Water—The Unavoidable Constraint?

"What California has experienced in the last five years could be characterized as a God-made drought, but a man-made shortage."

The session, chaired by Caltech's Norman Brooks, Irvine Professor of Environmental and Civil Engineering, included James Bonner, professor of biology, emeritus; Duane Georgeson, assistant general manager of the Metropolitan Water District of Southern California; James Morgan, Goldberger Professor of Environmental Engineering Science; and Zach Willey, senior economist with the Environmental Defense Fund.

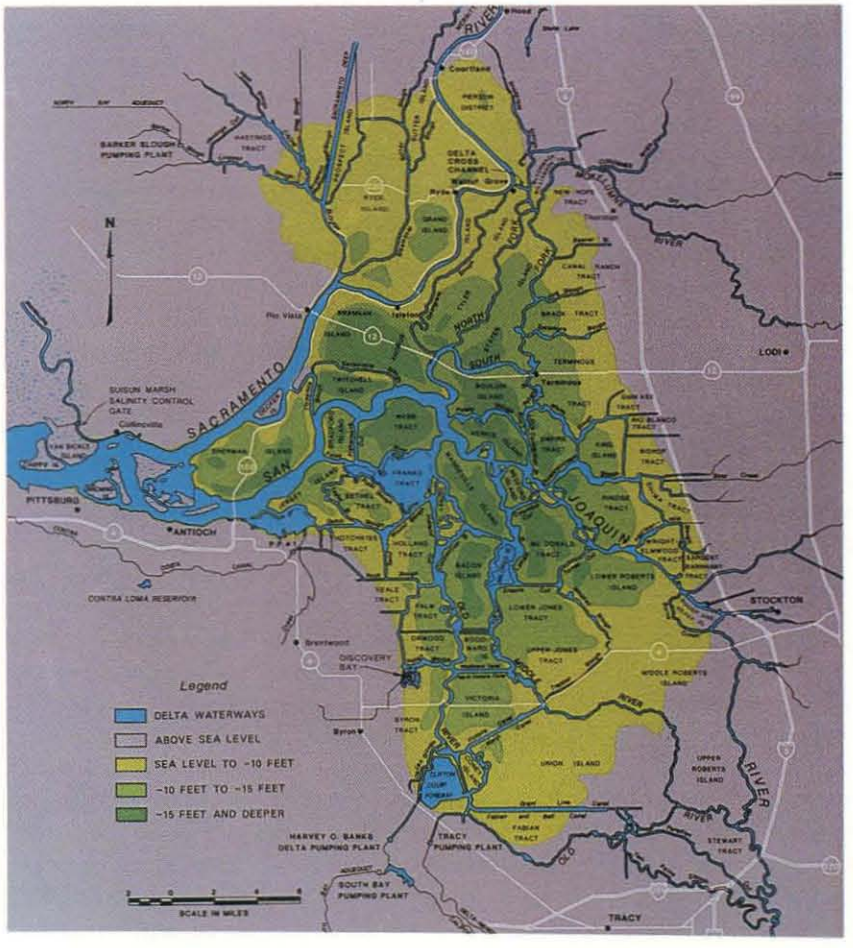
Norman Brooks introduced the session by remarking, "Although most of the water is up north, most of the people are down south. And that only gives you two policy choices—either you move the people to where the water is or you move some water to where the people are."

Zach Willey suggested transferring water from agriculture to the cities and to the environment. "What California has experienced in the last five years could be characterized as a God-made drought, but a man-made shortage." Roughly 70 million acre-feet of water runs off California watersheds each year. (An acre-foot of water—approximately 326,000 gallons—covers an acre of flat land to a depth of one foot, and is sufficient to supply the needs of three average families for a year.) Of that, roughly 40 million acre-feet gets diverted to agriculture and the cities. About 28 million acre-feet irrigates the San Joaquin Valley, and some four million the Imperial Valley and other southern areas. Less than eight million acre-feet goes to the cities. "There's more water used to water feed for livestock than there is to water people in the cities. But there's a complex set of legal, political, and institutional barriers to reallocating water from agriculture.

The Edmonston pumping plant on the California Aqueduct near Grapevine lifts water over the Tehachapi Mountains to Los Angeles.

"Water markets are an economist's dream. As early as the 1950s, economists wrote about the arbitrage potential of shifting water from agriculture uses to city uses." Water from the federal Central Valley Project, which was built for irrigation, costs as little as $10 per acre-foot, yet Los Angeles gets it wholesale from the Metropolitan Water District for $322 per acre-foot. So the incentive for trade exists, but, according to Willey, California's water law is at the tail end of the pack. There's confusion about who owns what, compounded by ambiguous state laws and complicated by third-party claims by environmentalists or other groups whose interests may be affected by the transaction. And should environmental interests compensate other water-rights holders for leaving their water in the river? Wildlife protection is only one environmental use and some of the others, such as white-water rafting and fishing, are big business.

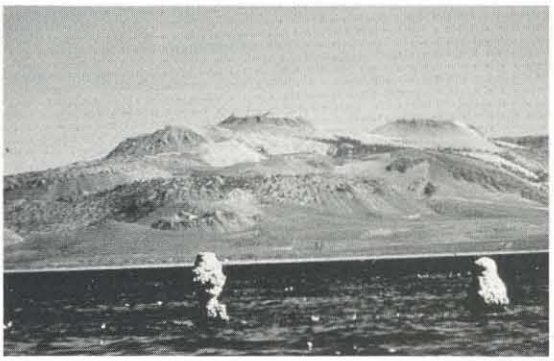
Willey is optimistic that the logjam is going to break. The Omnibus Water Act, signed by President Bush on October 30, 1992, for the first time permits California cities to buy federal water. This water would fetch the sellers—individual farmers and irrigation districts—a price enabling them to finance conservation and more efficient irrigation methods. And the water they save, they can sell—an incentive to finance efficient agriculture. "There aren't a lot of tax breaks to subsidize farmers to increase their efficiency. It's not easy, particularly in Washington, to get subsidies for farmers—there's a feeling that farmers have been subsidized long enough." (The Act has other provisions for California, including setting aside a guaranteed 800,000 acre-feet per year—nearly 20 percent of the project's capacity—to restore habitat damage caused by previous water diversions, establishing a $50-million-per-year fund for environmental repair, paid from water and power sales from the project, and ending automatic renewals of 40-year water contracts to farmers at 1940s prices.)

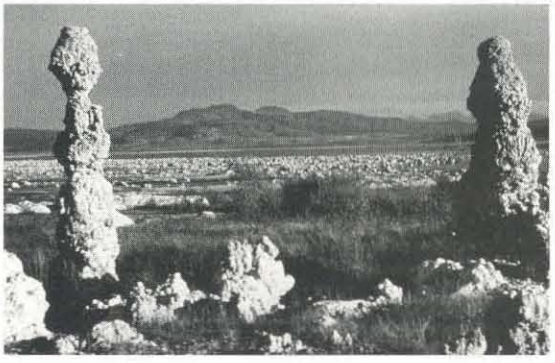


Willey noted that in Arizona and other states where water transfers occur, some constituencies equate water marketing with promoting growth. "In fact, they're equating water conservation in general with freeing up water for new growth." He sees them as a minority, however, noting that water transfers have many partisans, including environmentalists who want to restore habitats. "Maybe 50 years down the road water marketing won't be taken as an attack on agriculture. In fact, water marketing gives an opportunity for those who can conserve water, or who have marginal land such as irrigated pasture in production, to trade that water and increase the efficiency of their operations. I think there is so much fat in the agricultural-water system that marketing won't touch high-value agriculture."

The Sacramento-San Joaquin Delta, where water is diverted away from the San Francisco Bay and down the aqueducts, is the north-south conflict in a nutshell. Pitched battles over its development have been fought, and will be again. The environmental consequences of diversion are readily apparent: there is less fresh water outflow through the bay to repel the salt water. "Reversals in currents are caused by the way the pumps suck water around the delta islands and back. That's bad for everybody. It's bad for drinking water because it picks up more salt. It's bad for fish because they get confused—the currents are going the wrong way."

Declining populations of several indicator species reflect the delta's health. As water is diverted through the pumping plants, salt water from the ocean intrudes into the bay, and the striped





Opposite page, top: The waterscape of California. Bottom: The Sacramento-San Joaquin Delta.

Above right: Mono Lake in the 1940s (top), 1968 (middle), and 1982 (bottom). Diverting water from the lake's feeder streams to Los Angeles had lowered the lake's water level some 44 feet by 1982. Below: This underground drain was installed near Kesterson to collect runoff water from irrigated agriculture.

bass count declines. "Now with any biological population, you have multivariant causes. Diversion of fresh water from the feeding habitat could be one, but there can be others. Pollution by people in the Bay Area, for example. San Francisco Bay is not by any means a pristine estuary. It is a highly developed estuary and it's been kicked around really hard. Much of it has been filled over the years. The estuary has taken hits, not just from the south but from the north as well." The Dungeness crab, another indicator species, used to have a rich fishery in San Francisco Bay. About the time that fishery vanished, the fishery off Mendocino to the north burgeoned. "So did they die or did they move? I don't know. The point is that environmental arguments are not open-and-shut cases, and that's one reason why the state's bogged down."

But these environmental arguments do affect water rights. In 1989, the National Marine Fisheries Service declared the Sacramento River's winter Chinook salmon run an endangered species, the first migratory-fish run determined to be endangered on the west coast. (Others have since been proposed.) That run "is down to hundreds of individuals now, and there's a debate raging about how to manage Shasta Dam and other facilities to control flows and temperatures in the Sacramento River. And that has implications for the bay and for the water supply for farming and the cities." The Los Angeles Aqueduct, for example, diverts water from the streams leading to Mono Lake, reducing the water level in the lake. In 1983, *Audubon v. Los Angeles*—and subsequent court rulings—restricted the amount of water that the aqueduct could take. The ruling essentially said that Mono Lake is a public-trust resource, and water rights restricting its inflows must be re-evaluated. "The implications for people with established water rights aren't known. And it's that kind of uncertainty that makes it very difficult to engage in orderly water-rights transactions in the way that we would sell real estate, or other assets that have clear legal title."

Once the water has been used, for whatever purpose, some of it—now laden with additional salts and other contaminants—ultimately gets back into the system through drainage channels or outfalls. Irrigating regions that have been dry for millennia can cause other problems, as happened near Kesterson Reservoir, in the western San Joaquin Valley. Marine sediments in the subsurface strata began to leach out through the underground drainage system, and trace elements, including selenium, wound up in the San Joaquin Drain, which formerly terminated in the Kesterson Wildlife Refuge. The water evaporat-

ed, concentrating the selenium. "Ironically, Kesterson was originally intended as mitigation for habitat loss in other parts of the Central Valley project, and it wound up having toxic levels of selenium coming from subsurface drains installed to take off drainage water from the irrigated agriculture." In 1982, it was discovered that the nesting waterfowl were laying eggs containing embryos deformed by the selenium. Kesterson was closed, but the drainage problem hasn't been solved. "We've just finished a five-year, $50-million federal task force to try to decide what to do, but as is common in California water right now, there's stagnation."

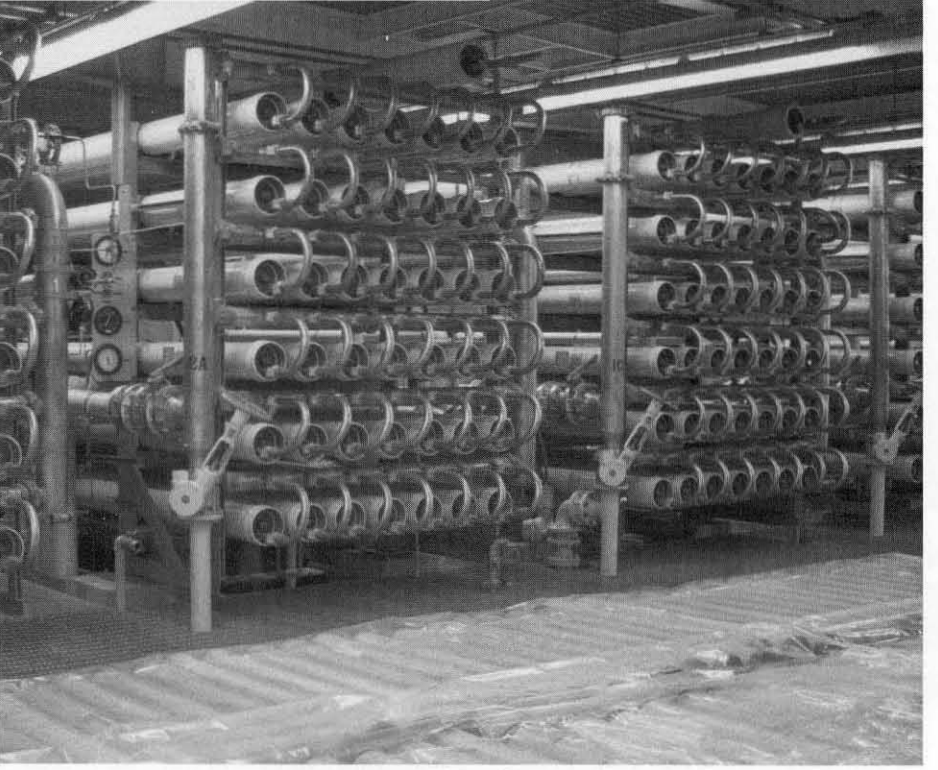
James Morgan pointed out that water quality and water quantity are intertwined. Water analysis is a highly developed science, but "measurements of water quality by professionals and perceptions of water quality by the public are often two different things. It is my perception that the general public is frequently well ahead of the experts in guessing where the next water-quality problems will be."

"We need to worry not only about deterioration under increased use, but our ability to anticipate and cope with unexpected hazards."

Many natural processes and human activities affect water quality. Precipitation washes airborne pollutants to earth. Runoff and infiltration pick up dissolved minerals from weathered rock and soil, and evaporation concentrates them. "The Colorado River has a total dissolved mineral content of about 600–700 milligrams per liter, or parts per million. If we were carrying those salts to southern California in a railroad train instead of an aqueduct, we would be carrying about 2,000 tons a day, something on the order of 60 railroad cars. In contrast, if we were carrying nitrates, we'd only need a truck. And if we were carrying the dissolved lead, we would need a teacup." Plants draw water out of the soil, leading to salt buildup. And some biological processes are profoundly affected by human activity. For example, eutrophication—the buildup of plant nutrients in standing water—is greatly disturbed by urban and agricultural runoff. Excessive eutrophication causes algae blooms that deplete the water's dissolved oxygen, killing the fish. And domestic wastewater includes other wastes besides the usual sewage. "A number of bad-actor chemicals, inorganic and organic, end up in our wastewaters because of their household uses." And, as San Francisco Bay shows, mixing salt and fresh water changes the salinity, the dissolved organic content, and other parameters of the water, often making it unusable.

On July 14, 1991, a train derailed along the Sacramento River north of Lake Shasta. A tank car spilled 13,000 gallons of the herbicide metam-sodium (sodium methyl dithiocarbamate) into the water, which reacted with it to form the deadlier MITC (methyl isothiocyamate), destroying stream life for 40 miles to the entrance to Lake Shasta. MITC, a volatile compound, also got into the air, affecting the residents of nearby Dunsmuir. "I think that's an illustration of what the future of water quality may be. We need to worry not only about deterioration under increased use, but our ability to anticipate and cope with unexpected hazards. [See "Contemplating the Unexpected" in the Spring 1992 *E&S.*] In a 1987 EPA document called *Unresolved Future Issues,* one of the environmental hazards identified was the possibility that a truck or train would go off the track and spill a large amount of some harmful compound into a freshwater system." At Shasta, fortunately, dilution downstream and natural degradation—primarily by sunlight—prevented significant quantities of MITC from entering the lake, although "EPA scientists reported—off the record—that residual amounts were found in lake sediments. The regulatory irony of the episode is that metam-sodium was not regulated in transportation rules, although the *product* [MITC] is well-known as a hazardous material. The agencies concerned with applications knew that, and indeed, were probably well on the path to regulating the source chemical as well."

Analytical technology and treatment technology evolve in parallel with the technological advances that put increasingly exotic pollutants in our drinking water. In the late 1800s, disease-bearing bacteria and viruses were the main concern. These biological issues were laid to rest with the successive introduction of filtration and chlorination to remove bacteria and to destroy viruses. Now chemical content is the issue. Morgan ticked off a list of pollutants: heavy metals ("There's been considerable discussion about making the lead standard stricter, based on medical evidence, and I predict we'll see greater attention paid to chromium in the next 10 years, as chromium from hazardous-waste sites and household trash landfills finds its way into groundwaters unintentionally as a result of questionable practices."); pesticides and herbicides; solvents including trichloroethylene and benzene, the latter of which "even shows up occasionally in water imported from France"; and various other organic chemicals such as PCBs (polychlorinated biphenyls). Recently, byproducts of disinfection became an issue, when it was discovered that chlorine reacts with the decay products of agricultural and natural runoff to form chloroform and other trihalomethanes. And radioactives such as alpha emitters and radon-222 are a concern. Basic physical issues, including the



This reverse-osmosis unit can remove the dissolved salts from 5 million gallons of treated municipal wastewater per day. It is part of a multiple-stage system at the Orange County Water District's Water Factory 21, an advanced water-reclamation plant. The water is purified to drinking-water standards, then injected into the Orange County groundwater basin through a series of wells. The process replenishes the groundwater basin, from which 70 percent of the county's water is drawn, and prevents seawater from flowing into the basin and contaminating it.

"The balance swings between birds and people—the trick is to keep your eye on both concerns at the same time."

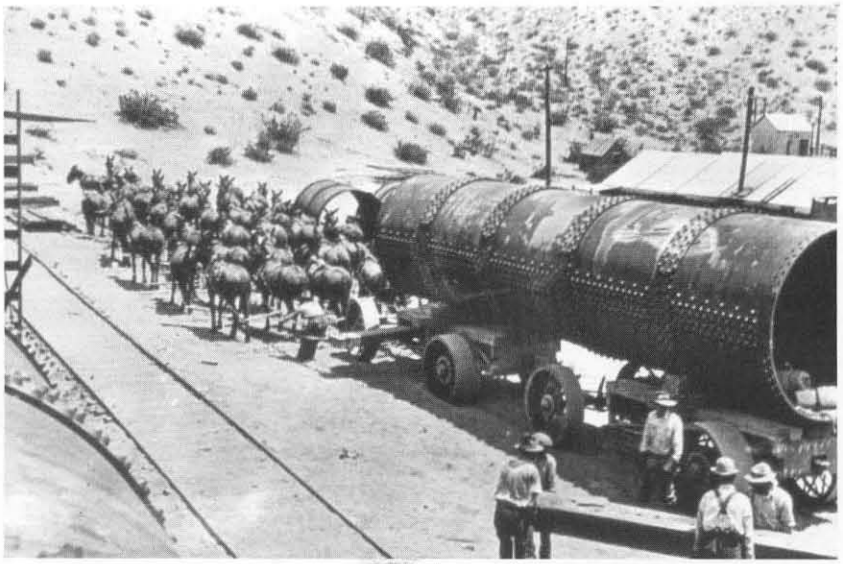
clarity of the water, as well as its color, temperature, taste, and odor, also remain—what water purveyors call aesthetic considerations. These aren't inimical to health, but make the water supply appealing and determine whether it's used.

"It might be instructive to take a historical glance at drinking-water quality standards. In 1925 eight inorganic chemicals had standards set, plus bacteria, clarity, and odor. In 1942, the list included 12 inorganic chemicals, one organic chemical—chloroform—and the bacteria and the aesthetic considerations. By 1962, the requirements comprised 17 inorganic chemicals, three organic chemicals, and, for the first time, three radioactives. In 1990, the standards totaled 22 inorganic chemicals, 43 organic chemicals, eight radioactives, and now foaming agents. It's likely that by the end of this century, there will be well over 100. You can trace the history of modern times in the water standards. Every water utility, public or private, must publish an annual report on the quality of the water distributed to the consumer. We're a highly regulated society with respect to water quality. Our tap water is safe. It's a different matter, of course, whether the water is aesthetically pleasing, and that may be one reason why some people prefer bottled water.

"It's my opinion that much less attention has been given to the scientific basis for the water quality needed to protect ecosystems than has been given to the scientific basis for protecting human health. Ecosystem water-quality science is still in a catch-up mode. That's part of the difficulty in understanding the quality issues in the bay-delta system." Ecosystem health can be affected by disturbances of natural flows of carbon, phosphorus, nitrogen, and acidity; sediment loads that influence light; and man-made chemicals such as PCBs and the even more toxic things that these may transform into. "Twenty years ago, human toxicology and ecotoxicology were more in balance. But ecotoxicological criteria were perhaps oversold in the 1972 Clean Water Act, and there's been a subsequent backlash in that ecologically based standards didn't always give clear-cut results. The balance swings between birds and people—the trick is to keep your eye on both concerns at the same time.

"The traditional approach of developing and protecting high-quality water sources will not be sufficient. The challenge will be the management of complex issues. Models that relate water quality to water quantity and chemistry to biology will play a larger part in decision making in the next century. Maintaining water quality is going to require more accurate measuring of a variety of things. Many people have said that this is going to be the information society, and this will be especially true of environmental decision making.

"California's surface reservoirs hold perhaps 45 million acre-feet, whereas the groundwater reservoirs, developed and undeveloped, hold something close to 800 million acre-feet. I think they'll increasingly be used to store water, avoiding evaporation loss. Where the character of a particular contamination is well-defined, there will be a very strong impulse to perfect the technology required to treat it." (Duane Georgeson pointed out that desalting, via reverse osmosis



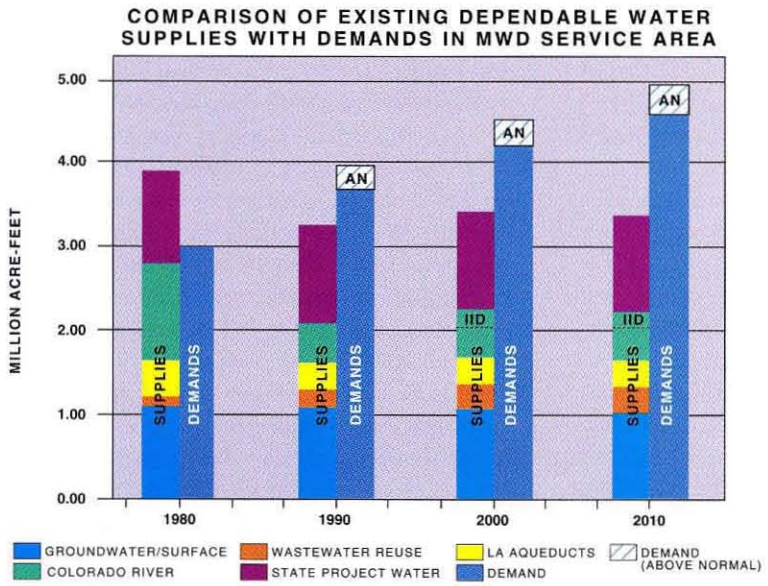
Above: The Los Angeles Aqueduct under construction. Below: Workmen building the Colorado River Aqueduct's San Jacinto Tunnel. The tunnel, which pierces the San Jacinto Mountains, is some seven miles long.

and electrodialysis, is already prevalent in groundwater basins that are brackish or have high nitrate levels. Desalting for drinking water, as on Catalina Island, is much rarer.) Morgan predicted that the already extensive reclamation and reuse of waste water will expand as the water-quality criteria for different uses become sharpened, and the risks of agricultural, recreational, and drinking-water uses become scientifically understood and technologically controllable.

Georgeson used the Metropolitan Water District of Southern California (MWD) as an exemplar of how growing demand can be met with shrinking resources. He started with a history and geography lesson. MWD was created by the state legislature in 1928, originally to finance, construct, and operate the Colorado River Aqueduct. It's composed of 27 member agencies: 14 cities such as Los Angeles, Santa Monica, and Pasadena—the smallest being the city of San Fernando—and 13 districts, starting in Ventura County and stretching south to the San Diego County Water Authority. It supplies supplemental water to about 95 percent of the people living in the coastal plain.

Several aqueducts supply water to southern California. The initial one, the Los Angeles Aqueduct, completed in 1913, "was the first great experiment in water marketing in California. Zach would probably say it went a little too far, in terms of setting a good precedent. In 1906, President Theodore Roosevelt made the judgment, based on the greatest good for the greatest number, that the water from the eastern Sierra would be better used by being exported to Los Angeles." Number two is the Colorado River Aqueduct, conceived when Hoover Dam was being planned. The aqueduct starts farther downriver, where Parker Dam created Lake Havasu. A series of canals, pipelines, and six pumping plants brings the water to Lake Mathews, south of Riverside. "In an era when the financing of water projects is controversial, particularly during a recession, it's interesting to note that this project was approved by the voters of southern California in 1930, just as the Great Depression was beginning, and that it was built to provide a future supply to this area." The third, the State Water Project, approved by a razor-thin majority in a statewide vote in 1960, begins with Oroville Dam and reservoir on the Feather River at the north end of the Sacramento Valley, and eventually the California Aqueduct brings the water to Pyramid and Castaic Lakes in the mountains north of L.A. "The costs of these projects tend to go up by a factor of 10. The Los Angeles Aqueduct was built at a cost of $22 million, which was a huge sum of money in 1913. The Colorado River aqueduct was built at a cost of $220 million during the Depression, and the State Water Project, in the 1960s, cost approximately two billion dollars."

Southern California gets about two-thirds of its water from pipelines and the rest from local groundwater basins, which helps regulate the consumption of imported water. "Currently, the total water use in our service area is a little under four million acre-feet a year, or about four billion gallons a day. The existing aqueduct systems, together with the local groundwater basins, are capable of supplying about five million acre-feet. So where's the problem? The problem is that those imported sources, and even our local supplies, are no longer reliable." The Los Angeles Aqueduct delivered nearly 0.5 million acre-feet per year for the last 20 years. Currently, because of environmental issues—Mono Lake litigation and Owens Valley groundwater problems—it supplies less than 200,000. The Colorado River Aqueduct has been running at 1.2 million acre-feet for 25 or 30 years, but about half of that supply will soon go to Arizona, as that growing state



Southern California's dwindling dependable water supply, plotted next to southern California's burgeoning water demand, assuming that water-conservation measures are not invoked. The "above-normal demand" represents a worst-case projection. The piece of the green bar above the dotted line labeled IID is the water MWD plans to acquire by paying to line the All-American Canal.

"The courts are sometimes seen as a way to find resolution, although you have to make sure you start with young attorneys because the litigation frequently lasts a long time."

exercises its water rights. Southern California has rights to two million acre-feet from the State Water Project, which in 1991 barely met 15 percent of its obligations, due to the drought. "During the 1980s, southern California's reliable supply dropped to about 3.3 million acre-feet, while our use grew from about three million acre-feet to four million. The two lines crossed."

And the local supply is subject to groundwater contamination. Many coastal, and some inland, areas have high mineral content from seawater intrusion or agricultural drainage. There's nitrate buildup around the dairies in the Chino basin and in other agricultural areas. And there's extensive solvent contamination in many places, including the San Fernando and San Gabriel valleys, and around Burbank Airport.

Georgeson outlined MWD's strategy to restore reliability through demand management, wastewater reclamation, water transfers—primarily from agriculture—and infrastructure improvements. "We've just reached a milestone agreement after two years of hard work with six urban water agencies in the Bay Area, including the city of San Francisco, and half-a-dozen water agencies from southern California, along with groups like the League of Women Voters, the Sierra Club, and the Environmental Defense Fund. In some respects, it's not that the water agencies are able to work with the environmental groups that's surprising, but that the agencies in the Bay Area and southern California are working together." The agreement includes promoting water conservation at the consumer level—such things as giving away low-flow shower heads, rebates on water-saving washing machines, and consulting with industrial customers on improving the efficiency of their water use—a radical departure from the old mindset of selling all the water the customer could swallow. And MWD encourages its subagencies to do likewise. "We pay up to $154 per acre-foot to subsidize wastewater reclamation projects. Reclaimed water can irrigate golf courses, cemeteries, parks, playgrounds, and freeways, and can recharge groundwater basins. We have a similar subsidy on water conservation, for things like retrofitting ultra-low-flush toilets. California as a state may be lagging, but southern California is making significant strides in water transfers. We will pay the Imperial Irrigation District about $128 million to line some of their canals, and in return we'll get the 106,000 acre-feet of water per year this will conserve. We have a similar program to pay the federal government around $100 million to line the All-American canal and save perhaps another 75,000–100,000 acre-feet. We have another innovative program whereby we'll be storing water in the Arvin–Edison District south of Bakersfield. In wet years, we'll store water in their groundwater basins, and in dry years they'll pump it out with facilities we will build for them. In return, we'll get some of their surface water. Our efforts should net us almost 400,000 acre-feet per year by 1994, growing to about 700,000 acre-feet per year by 2010. That's more than the total water use in the city of Los Angeles. But there are a lot of uncertainties, because these projects usually involve negotiations with many other players to solve institutional, legal, financial, and water-quality problems.

"We've been on hold for 15 or 20 years while the different interests—agriculture, the cities, and the environmentalists—all saw water management in terms of meeting their own needs, with no one group strong enough politically to have its way. As a result, there's been a deterioration in the reliability of southern California's water supply, with water rationing this year for the first time, really, in history. And agricultural areas throughout California are living on short rations, and mining their groundwater basins."

Georgeson sees conflict resolution through negotiation as the way of the future, along with making better use of our resources, especially the groundwater basins. "The courts are sometimes seen as a way to find resolution, although you have to make sure you start with young attorneys because the litigation frequently lasts a long time. The city of Los Angeles just signed an agreement with Inyo County on restricting groundwater pumping in the Owens Valley,

"We live in a postindustrial society. But there has never been a postagricultural society. Everybody still eats."

ending a lawsuit filed 19 years ago. And Colorado River litigation, needless to say, is job security for a lot of attorneys up and down the river."

Similar negotiations between the agricultural water agencies, the urban water agencies, and about a dozen environmental groups are trying to resolve the delta's problems. "A key part of resolving the issue of how to build and operate facilities in the delta is to provide some kind of permanent guarantee that could not be upset by political processes, or even by a vote. And so a lot of attention is being given to institutional mechanisms—perhaps some kind of contract that would lock in guarantees protecting the fisheries and other environmental values. The delta is an area of great conflict, but if it's going to continue as the source of drinking water for the 20 million Californians in the north and south who depend on it today, we're going to need better facilities."

MWD's major new construction project is in line with their get-more-from-less approach—an off-stream reservoir in Riverside County near Hemet to store water in wet periods for use in dry ones, and to recharge local groundwater basins. It will store water that becomes available from the Colorado River or the state water project in wet winters. "We don't have room in our spreading grounds. Typically, if it's raining in northern California in the winter, it's raining in southern California. So we'd fill this new reservoir in the wintertime and then transfer that water to groundwater basins in the spring, summer, and fall."

The Colorado River Aqueduct crosses an awful lot of desert to bring water to the cities of southern California.

Regional and state planning agencies have recently raised the population projections upon which MWD bases its plans. "So now, even with these programs, there would be many dry years when we will continue to be in the market to buy large quantities of water from agriculture."

James Bonner went to bat for agriculture. "We live in a postindustrial society. But there has never been a postagricultural society. Everybody still eats. The recent history of California agriculture is Orange County, which used to be a monolayer of orange trees as far as the eye can see. We've cured it of that. And before that, Los Angeles County was the biggest single agricultural produce-producing county in the United States. We sure cured L.A. County of that, too. Agriculture was the biggest producer of export revenue for California—about an $18-billion-per-year business—before we embarked on making defense equipment. Today, we have left the great Central Valley and the Imperial and Coachella valleys further south, in the region of the Salton Sea. These are incredibly productive agricultural areas—high-technology, sustainable, irrigated agriculture that doesn't salinize the soil. Zach said that we use this water to grow low-value feed for animals. Most of that is alfalfa. Alfalfa produces more protein per acre than any plant or animal we know of. It's a complete diet—human beings could live on alfalfa if they just would. All the amino acids, the vitamins, everything you need is in alfalfa. That's why it's grown to feed animals. We also produce high-value crops such as a specialized variety of cotton, sold with guaranteed physical specifications—fiber length, fiber strength, and so forth. It's what Levi's jeans are made of, and is sold in vast amounts to Japan to make high-fashion clothes. We grow fruits, raisins, fresh grapes—all kinds of goodies—and the Imperial and Coachella valleys produce all sorts of nice vegetables for the winter season.

"Now it's true that these crops use water. So I had thought that our last protection against infinite population growth would be that we'd share the water between agriculture and the cities, and the amount left over from agriculture would determine how many people we could accommodate. But it looks like people are getting priority, and that's what I'd like to head off if we can. Farmers *do* get water cheaply. We can increase the price. I would argue as the Japanese government does: they're very particular about maintaining their ability to grow rice, so that if they ever need to, they can still grow their own. Let's keep our little bit of agricultural productivity alive so that when the time comes, we can grow our fruits and vegetables ourselves."

Georgeson noted, "As a matter of fact, intensive agriculture in the San Joaquin Valley uses 2.5–3.5 acre-feet per acre, and water use in a typical urban area in California is about the same. So you could convert all of the agri-use in the San Joaquin Valley, and get enough water for 100 million people, God forbid. My own view is that controlling population or managing growth is an exceedingly difficult subject that's tied up with national immigration policy, the economy, etc."

Willey had the last word. "I think we can balance all these competing uses and still have plenty of water for growth. We don't always use the same amount of water per unit of gross-national-product growth. Technology changes. Incentives change. We can accommodate a different type of growth using a lot less water and a lot less natural resources. That makes me feel fairly bullish that in the next 50 years, we can restore much of the environmental damage, take care of a lot of people, and still have agriculture. I think we're very lucky. We've got lots of options, and water, I think, is not the issue in California. Other constraints are the issue." □