking water.

Not until 2009 did the State Engineer gain authority to regulate non-potable water in aquifers that lie deeper than 2,500 feet. The new law applies primarily to potential use for public water supply; existing exemptions remain for oil and gas exploration and production, prospecting, mining, road construction, agriculture, generation of electricity, and industrial processes or geothermal use.

Evaporation

New Mexico loses at least 400,000 acre feet a year to evaporation from reservoirs, streams and lakes – nearly the equivalent of all public use in the state. Reservoirs alone lose more water to evaporation than is consumed by power generation, mining, livestock, commercial, domestic wells and industrial uses combined.



In 2005 the average annual evaporation from reservoirs with at least a 5,000 acre-feet capacity ranged from about 40 inches in the mountains of Northern New Mexico to about 75 inches in the valleys of the southern border area. It totaled 279,293 acre-feet, or 7 percent of all withdrawals in 2005.

Evaporation losses from Elephant Butte Reservoir are counted against New Mexico's share of water under the Rio Grande Compact.

Some legislators have pressed for **underground water storage** to reduce evaporation losses, and recent experiments in Albuquerque and Alamogordo appear successful.

Arizona stores its extra Colorado River water underground by exchanging it for the groundwater an irrigation farmer would have pumped; it also adds water into aquifers through basins and wells.

The Middle Rio Grande aquifer beneath Albuquerque, depleted of about 1 million acre feet of water, could store treated river water. As the aquifer refilled, the Rio Grande itself would benefit, making compact requirements easier to meet.

Conservation

Every gallon saved is a gallon that doesn't have to be pumped or taken from a reservoir. Urban conservation gets the most attention because it's the easiest to implement. Agricultural

conservation is more difficult and more costly, and the state's prior-use laws don't reward conservation, efficiency or sharing with junior rights holders during a drought.

Conservation remedies will vary. In some places, lining irrigation ditches would save water, but along the Rio Grande, unlined ditches support wells and the bosque (cottonwood forest).

Removing non-native plants like salt cedar (tamarisk) along the rivers could achieve water savings of an estimated 13,000 acre feet a year for every 10,000 acres of salt cedar removed, but the eradication must be maintained.

Reuse

Municipalities and developers have become more adept at reusing water. One popular measure is irrigating parks and golf courses with treated wastewater. However, in Albuquerque, for example, the wastewater would otherwise be returned to the river, so downstream users might see the measure as depletion.

Drought

Tree-ring data tell us that for the last 2,000 years, drought has been a regular event in New Mexico. During the 1980s, when the state was growing dramatically, New Mexico experienced abnormally wet years. However, major droughts occurred in the 1950s, the 1970s, the 1990s and early 2000.

Scientists say we now face a period of even lower annual precipitation than we had during most of the 20th century. In a worst-case scenario, the State Engineer might have to make a priority call on certain river basins in order to manage the state's supplies.

Quality

Groundwater: Water from aquifers under Albuquerque is very good. Because it's thousands of years old, it's highly unlikely to be contaminated by human activities on the surface.

In other areas, water in deep acquifers (2,500 feet or more) is brackish or saline.

In locations where the soil is permeable and surface water seeps down, groundwater and domestic wells are vulnerable to contamination. Septic systems and other domestic wastewater disposal systems are the state's single largest source of groundwater contamination, although industrial sites, fuel storage tanks, and landfills can also contribute.

One naturally occurring groundwater contaminant is arsenic, the result of volcanic activity that created arsenic-bearing sediments. Too much arsenic can increase cancer risks. In January 2001 the EPA lowered its arsenic standard from 50 parts per billion to 10 parts per billion and gave affected cities five years to comply.

Fluoride also occurs naturally in mineral deposits and leaches into groundwater. Some municipalities add it to drinking water to promote strong teeth.

Surface water: Pollution can enter surface water from **point sources** (a specific place, such as a sewage treatment plant or dairy) and **non-point sources**, such as storm-water runoff.

The EPA requires each point source to have a National Pollution Discharge Elimination System (NPDES) permit and treat discharges to meet NPDES standards to protect human health and the environment.

Non-point sources can include fertilizers and other agricultural chemicals draining into rivers, antifreeze spilled on a driveway, or dog waste littering a park. Other contaminants are fecal coliform bacteria, including *E. coli*, possibly from pets, livestock, wildlife, birds (especially waterfowl) and human waste from septic tanks or leaking sewers.

It's all washed into the river in storm-water runoff. These non-point sources deliver 92 percent of contaminants to the Rio Grande, compared with 2 percent from point sources and 6 percent from natural or unknown sources.

Pharmaceutical residue (everything from ibuprofen to caffeine) is a smaller issue here, probably because of our climate, high elevation and sparse population. Sunlight rapidly degrades most drug residues in water, and the state's wide, shallow rivers, lends themselves to rapid breakdown of drugs.

Regulation

Pricing

Farmers and ranchers who want to sell their water rights and municipalities or others wishing to buy them presently have no public source of information about the going price. In fact, when prices are fluctuating rapidly, there may be *no* going price.

Price information is closely held and increasingly difficult to obtain. Such secrecy is good if you're an appraiser or water broker, but it doesn't serve buyers, sellers or the public.

Economists say market prices should be a measure of scarcity. Rising water prices support water conservation, encourage us to find new water, and smooth the transfer from one use to another.

Some municipalities are reluctant to disclose what they've paid for water rights, fearing that if they once paid $25,000 per acre foot during an emergency, they will always be expected to pay that amount. Water economists say that if there are a number of willing sellers and buyers, along with public information, everyone will benefit.

For example, prices on the Lower Pecos nearly doubled after the state began leasing water or buying water rights to meet compact requirements; dairies and pecan farms also contributed to higher prices. But even at current price levels, adjudicated rights in the Lower Pecos are lower than Middle Rio Grande levels.

Process

Presently, it takes years and costs thousands in legal and experts' fees to transfer water rights from one owner and use to another. Months pass before buyers and sellers can learn if the proposed transfer is even possible.

The process is cumbersome because, without adjudication, the State Engineer's Office must determine if the right is valid and evaluate the impact of the transfer on other users.

Other owners may protest the transaction. Protests may be justified on the basis of impact or they may be unjustified, but protest criteria aren't consistent with similar government processes and may be weighted unfairly in favor of someone wishing to derail a transaction.

The concept of **public welfare** is poorly defined. For example, in a transfer of water from one basin to another for municipal use, "public welfare" can refer to residents of a municipality needing water or to water users in the originating basin.

Traditional users

Agricultural users and acequia members tend to resist transferring water from rural to urban uses. But the fact remains that some rural people are interested in selling their water rights, and buyers aren't hard to find.

Impacts don't have to be drastic. Irrigation accounts for 78 percent of water use in the state, so even a 10 percent reduction in agricultural use (easily reached through conservation) would accommodate a doubling of the state's population.

Increasingly, farmers are amenable to leasing their water rights.

Information

Policy makers and the public suffer from a flood of conflicting and often inaccurate information about water. We need one reliable source of information, preferably a Web site provided by an agency like the State Engineer's Office that could be the single repository of new developments, reports, and water-related data.

New Sources

Because New Mexico's surface waters and known basins are fully appropriated, there's an assumption that no new water rights are available. Not all the state's water has been tapped. Here are just a few possibilities:

1. The state still has geologically and hydrologically unexplored basins that may contain large volumes of potable water.
2. Certain supplies of deep, brackish water may still be appropriated for non-public use. And a few places remain where nobody has ever looked for water.
3. The uranium industry during the 1970s pumped enormous volumes of water from underground mines in western New Mexico's Morrison Formation. These sandstone beds are relatively permeable and can serve as aquifers. The water pumped to dewater the mines indicates that other users might find water there. However, like other groundwater, this source would not be renewable.
4. Under the settlement of claims on the San Juan River, Navajos would receive about 340,000 acre-feet of consumptive rights. The tribe currently can't use all of this water, and the unused portion flows downstream to California.
5. At Elephant Butte reservoir, calculated spills over the dam have relieved overcapacity during wet years. Spill waters aren't counted under river compacts. This water should be stored, preferably underground.

One example of new sources is Albuquerque's use of 47,200 acre feet of San Juan River water, transported by trans-mountain tunnels beneath the Continental Divide and carried to Albuquerque in the Chama River and Rio Grande, where it is treated and used as drinking water.

Leasing

Potentially, a substantial amount of water could be available if the state had a leasing program in which owners of water rights, including tribes and farmers, could lease water they're

not using without fear of forfeiting their rights. Senior water rights owners could profit without having to sell their water.

Deep Water

Recently, the state's abundant stores of brackish and saline water have gained attention.

New technology is improving efficiency. A desalination demonstration pilot program is under way in the Tularosa Basin of southern New Mexico, Sandia National Laboratories scientists are studying desalination, and two New Mexico high-tech companies have breakthrough water purifying technologies.

Keep in mind that deep brackish water may be abundant, but it's not unlimited. These aquifers receive little or no recharge from surface water, so once the water is gone, it won't be replenished. It can, however, provide water during a drought, and water could be reinjected during wet periods.

Produced Water

For every 42-gallon barrel of oil produced, about 10 barrels of brackish water are generated – about 640 million barrels a year, the equivalent of 82,000 acre-ft, or about 2 percent of total annual water diversion.

Produced water comes to the surface with the oil or gas. It's separated from the hydrocarbons and either reinjected or taken to a disposal site to evaporate.

To the oil and gas industry, this "produced water" is a high-volume waste product and the subject of regulation by the state Oil Conservation Division. About 90 percent of produced water is re-injected.

Water Markets

Water in New Mexico is a scarce resource, so it must be managed and allocated. Increasingly, western states are looking at new kinds of transactions and new ways to buy and sell water rights.

The first two sections of this brochure have been impartial presentations of water basics and issues. This section, like the editorial page of your local newspaper, takes a position. We believe water markets would be a solution to some of the state's water challenges.

Water rights are already bought and sold informally. Organized water markets can be an efficient, flexible way to reallocate the water we have, and they would help create new resources by encouraging conservation and the development of new sources.

Establishing formal water markets, however, will mean rethinking the state's water policies. New Mexico water law has changed little since 1907 and doesn't necessarily reflect today's realities.

Apportioning Water

Water is already allocated by prior appropriation, but when it's in short supply, there are several ways to reallocate: Government regulation, in which an agency determines who gets water and in what quantity; priority, in which the first in line gets water; and financial clout, in which the individual or entity with the most money can obtain water.

New Mexico has all of these deciding factors in some form, but they're often inefficient and slow. And they don't adequately address the state's changing needs.

Two alternatives offer more choices to water-rights owners as well as to the individuals, communities, and industry needing water: Leased water rights and water markets.

Leased Water Rights

If water rights owners don't need to use their water during a given year but don't want to sell their water rights, they could lease them at a prevailing market price, and a fixed amount of water would be delivered at a designated point in a specified year. A municipality that needs water for one year or several years could buy contracts for water while it developed long-term strategies. A power plant that needs water for 50 years could purchase multi-year or multiple one-year contracts.

Surveys have shown that farmers are more likely to embrace a short-term option like this than they are to sell their water rights. Other advantages: A leased water right is less likely to draw protests over a change in use or location, and the shorter term allows water managers to see if there are any consequences. On the other hand, municipalities may be unwilling to depend on short-term leases.

Water made available through leases has its own pricing system. The longer the lease, the higher the price. New Mexico's lease rates in 2009 were in the middle range of western states.

New Mexico has already seen some innovation in leasing. In 2003 the Legislature passed a bill allowing municipalities to form Special Water Users' Associations. In 2005 the City of Las Cruces formed the Las Cruces Special Water Users' Association to enter into 40-year leases of annual allotments of Rio Grande Project water from land owners in the Elephant Butte Irrigation District.

Water Markets Defined

Economists define a market as the buying and selling of a scarce commodity or service, whether it's informal or organized into an exchange with rules. A formal water market is an organized exchange for water rights or for water leased as a commodity.

A well-functioning market requires known prices. An organized water exchange would have posted bid and asked prices.

A market also requires multiple buyers and sellers. If you have only one buyer or one seller, you don't have a competitive market. The Middle Rio Grande, for example, is a fairly competitive market because Albuquerque, Rio Rancho and Santa Fe are competing buyers, and many different farmers are potential sellers.

A decentralized approach like water markets empowers individual water users. Farmers in Northern Victoria, Australia who routinely use water markets to manage scarcity have found that water markets are more advantageous than building new desalination plants.

Types of Markets

Organized markets for leased water rights could operate separately from markets for sale of water rights.

Leased water-right markets could include spot markets and options markets.

A **spot market** would allow individual farmers, during irrigation season, to negotiate transfers of water among themselves at prices they negotiate, with approval from the irrigation district.

An **options market** would allow one farmer to buy an option to purchase a certain amount of water at a specified time during irrigation season. The fee is nonrefundable, but farmers pay for the additional water only if they exercise the option by its expiration date. If the farmer doesn't exercise an option, the seller can negotiate with someone else.

Markets for sale of water rights would allow farmers to negotiate individually. One market might serve transfers of rights, separate from land, with the approval of the irrigation district. Another market would serve transfers of water rights with land and would not require district approval.

In the same way, businesses and municipalities could also participate on the buying side, and tribes could participate on either side.

Water banks

A water bank is an organization that facilitates the buying and selling of water on a short-term basis at prices set administratively by the water bank. Buying prices are higher than selling prices; the difference covers costs of administration. Water banks don't generally broker water rights. And they can participate in the market in the same way as an individual.

An owner who is conserving water or not using it can deposit that water for use by a borrower without being subject to the state's forfeiture rules for non-use. In Idaho farmers with entitlements to water in reservoirs can deposit their water for up to 20 years; borrowers can lease the water at rates set by a management committee.

The State of California currently operates a drought water bank in which farmers are the sellers and cities are the buyers. The State of Arizona allows Las Vegas to bank water in Arizona aquifers and users to "withdraw" it by increased pumping from Lake Mead.

Water banks don't take power away from conservation and irrigation districts and acequias; those entities, in fact, have the authority to establish their own water banks for members. Banked water is not subject to forfeiture, leased or not.

The Middle Rio Grande Conservancy District and some other districts have had water banks that are primarily restricted to agriculture and related uses. They're a step toward a more formal mechanism that might some day include transfers for endangered species' use, as well as municipal, industrial and non-irrigation purposes.

Conservation and Markets

Farmers could conserve, salvage or save irrigation water and shift it to another use, but right now they're prevented by regulatory and legal obstacles. Transferring water for a different use, place of use, or new point of diversion requires a sale of the right and loss of the water to the originating location and owner. Farmers are also constrained by the use-it-or-lose-it provisions of state law and lack of storage facilities and infrastructure. However, state law doesn't prevent farmers from leasing water rights.

In 2007 the Legislature gave the State Engineer authority to award water credits for approved conservation methods. Farmers could then sell or lease the water credits. Those who accrue water credits could store their credits in a water bank. Developers, municipalities and industry would have the same incentive. For this system to work, the State Engineer would need staff and resources to assure the water has actually been conserved.

Status of Water Markets

Currently, informal water markets operate in many New Mexico basins, but they're not too efficient. The buyer and seller get together indirectly (usually through a broker), agree on a price and sell their rights.

The Middle Rio Grande is the most active, but rudimentary markets exist in the Pecos, the Lower Rio Grande, the San Juan and the Mimbres basins.

One of the earliest informal markets developed on the Lower Pecos. Declining water levels in the Roswell Artesian Basin led to the adjudication of water rights, metering of wells and introduction of conservation measures. Between 1958 and 1985 the Pecos Valley Artesian Conservancy District retired nearly 7,000 acres of irrigated farmland with their water rights through market purchases. The Interstate Stream Commission also made market purchases to retire water rights to comply with compact mandates.

Next Steps

New Mexico must take control of its future with water markets that would relieve demands, provide more choices during drought and reward farmers for conservation practices.

Here are the next steps:

1. Buyers and sellers must know in advance which water rights can and can't be transferred. The State Engineer's Office could inventory and publish water rights acceptable for change of place or use in each basin and provide some form of pre-approval or pre-vetting process or transferability certificate.
2. Licensing or adjudication should provide transparency and define the commodity, so buyers know what they're getting, and market participants can look up a transaction.

3. Water, especially leased water rights, should be a standardized commodity. Water contracts should be as homogeneous as possible to simplify negotiation and speed up the process.
4. Buyers and sellers need to know the going rates. The State Engineer could require sellers to report the sales prices on a change-of-ownership form, which would become public information.
5. Water-right transfers should take place in a timely fashion.
6. The state could charter one or more public water exchanges for each basin. In each exchange, certificates of marketability could be traded that would allow use or place of use to be changed.
7. The Legislature should designate an agency to regulate water markets and design a system to minimize abuses of the markets. The State Engineer's Office or the Public Regulation Commission are possibilities.

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The Business Water Task Force thanks our sponsors:

The Business Water Task Force is an informal group of interested individuals, water experts and business people dedicated to helping develop sound water policy in New Mexico. Participants have varied, depending on the issues.

In the past the Task Force has supported the City of Albuquerque San Juan-Chama Drinking Water Project and participated in developing the Middle Rio Grande Regional Water Plan. Its current focus is to help develop policy and legislation that creates an effective water market system in New Mexico.

Currently, Brian Burnett is task force chairman. Jerry Geist chaired the subcommittee that produced this document; its members were F. Lee Brown, Greg Gates, Bob Grant, Martin Haynes, and John Shomaker.

The Business Water Task Force is grateful to F. Lee Brown, Bob Grant and John Shomaker for their contributions to this report.

Sherry Robinson assembled the research for this primer and is the Task Force author and official scribe.