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Chapter 1

The Worth of Water in the United States

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“True conservation of water is not the prevention of its use. Every drop of water that runs to the sea without yielding its full commercial returns to the nation is an economic waste.”

—Herbert Hoover (1926)

On July 4, 1997, NASA's Pathfinder landed on Mars, and its little rover, Sojourner, captured the hearts and the imaginations of people around the world. In succeeding days and weeks, NASA's Mars Web site was overwhelmed with hits from curious citizens who were captivated by the crisp images that Pathfinder returned to Earth. Among its most significant scientific discoveries, Pathfinder offered clear evidence of the past existence of water on Mars. The images suggested that Mars may once have been a warm, wet place. The rolling terrain and variety of rocks offered testimony to an ancient past when Mars was beset by massive floods. These discoveries tantalizingly raise the possibility that there was once life on Mars. Billions of years ago, a thick blanket of carbon dioxide clouds may have kept the surface of Mars warm enough for a long enough time that life could develop. The prerequisite of life is liquid water.

Water is the essence of life, the core of chemistry, the prime component of the human body; it covers two-thirds of the surface of the earth. Without it, life ceases. With it, life can flourish. In the American Southwest, Pueblo societies cherished water. Its scarcity led them to pray to water deities in hope of rain. Peoples such as the Anasazi and the Hohokam (between 1000 A.D. and 1300 A.D.) developed irrigation systems to har-

ness this precious resource. They sought to cultivate sufficient food to subsist; they sought to adapt to the environment rather than to dominate it. Many native myths and traditions celebrated water as sacred, the lifeblood of Mother Earth.

In contrast, most Americans, even those of us living in the Southwest, take water for granted. Turn on the tap, and water flows for cooking and drinking. Jump in the shower, wash off the dirt, and feel refreshed. Turn on the hose to wash the car or water the lawn and garden. Most Americans' involvement with their water supply occurs once a month when they write a small check to the local water utility. Some cities do not even have a separate charge for water. In these cities, people are literally free to use as much water as they desire.

Why? We've been spoiled by excess. The European colonists of North America came to a continent with abundant, untapped natural resources, including water. Many settlers aspired to reap the economic value of those resources. To a considerable extent, the story of settlement involves the exploration, extraction, harvesting, and exploitation of these resources. It began with fur trappers and hunters, continued with gold and silver miners, then turned to mining copper, oil, and gas, to logging, and to commercial harvesting of salmon stocks. It has continued with water.

In the eighteenth century, the American colonists borrowed the English law of riparian water rights, the legal theory that owners of land abutting lakes, rivers, or streams were guaranteed the "natural flow without diminution or alteration" of the watercourse. The idea was that property was an estate to be enjoyed for its own sake and left undisturbed. In colonial America, surface water served mostly domestic needs that were relatively modest and did not involve large-scale diversion projects. By prohibiting consumptive uses or diversions of water, the natural flow doctrine served as a brake on economic development. Colonial entrepreneurs saw opportunities to harness the power of rivers for mills that would grind grain into flour or meal, but few in the American colonies wished to risk their capital without secure water rights. Recognizing this, legislatures and courts rejected the natural flow theory in favor of a rule of priority that protected the first entrepreneur against the claim of neighboring landowners to the natural flow. A river's water had become valuable as an instrument of economic development.

Although the rule of priority initially created an incentive to invest, it eventually threatened to retard economic development. In the nineteenth

century, as the country began to industrialize, New England developed textile factories that relied on the powerful force of moving water to turn the gears that determined the rotational speed of spindles. This use involved impounding large amounts of water behind dams to produce sufficient force to operate the textile machines as the water was released. However, the priority doctrine protected the small gristmill against the subsequent textile mill.

Once again, the law changed course. Courts now embraced the "reasonable use" doctrine which allowed consideration of "the usages and wants of the community." In other words, the economic benefit of a textile factory to the town suddenly outweighed the prior interests of the gristmill owner. At each step in this history, the legal rules changed to favor economic development. Property rights evolved from a static concept to an instrumental component of the industrial revolution. Note, however, that the textile factories didn't permanently remove the water. After impoundment, the factories released it back to the river to flow downstream.

That was not true of mid-nineteenth-century California, where the discovery of gold bred new uses of surface water. Miners diverted water from rivers and creeks, built canals to transport the water to reach their mining claims, and constructed sluices to wash the gold ore. As the water washed over the gangue, the heavier ore settled out. Mining involves a consumptive use of water; only a small percentage of water diverted into these canals ever returned to the rivers and creeks.

Most gold mining involved unauthorized incursions onto federal property, and it is not an overstatement to suggest that the miners stole gold from federal lands. In 1848, the military governor of California, Colonel Richard B. Mason, told a group of miners: "This is public land and the gold is the property of the United States; all of you here are trespassers, but as the Government is benefited by your getting out the gold, I do not intend to interfere." In reality, the colonel had little choice, given his meager military force.

The miners lawlessly diverted water from the rivers and creeks. In the absence of legal rules or procedures, the mining camps relied on their own sense of frontier justice. Which miner had a right to divert water from which river or creek and in what quantity? The miners developed their own system of water rights, a set of rules that profoundly impacted the entire American West, not just in the nineteenth century but also to this very day.

They created the prior appropriation doctrine, a more sophisticated version of the New England priority doctrine. The essence of prior appropriation is "first-in-time, first-in-right." The first miner secured the right to divert from a stream however much water he needed. The earliest efforts to mine obtained superior rights, fixed as of the date of diversion; later miners took what was left. The diverters were "senior" or "junior" to each other based on the date each miner first turned the stream to his purposes. Unlike riparian law, this doctrine did not require the appropriators to own property on the river or stream. The prior appropriation doctrine was especially critical during years of low precipitation, when only the more senior users would receive water.

Although the prior appropriation doctrine arose in the gold mining camps, it soon spread to agricultural areas. In the East, farmers cultivated small farms, and natural rainfall provided ample water for their crops. However, as settlers moved west, the land became more arid and, as a result, growing crops was impossible without additional water. Moving water from rivers and creeks to a farmer's fields often required a major effort, particularly when the fields were several miles from the water source. Like the eastern mill operators, western farmers were understandably reluctant to undertake that effort without assurance that they would be rewarded by a consistent and reliable supply of water. The prior appropriation doctrine became a bedrock principle in agricultural communities throughout the West: it guaranteed water rights to those who invested the energy and capital to use the water productively. It fostered economic growth by encouraging farmers to construct massive canals to bring water to their lands. In some communities it stimulated joint enterprises, known as mutual water companies or irrigation districts, to share in the infrastructure costs and attendant benefits. This doctrine has been the unalterable rule of water allocation, and it still governs most uses of surface water in every western state.

One characteristic of the prior appropriation system deserves special mention. Unlike the riparian system, which treated water rights as "correlative," that is, contingent on the amount used by others on the river, prior appropriation granted the right to divert a specific quantity of water. How much water? As much as the appropriator wanted, limited only by the requirement that the water be used for a "beneficial purpose," which meant basically any use at all. In an arid region, rewarding appropriators with rights to as much water as they could divert created enormous incen-

tives to maximize the diversions. Once the appropriator made the diversion, he now possessed a permanent legal right to that water.

Such an allocation system creates tremendous inefficiencies. It ignores the economic value of the activity, treating higher- and lower-value uses alike. It encourages economic speculation. It creates an incentive to hoard the resource because the appropriator need not pay for the resource. The government essentially gave away the water to anyone who could use it. Most importantly, allocating a specific quantity of water transformed water into a commodity, like gold or timber. The prior appropriation doctrine transformed water from a shared common resource into private property.

Over time, as western farmers irrigated additional lands with surface water, they diverted more and more water from rivers through their headgates, into their canals, and onto their fields. In many places, the farmers eventually exhausted the supply: the rivers dried up and remained dry until the next rainstorm. Additionally, many rivers became overappropriated, which means that the total quantity of water rights claimed by diverters exceeded the actual annual flow in the river. By 1898, diverters from the Boise River claimed rights to 150 times more water than the actual flow of the river. This anomaly led to the creation of the curious distinction between "paper rights" and "wet water." Perhaps only in the surreal world of western water is it possible to refer, with a straight face, to "wet water."

The prior appropriation doctrine had horrific effects. It allowed, for example, the complete dewatering of a river or creek. To early miners and farmers, the most important objective was the extraction of ore and the cultivation of land. If fish in a dewatered river died as a consequence, it seemed a small price to pay for progress. If dewatering caused the death of riverbank trees and shrubs or a decline in the number of animals and birds, those effects were accepted as inevitable by-products of the conquest of nature by human effort. Nineteenth-century settlers were not concerned with environmental protection, ecosystem management, or riparian habitat, nor did they have an aesthetic appreciation for the value of water in a free-flowing river or creek. To them, nature was to be explored, conquered, and tamed. Indeed, water law developed a curious doctrine of waste. A diverter could lose his prior appropriation right by failing to divert the water. Leaving water in the river did not conserve the water. It wasted it.

Remarkably, this system endures, though our interests and values have changed. We allocate enormous quantities of water to senior appropriators

so that they can grow low-value crops. They receive this water even though others could make better use of it. The prior appropriation system is so entrenched that courts and legislatures have not yet developed the final stage of the history of riparianism: a reasonable use system that balances the utility of new water uses against those of senior appropriation rights.

The rise of the prior appropriation doctrine is often attributed to the natural aridity of the American West. The hundredth meridian runs through the middle of North and South Dakota, Nebraska, and Kansas, divides the Oklahoma panhandle from the rest of the state, and continues down through the middle of Texas. The annual precipitation west of that line ranges between five and twenty inches per year (except for the Pacific Northwest), compared with thirty to sixty inches per year east of the hundredth meridian. Aridity alone, however, cannot account for the rise of the prior appropriation system because other, equally tenable, competing systems emerged in these arid lands.

Quite tellingly, several different ethnic groups in the West recognized water rights that differed profoundly from the prior appropriation system. In some Native American communities, including the Anasazi and the Hohokam during the first millennium A.D., and the Tohono O'odham, the Hopi, and the Western Shoshone more recently, water was a sacred element of their religions. Pilgrimages, songs, and ceremonies celebrate the regenerative power of water. These tribes conceived of water in communal, not individualistic, terms. In New Mexico and California, a unique form of water rights, called "pueblo water rights," developed during the period of Spanish and Mexican domination. Under pueblo water rights, the town, or pueblo, holds water rights in trust for the benefit of the entire community. To this day, in many Hispanic communities in northern New Mexico, the allocation of water through irrigation canals, called acequias, is administered by an elected official, called the majordomo, who assures that all members of the acequia association receive an adequate supply of water. The allocation is according to need, not according to priority. In Utah, the Church of the Latter-day Saints, whose members are better known as Mormons, developed a system of water rights that served religious interests. A centralized system of decision making led to the cooperative construction of thousands of canals that produced a flourishing agricultural community in the late nineteenth century. According to the church, the water belonged to the group, not to specific individuals.

So why did prior appropriation come to dominate water rights? Rather than being an inevitable function of aridity, the prior appropriation doctrine reflects the values that European settlers embraced concerning the role of government, the legal system, and the environment. In this nineteenth-century democratic society, government encouraged free enterprise, the legal system fostered private property rights, and the environment was used as an instrument of economic development. In the context of this set of values, the prior appropriation system served beautifully. It stimulated economic activity by rewarding entrepreneurs with secure property rights; it also encouraged the maximum utilization of water resources.

Aridity was nonetheless important. In the United States, political boundaries seldom conform to the boundaries of watersheds, which are ridges of high land that divide an area drained by one river from areas drained by adjoining river systems. In the West, many states are simply rectangular swatches of prairie, lines drawn on a blank map in utter disregard of topographical features. The first person to protest such an odd system was John Wesley Powell. Though best known as the first white explorer of the Colorado River through the Grand Canyon, Powell is equally important to history as an early director of the U.S. Geological Survey (USGS). In 1878, Powell prepared a report for Congress that explained the folly of attempting to dole out federal lands to settlers based on the Homestead Act's assumption that 160 acres was sufficient land for a family farm. In the West, everything turns on water. If one had access to water, 160 acres was an enormous amount of land, but without water, 160 acres would prove sufficient only to graze a few head of cattle. Despite the soundness of his reasoning and report, Congress disregarded his advice, and the country has ignored him ever since. Instead of honoring or respecting the boundaries of watersheds, we have engineered various projects that flout or challenge hydrologic reality.

Nowhere is the effort to conquer nature to suit human needs more evident than in the role of the federal government in harnessing and exploiting the waters of the United States, particularly in the West. The West has substantial surface flows produced by the winter snowpack that melts over the course of the spring season, filling rivers and streams. The problem for farms and cities is that these flows are not always available when they are needed. By summertime, these surface flows may be reduced to a trickle. In the state of nature, there is an abundance of surface water in the springtime, when little or none is needed, and a paucity of

surface flow in mid- to late summer, when the need is acute. The seasonality of this timing has been the prime impetus for creating dams. Dams create reservoirs, which serve as storage facilities, smoothing out the boom-or-bust cycle of surface water supplies by providing controlled flows that are available to downstream farmers when and as needed for their crops and to growing cities for municipal and industrial use.

Although humans have dammed rivers for centuries, the heyday of the dam-building era occurred in the twentieth century, when engineers, with considerable bravado and technological wizardry, dammed the most formidable and wildest rivers in North America. This era began with the classic effort to tame the mighty Colorado River with the construction of Hoover Dam during the 1930s. Set against the backdrop of the Great Depression, this engineering challenge dazzled the country. Although Hoover Dam is a remarkably beautiful example of art deco architecture, this technological success was achieved at no small cost: 112 men died during the effort. The creation of Hoover Dam led to a frenzy of dam building between the 1930s and the 1960s that resulted in the transformation of many of the great rivers in the West into storage reservoirs and hydroelectric generating plants. Such was the fate of the Columbia, Snake, Green, Sacramento, San Joaquin, American, Kings, Kern, Stanislaus, Salt, Gila, Verde, Missouri, San Juan, Gunnison, and, of course, the Colorado, all at the hands of engineers from the U.S. Bureau of Reclamation (Bureau) and the U.S. Army Corps of Engineers (Corps). The mighty Colorado, the once wild river that drew John Wesley Powell to raft its entire length in 1869, has become a set of storage reservoirs, a gigantic plumbing system under the control of the Bureau.

An obvious but important fact about dams is that it takes money, a lot of money, to build a dam on a major river. The private sector showed no interest in such undertakings because the risks were huge and the costs far outweighed the return on private capital. The Bureau and the Corps, whose allies included agribusiness and important members of Congress from the West, undertook such projects on behalf of farmers and cities. The immediate losers in these water projects were Native American tribes. Seldom did tribes obtain water rights from federal projects. Indeed, these projects frequently and profoundly damaged the agricultural economies on many reservations. By holding back melting snow waters until the summer, when they would be needed by Anglo farmers and cities, dams eliminated the historic springtime floods that created wide and fertile floodplains on

which many tribes depended to plant beans and corn. The subsistence agricultural economies of some tribes suffered because of dams.

Today, as a result of the dam building era, we move huge quantities of water out of watersheds, often to cities hundreds of miles away. To accomplish this feat, we have engineered pumping stations with pipes that go over mountains, drilled tunnels that go through mountains, used unlined canals through the sand dunes of the Imperial Irrigation District in southern California, and built a concrete-lined canal called the Central Arizona Project that moves water from the Colorado River east to Phoenix and eventually south to Tucson, a distance of 330 miles and almost 3,000 feet up in elevation. From the Colorado River basin alone, we supply water to areas outside the basin that include Denver, Albuquerque, Salt Lake City, San Diego, and Los Angeles. We literally move water uphill to wealth and power.

As the history of riparianism and prior appropriation suggests, legal rules promoted economic development and created private property rights in water. Alas, the rules encouraged waste and placed no importance on protecting the environment. Thanks to the federal government, enormous growth has occurred in areas that lack adequate water resources, such as Los Angeles. To achieve this growth, we have engineered an elaborate infrastructure that ignores Mother Nature's hydrologic boundaries at an enormous cost to the environment.