almost 50 percent of repayment costs would be liquidated by hydroelectric generation.

—Adam Eastman

See also: *Carpenter, Delphus E.; Colorado River Basin; Colorado River Compact of 1922; Interbasin Water Transfer; National Parks and Water; Roosevelt, Franklin D.; United States–Mexico Water Treaty (1944)*

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Colorado River Aqueduct

The Colorado River Aqueduct (CRA) conveys water from the Colorado River (at Lake Havasu/Parker Dam on the California/Arizona border) to Lake Mathews, which is near Riverside, California. Starting at an elevation of about 450 feet, water is pumped through 5 plants (a total lift of 1,617 feet) over 242 miles of dry, uneven terrain to a final elevation of about 1,350 feet. The CRA has 92 miles of tunnels, 63 miles of lined canals, 55 miles of covered canals, and 29 miles of inverted siphons. It has a rated capacity of 1,800 cubic feet per second (cfs), which means that it can move 1.3 million acre-feet of water per year. After entering service in 1941, the CRA played a critical role in southern California's post–World War II growth. Today, the CRA supplies 20 to 25 percent of the 4 million acre-feet of water used in urban southern California each year. (An acre-foot of water will cover one acre one foot deep; it's approximately 326,000 gallons or 1.23 megaliters of water.)

The CRA was built by the Metropolitan Water District of Southern California (MWD) between 1933 and 1941. MWD was formed in 1928 to build and operate an aqueduct that would bring water to a "parched" southern California. Although MWD promised that the CRA would relieve "imminent" water shortages, increase property taxes only slightly, create jobs, and "perfect" MWD's rights on the Colorado River, three of these claims were false. There was no shortage of water in the region as a whole, property taxes rose steeply, and MWD's water rights were cut from 1,212 thousand acre-feet (taf) to 550 taf in the 1963 *Arizona v. California* decision. The CRA did employ 10,000 workers—about 1.2 percent of all workers in the region. Nonetheless, voters believed MWD and approved the $220 million bond—the largest in the region's history—in September 1931. The CRA actually cost $190 million.

CRA pumps use hydroelectric power that travels over 237 miles of transmission lines from Hoover Dam. The Department of the Interior awarded 36 percent of the fifty-year contracts for Hoover power to MWD in April 1930—before MWD had the money to build the project that would use the power. Today, MWD has contracts for 28.5 percent of Hoover Dam's 2,080-megawatt capacity. These contracts are sufficient to pump 800 taf of water; MWD needs to buy power on the "open market" to cover the next 500 taf. Depending on volume and energy prices, it costs MWD $70–$100 per acre-foot to move water through the CRA. In comparison, MWD pays $135–$294 per acre-foot for water it buys from the State Water Project.

The CRA is significant in several ways. Like the 1913 Los Angeles Aqueduct (LAA, 485 cfs capacity) and the 1934 Hetch Hetchy Aqueduct (HHA, 465 cfs capacity), it brings water to urban areas. Unlike these gravity-flow aqueducts, it uses pumps to move water. Further, the CRA was put into operation without any firm customers. The LAA was built for existing municipal and industrial users, and HHA was built for municipal and industrial users in the San Francisco Bay Area.

The CRA's "supply without demand" character emerged from conflicting needs. Although Los Angeles had plenty of water from the LAA, it ran the LAA at full capacity to generate power. The city used its "surplus" water as a reward to neighboring areas that agreed to annex to the city. Between 1910 and 1932, Los Angeles grew from 90 to 450 square miles. Robert Townsend's 1974 film *Chinatown* portrayed the manipulation of water shortages by land developers using imported water in a fictionalized plot that mixed the histories of the LAA and CRA. Los Angeles wanted the CRA and put up the money to study the idea and form MWD only because the CRA made Hoover Dam—and its generating capacity—more likely. Neighboring cities (e.g., Pasadena and Burbank) wanted a water supply that was not controlled by Los Angeles. They made a deal: Los Angeles would provide money; the other twelve founding members of MWD would provide political support in the state capitol and Washington, D.C. Los Angeles got 19 percent of the contracts for Hoover power in 1930 and gets 15.4 percent today.

The trouble began when the per unit cost of CRA water turned out to be roughly three to five times the cost of local

water. At breakeven prices, demand was weak: MWD projected sales of 400 cfs but only sold 20 cfs in 1942. MWD's solution—subsidized prices and expansion—eventually created demand but also established a precedent of cheap water and sprawling urbanization that continued into the 1980s.

On a positive note, nobody claims that the CRA harms the environment—unlike the LAA or HHA. That's because everyone assumes that the Colorado River will be diverted. Colorado overallocation originates with a badly designed Colorado River Compact.

For current residents of southern California, the CRA is a valuable source of water for their increasingly drought-prone region. Unfortunately, they may not understand that the CRA probably increased demand more than supply. Put differently, the CRA's development made today's shortages *more* likely.

—David Zetland

See also: Arizona v. California *(1963); Boulder Canyon Project Act (1928); Colorado River Compact of 1922; Hoover Dam*

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Colorado River Basin

The Colorado River Basin is the watershed straddling the Colorado River. The Colorado River serves seven western states within the United States (Colorado, Wyoming, Utah, New Mexico, Nevada, Arizona, and California) as well as the Mexican states of Baja California and Sonora; the latter comprise just 2 percent of the total watershed. Though small compared to many larger North American rivers, the Colorado River is a vital water source for the basin's inhabitants and its fauna and flora, making it one of the most intensively utilized rivers in the world today.

From headwaters in the Rocky Mountains, the Colorado runs 1,450 miles to empty into the Gulf of California. It is served by a watershed of 246,000 square miles. Along its course, the river is joined by numerous tributaries, including the Green, Yampa, Gunnison, Dolores, San Juan, Little Colorado, Virgin, and Gila Rivers and numerous lesser streams. Its average annual flow of 15 million acre-feet (maf) is just 3 percent of the flow of the Mississippi River, but its location in the arid Southwest has historically amplified its economic and social importance.

The Colorado River traverses diverse geographic zones in its descent. Its headwaters are across the Southwest from Utah and Wyoming through Colorado to the Gila Range in New Mexico and Arizona and reaching as far south as Sonora in Mexico. Mountain peaks in the central Rockies rise above 14,000 feet. At midbasin, the Colorado River cuts spectacularly through the sandstone buttes and mesas of Colorado, Utah, and Arizona, where it carves the landscapes of the Grand Canyon, Canyonlands, Arches, Bryce, and Zion National Parks and numerous other parks. Below Arizona's Mogollon Rim, the basin drops sharply to the Sonoran Desert where scant precipitation and extreme temperatures prevail.

Harnessing the river's waters has been central to regional development. The Colorado River supports many of the region's most productive agricultural areas and its largest cities (Las Vegas, Nevada; Phoenix, Arizona), including cities

Water Education Foundation

The Water Education Foundation is a nonprofit organization based in Sacramento, California. Founded in 1977, its primary mission is to foster an impartial understanding of all aspects of water issues and to assist in the resolution of water resource problems in California and other western states. The foundation creates easy-to-understand educational materials that it targets towards three distinct audiences: government officials who make water policy; advocacy groups, businesses, and officials in urban population centers that are involved in addressing the respective water needs of their primary constituencies; and the general populace. Information intended for lay citizens is often distributed through media outlets, such as newspapers and periodicals. The organization also disseminates data through its website, research reports, videos, and other publications. Its best-known publications are the bimonthly periodical *Western Waters,* which began publication in 1977, and the biannual report entitled *River Report,* which focuses on the Colorado River Basin.

—John R. Burch Jr.

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