

OZYMANDIAS

I met a traveller from an antique land
Who said: Two vast and trunkless legs of stone
Stand in the desert . . . Near them, on the sand,
Half sunk, a shattered visage lies, whose frown,
And wrinkled lip, and sneer of cold command,
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them, and the heart that fed:
And on the pedestal these words appear:
"My name is Ozymandias, king of kings:
Look on my works, ye Mighty, and despair!"
Nothing beside remains. Round the decay
Of that colossal wreck, boundless and bare
The lone and level sands stretch far away.

PERCY BYSSHE SHELLEY

MARC REISNER

CADILLAC
DESERT

The American West
and Its Disappearing Water

REVISED AND UPDATED



PENGUIN BOOKS

For Konrad and Else Reisner

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CHAPTER THREE

First Causes

When archaeologists from some other planet sift through the bleached bones of our civilization, they may well conclude that our temples were dams. Imponderably massive, constructed with exquisite care, our dams will outlast anything else we have built—skyscrapers, cathedrals, bridges, even nuclear power plants. When forests push through the rotting streets of New York and the Empire State Building is a crumbling hulk, Hoover Dam will sit astride the Colorado River much as it does today—intact, formidable, serene.

The permanence of our dams will merely impress the archaeologists; their numbers will leave them in awe. In this century, something like a quarter of a million have been built in the United States alone. If you ignore the earthen plugs thrown across freshets and small creeks to water stock or raise bass, then fifty thousand or so remain. These, in the lexicon of the civil engineer, are "major works." Even most of the major works are less than awesome, damming rivers like the Shepaug, the Verdigris, Pilarcitos Creek, Mossman's Brook, and the North Fork of the Jump. Forget about them, and you are left with a couple of thousand really big dams, the thought of whose construction staggers the imagination. They hold back rivers our ancestors thought could never be tamed—the Columbia, the Tennessee, the Sacramento, the Snake, the Savannah, the Red, the Colorado. They are sixty stories high or four miles long; they contain enough concrete to pave an interstate highway from end to end.

These are the dams that will make the archaeologists blink—and

wonder. Did we overreach ourselves trying to build them? Did our civilization fall apart when they silted up? Why did we feel compelled to build so many? Why five dozen on the Missouri and its major tributaries? Why twenty-five on the Tennessee? Why fourteen on the Stanislaus River's short run from the Sierra Nevada to the sea?

We know surprisingly little about vanished civilizations whose majesty and whose ultimate demise were closely linked to liberties they took with water. Unlike ourselves, future archaeologists will have the benefit of written records, of time capsules and so forth. But such things are as apt to confuse as to enlighten. What, for example, will archaeologists make of Congressional debates over Tellico Dam, where the vast majority ridiculed the dam, excoriated it, flagellated it—and then allowed it to be built? What will they think of Congressmen voting for water projects like Central Arizona and Tennessee-Tombigbee—projects costing three or four billion dollars in an age of astronomical deficits—when Congress's own fact-finding committees asserted or implied that they made little sense?

Such debates and documents may shed light on reasons—rational or otherwise—but they will be of little help in explaining the psychological imperative that drove us to build dam after dam after dam. If there is a Braudel or a Gibbon in the future, however, he may deduce that the historical foundations of dams as monumental as Grand Coulee, of projects as nonsensical as Tennessee-Tombigbee, are sunk in the 1880s, a decade which brought, in quick succession, a terrible blizzard, a terrible drought, and a terrible flood.

The great white winter of 1886 came first. The jet stream drove northward, grazed the Arctic Circle, then dipped sharply southward, a parabolic curve rushing frigid air into the plains. Through December of 1886, the temperature in South Dakota barely struggled above zero. A brief thaw intervened in January, followed by a succession of monstrous Arctic storms. Week after week, the temperature fell to bottomless depths; in the Dakotas, the windchill factor approached a hundred below. Trapped for weeks, even for months, in a warp of frozen treeless prairie, thousands of pioneers literally lost their minds. As the last of the chairs were being chopped and burned, settlers contemplated a desperate hike to the nearest town, unable to decide whether it was crazier to stay or to leave. No one knows how many lost their lives, but when the spring thaw finally came, whole families were discovered clutching their last potatoes or each other, ice encrusted on their staring, vacant eyes.

But the settlers' suffering was merciful compared to that of their

cows. On the woodless plains, barns were rare. Cattle were turned out into blizzards to survive by their wits, which they don't have, and which wouldn't have done them much good anyway. They were found piled by the hundreds at the corners of fenced quarter sections, all facing southeast; even when a storm abated, the survivors were too traumatized to turn around, and they died a night or two later under a listless winter's moon. It was a winter not just of horrendous cold but of gigantic snows, horizontal broadsides that reduced visibility to zero and stung the cattle like showers of needles. Twenty-foot drifts filled the valleys and swales, covering whatever frozen grass was left to eat. At night families would lie awake listening to their cows' dreadful bawls, afraid to go out and have the wind steal their last resources of warmth. Anyway, there was nothing they could do.

The toll was never officially recorded. Most estimates put the loss of cattle at around 35 percent, but in some regions it may have been nearer 75 percent. In sheer numbers, enough cows died to feed the nation for a couple of years. Much of the plains' cattle industry was in financial ruin. The bankrupt cattle barons dismissed thousands of hired hands, who were forced to find new careers. When the snows of 1886 melted, Robert Leroy Parker, a young drover, cattle rustler, and part-time bank robber with a reputation, had more recruits on his hands than he knew what to do with. He organized them into a gang known as the Wild Bunch and called himself Butch Cassidy. The Wild Bunch and the scores of outlaw bands like them worked the banks, the railroads, and the Pinkerton agents into a murderous froth. To others, however, they were a moral weight on the mind. Many of the outlaws had been "good boys," former ranch hands and farmers, occupations that everyone hoped would domesticate the West and cure it of its cyclical agonies of boom and bust. But weather was the ultimate arbiter in the American West. Unless there was some way to control it, or at least minimize its effects, a good third of the nation might remain uninhabitable forever.

As if to confirm such a prophecy, the decade following the great white winter was a decade when the western half of the continent decided to dry up. Like most droughts, this one came gradually, building up force, nibbling away at the settlers' fortunes as inexorably as their cattle nibbled away the dying grass. The sun, to which the settlers had so recently offered prayerful thanks, turned into a despotic orb; as Hamlin Garland wrote, "The sky began to scare us with its light." In July of 1888, at Bennett, Colorado, the temperature rose to 118, a record that has never since been equaled in the state. It was the same throughout the West, as an immense high-pressure zone sat immobile

across the plains. Orographic clouds promising rain formed over the Rockies, were boiled off in midair, and disappeared. The atmosphere, it seemed, had been permanently sucked dry.

By 1890, the third year of the drought, it was obvious that the theory that rain follows the plow was a preposterous fraud. The people of the plains states, still shell-shocked by the great white winter, began to turn back east. The populations of Kansas and Nebraska declined by between one-quarter and one-half. Tens of thousands went to the wetter Oklahoma territory, which the federal government usurped from the five Indian tribes to whom it had been promised in perpetuity and offered to anyone who got there first. Meanwhile, the windmills of the farmers who remained north were pumping up sand instead of water, and the huge dark clouds on the horizon were not rain but dust. The great cattle freeze of the white winter had been, in retrospect, a blessing in disguise. Had several million more cows been around to graze the dying prairie grasses to their roots, the Dust Bowl of the 1930s could have arrived half a century early.

When statistics were collected a few years later, only 400,000 homesteading families had managed to persevere on the plains, of more than a million who tried. The Homestead Acts had been a relative success in the East; west of the hundredth meridian, however, they were for the most part a failure, even a catastrophic failure. Much of the blame rested on flaws in the acts themselves, and on the imperfections of human nature, but a lot of it was the fault of the weather. How could you settle a region where you nearly froze to death one year and expired from heat and lack of water during the next eight or nine?

The drought that struck the West in the late 1880s did not occlude the entire continent. In the spring of 1889, the jet stream that had bypassed the West was feeding a thoroughfare of ocean moisture into the eastern states. In the mountains of Pennsylvania, it rained more or less continuously for weeks. The Allegheny and Susquehanna rivers became swollen surges of molten mud. Above Johnstown, Pennsylvania, on the South Fork of the Conemaugh River, a tributary of the Allegheny, sat a big earthfill dam built thirty-seven years earlier by the Pennsylvania Canal Company; it was, for a while, the largest dam in the world. Pounded by the rains, infiltrated by the waters of the rising reservoir, the dam was quietly turning into Cream of Wheat. On May 31, with a sudden flatulent shudder, it dissolved. Sixteen billion gallons of water dropped like a bomb on the town below. Before anyone had time to flee, Johnstown was swallowed by a thirty-foot wave. When the reservoir was finally in the Allegheny River, sending

it far over its banks, the town had disappeared. Four hundred corpses were never positively identified. The number of dead was eventually put at twenty-two hundred—twice as many casualties as in the burning of the *General Slocum* on the East River in 1904; many more than in the San Francisco earthquake and fire; nine times as many as in the Chicago fire. The only single disaster in American history that took more lives was the hurricane that struck Galveston, Texas, eleven years later. The Johnstown flood was significant if only for this sheer loss of life; but it was also an indictment of privately built dams.

The rapid rise of the federal irrigation movement in the early 1890s was due in part to this succession of overawing catastrophes. But it had just as much to do with the fact that by the late 1880s, private irrigation efforts had come to an inglorious end. The good sites were simply gone. Most of the pioneers who had settled successfully across the hundredth meridian had gone to Washington and California and Oregon, where there was rain, or had chosen homesteads along streams whose water they could easily divert. Such opportunities, however, were quick to disappear. Groundwater wasn't much help either. A windmill could lift enough drinking water for a family and few cattle; but it would require thirty or forty windmills, and reliable wind, to lift enough water to irrigate a quarter section of land—a disheartening prospect to a farmer with no money in a region with no wood.

Even if their land abutted a stream with some surplus water rights, few farmers had the confidence, cooperative spirit, and money to build a dam and lead the stored water to their lands through a long canal. It was one thing to throw a ten-foot-high earthen plug across a freshet in order to create a two-acre stock pond—though even that taxed the resources of most farmers in the West, who had invested all their savings simply to get there from Kentucky or Maine. It was quite another thing to build a dam on a stream large enough to supply a year-round flow, and to dig a canal—by horse and by hand—that was long enough, and deep enough, and wide enough, to irrigate hundreds or thousands of acres of land. The work involved was simply stupefying; clearing a field, by comparison, seemed like the simplest, most effortless job.

The farmers' predicament, on the other hand, was an opportunity for the legions of financial swashbucklers who had gone west in pursuit of quick wealth. In the 1870s and 1880s, hundreds of irrigation companies, formed with eastern capital, set themselves to the task of reclaiming the arid lands. Almost none survived beyond ten years. At the eighth National Irrigation Congress in 1898, a Colorado legislator

likened the American West to a graveyard, littered with the "crushed and mangled skeletons of defunct [irrigation] corporations . . . [which] suddenly disappeared at the end of brief careers, leaving only a few defaulted obligations to indicate the route by which they departed."

There was, indeed, a kind of cruel irony in the collapse of the irrigation companies. Most of them operated in the emphatically arid regions—the Central Valley of California, Nevada, Arizona, south-eastern Colorado, New Mexico—where agriculture without irrigation is daunting or hopeless, but otherwise the climate is well suited for growing crops. The drought, on the other hand, struck hardest in the region just east of the hundredth meridian, where, in most years, a nonirrigating farmer had been able to make a go of it. Kansas was emptied by the drought and the white winter, Nevada by irrigation companies gone defunct. In the early 1890s, the exodus from Nevada, as a percentage of those who hung on, was unlike anything in the country's history. Even California, in the midst of a big population boom, saw the growth of its *agricultural* population come to a standstill in 1895.

California, the perennial trend-setting state, was the first to attempt to rescue its hapless farmers, but the result, the Wright Act, was another in the long series of doomed efforts to apply eastern solutions to western topography and climate. The act, which took its inspiration from the township governments of New England, established self-governing mini-states, called irrigation districts, whose sole function was to deliver water onto barren land. Like the western homestead laws, it was a good idea that foundered in practice. The districts soon buckled under their responsibilities—issuing bonds that wouldn't sell, building reservoirs that wouldn't fill, allocating water unfairly, distributing it unevenly, then throwing up their hands when anarchy prevailed. Elwood C. Mead, then the state engineer of Wyoming and probably the country's leading authority on irrigation, called the Wright Act "a disgrace to any self-governing people." George Maxwell, a Californian and founder of the National Irrigation Association, said "the extravagance or stupidity or incompetence of local [irrigation] directors" had left little beyond a legacy of "waste and disaster." Though the Wright Act was in most ways a failure, Colorado, thinking it had learned something from California's mistakes, adopted its own version, which added a modest subsidy for private irrigation developers in order to improve their odds of success. By 1894, under Colorado's new program, five substantial storage reservoirs had been built. Three were so poorly designed and situated that they stored no water at all; the fourth was declared unsafe and was never even filled;

and the fifth was so far from the land it was supposed to irrigate that most of the meager quantity of water it could deliver disappeared into the ground before it got there.

In that same year—1894—Senator Joseph Carey of Wyoming, thinking he had learned something from California's and Colorado's mistakes, introduced a bill that offered another approach: the federal government would cede up to a million acres of land to any state that promised to irrigate it. But, by some elusive reasoning, the states were forbidden to use land as the collateral they would need to raise the money to build the irrigation works—and land, at the time, was the only thing of value most of them had. Sixteen years later, using a generous estimate, the Carey Act had caused 288,553 acres to come under irrigation throughout the entire seventeen-state West—about as much developed farmland as there was in a couple of counties in Illinois.

As the private and state-fostered experiments with irrigation lay in shambles, many of the western reclamation advocates heaped blame on the East and "Washington" for not doing more to help, just as their descendants, four generations later, would vilify Jimmy Carter, an easterner and southerner, for not "understanding" their "needs" when he tried to eliminate some water projects that would have subsidized a few hundred of them to the tune of hundreds of thousands of dollars apiece. In each case, the West was displaying its peculiarly stubborn brand of hypocrisy and blindness. Midwestern members of Congress were understandably uneager to subsidize competition for their own farmer constituents, but they had little to do with making reclamation fail; the West was up to the task itself. Its faith in private enterprise was nearly as absolute as its earlier faith that settlement would make the climate wetter. John Wesley Powell, a midwesterner, knew that all the private initiative in the world would never make it bloom. Theodore Roosevelt, an easterner, had returned from the West convinced that there were "vast areas of public land which can be made available for . . . settlement," but only, he added, "by building reservoirs and main-line canals impractical for private enterprise." But the West wasn't listening. For the first time in their history, Americans had come up against a problem they could not begin to master with traditional American solutions—private capital, individual initiative, hard work—and yet the region confronting the problem happened to believe most fervently in such solutions. Through the 1890s, western Senators and Congressmen resisted all suggestions that reclamation was a task for government alone—not even for the states, which had failed as badly as the private companies, but for the national govern-

ment. To believe such a thing was to imply that their constituents did not measure up to the myth that enshrouded them—that of the indomitable individualist. When they finally saw the light, however, their attitude miraculously changed—though the myth didn't—and the American West quietly became the first and most durable example of the modern welfare state.

The passage of the Reclamation Act of 1902 was such a sharp left turn in the course of American politics that historians still gather and argue over why it was passed. To some, it was America's first flirtation with socialism, an outgrowth of the Populist and Progressive movements of the time. To others, it was a disguised reactionary measure, an effort to relieve the mobbed and riotous conditions of the eastern industrial cities—an act to save heartless capitalism from itself. To some, its roots were in Manifest Destiny, whose incantations still held people in their sway; to others, it was a military ploy to protect and populate America's western flank against the ascendant Orient.

What seems beyond question is that the Reclamation Act, or some variation of it, was, by the end of the nineteenth century, inevitable. To resist a federal reclamation program was to block all further migration to the West and to ensure disaster for those who were already there—or for those who were on their way. Even as the victims of the great white winter and the drought of the 1880s and 1890s were evacuating the arid regions, the trains departing Chicago and St. Louis for points west were full. The pull of the West reached deep into the squalid slums of the eastern cities; it reached back to the ravined, rock-strewn farms of New England and down into the boggy, overwet farmlands of the Deep South. No matter what the government did, short of erecting a wall at the hundredth meridian, the settlement of the West was going to continue. The only way to prevent more cycles of disaster was to build a civilization based on irrigated farming. Fifty years of effort by countless numbers of people had resulted in 3,631,000 acres under irrigation by 1889. There were counties in California that contained more acreage than that, and the figure included much of the easily irrigable land. Not only that, but at least half the land had been irrigated by Mormons. Each additional acre, therefore, would be won at greater pain. Everything had been tried—cheap land, free land, private initiative, local initiative, state subsidy—and everything, with a few notable exceptions, had failed. One alternative remained.

There seemed to be only one politician in the arid West who fathomed his region's predicament well enough to end it. He had emigrated to San Francisco from the East, made a fortune through a busy law

practice and the inheritance of his father-in-law's silver mine, moved to Nevada, and in 1888 launched the Truckee Irrigation Project. It was one of the most ambitious reclamation efforts of its day, and it failed—not because it was poorly conceived or executed (hydrologically and economically, it was a good project) but because squabbles among its beneficiaries and the pettiness of the Nevada legislature ruined its hopes. In the process Francis Griffith Newlands lost half a million dollars and whatever faith he had in the ability of private enterprise to mount a successful reclamation program. "Nevada," he said bitterly as his project went bust in 1891, "is a dying state."

Newlands, who succeeded at everything else he tried, gave up on irrigation, ran for Congress, and won. For the remainder of the decade, he kept out of the reclamation battles, if only to give everyone else's solutions an opportunity to fail. All the while, however, he was waiting for his moment. It came on September 14, 1901, when a bullet fired by an anarchist ended the life of President William McKinley.

Theodore Roosevelt, the man who succeeded McKinley as President, was, like Francis Newlands, a student and admirer of John Wesley Powell. Infatuated with the West, he had traveled extensively there and been struck by the prescience and accuracy of Powell's observations. Roosevelt was first of all a politician, and had no interest in sharing Powell's ignominious fate; nonetheless, he knew that Powell's solutions were the only ones that would work, and he wanted a federal reclamation effort badly. A military thinker, he was concerned about Japan, bristling with expansionism and dirt-poor in resources, and knew that America was vulnerable on its underpopulated western flank. A bug for efficiency, he felt that the waste of money and effort on doomed irrigation ventures was a scandal. Roosevelt was also a conservationist, in the utilitarian sense, and the failure to conserve—that is, use—the water in western rivers irritated him. "The western half of the United States would sustain a population greater than that of our whole country today if the waters that now run to waste were saved and used for irrigation," he said in a speech in December of 1901. For all his enthusiasm, however, Roosevelt knew that his biggest problem would be not the eastern states in Congress but the myth-bound western bloc, whose region he was trying to help. His second-greatest problem, ironically, would be his chief ally, Francis Newlands.

As soon as Roosevelt was in the White House, Newlands introduced a bill creating a federal program along the lines suggested by Powell. But the bitterness he felt over his huge financial loss was so strong that he described his bill in language almost calculated to infuriate his western colleagues, who were clinging to the myth that the hostile

natural forces of the West could be overcome by individual initiative. In a long speech on the floor of Congress, Newlands said outright that the legislation he was introducing would "nationalize the works of irrigation"—which was like saying today that one intended to nationalize the automobile industry. Then he launched into a long harangue about the failures of state reclamation programs, blaming them on "the ignorance, the improvidence, and the dishonesty of local legislatures"—even though many of his listeners had recently graduated from such legislatures themselves. He even suggested that *Congress* should have no oversight powers, implying that he distrusted that body as much as he did the thieves, opportunists, and incompetents whom he saw controlling the state legislatures.

Newlands' bill, as expected, ran into immediate opposition. When it came up for a vote in March, it was soundly defeated. Western members then began to support a rival bill, proposed by Senator Francis E. Warren of Wyoming, that contained none of the features Newlands wanted. By February of 1902, Warren's bill was finally passed by the Senate and seemed destined to become law. At that point, however, fate and Theodore Roosevelt intervened. Mrs. Warren became gravely ill, necessitating the Senator's return to Wyoming. In Warren's absence, Roosevelt leaned on Newlands to tone down his language, and before long the Congressman was describing his defeated measure, which he had already reintroduced, as a "conservative" and "safe" bill. Roosevelt still wouldn't risk supporting it, but he came up with a brilliant ploy. Announcing his "sympathy with the spirit" of Warren's bill, he said he would support it with "a few minor changes." The person whom he wanted to make the changes and lead the bill through Congress was Wyoming's young Congressman-at-large, Frank Mondell, the future Republican leader of the House. Mondell had a weakness for flattery and a less than athletic mind, and Roosevelt was a master at exploiting both. Before long, he had persuaded Mondell to incorporate as "minor changes" in Warren's bill almost all of Newlands' language. Roosevelt then softened up his eastern opposition with some implied threats that their river and harbor projects might be in jeopardy if they did not go along—a strategy that has seen long useful service. By the time Warren returned from Wyoming, Newlands' bill, disguised as his own, had cleared both houses. On June 17, 1902, the Reclamation Act became law.

The newly created Reclamation Service exerted a magnetic pull on the best engineering graduates in the country. The prospect of reclaiming a desert seemed infinitely more satisfying than designing a steel mill in Gary, Indiana, or a power dam in Massachusetts, and

the graduates headed west in a fog of idealism, ready to take on the most intractable foe of mankind: the desert. But the desert suffers improvement at a steep price, and the early Reclamation program was as much a disaster as its dams were engineering marvels.

The underlying problems were politics and money. Under the terms of the Reclamation Act, projects were to be financed by a Reclamation Fund, which would be filled initially by revenues from sales of federal land in the western states, then paid back gradually through sales of water to farmers. (It should be mentioned right away that the farmers, under the law, were exempted from paying interest on virtually all of their repayment obligations—a subsidy which was substantial to begin with, and which was to become breathtaking in later decades, as interest rates topped 10 percent. In some cases, the interest exemption alone—which is, of course, an indirect burden on the general taxpayer—has amounted to a subsidy of ninety cents on the dollar.) Section 9 of the Reclamation Act implied, if it didn't require, that all money accruing to the Reclamation Fund from sales of land in any given state should be spent in that state as well. Frederick Newell, the Service's first director, was particularly anxious to locate a few projects in each state anyway, because that might dispel some of the antipathy that had attended the Service's creation. By 1924, twenty-seven projects were completed or under construction. Of those, twenty-one had been initiated before the Service was even half a decade old.

The engineers who staffed the Reclamation Service tended to view themselves as a godlike class performing hydrologic miracles for grateful simpletons who were content to sit in the desert and raise fruit. About soil science, agricultural economics, or drainage they sometimes knew less than the farmers whom they regarded with indulgent contempt. As a result, some of the early projects were to become painful embarrassments, and expensive ones. The soil turned out to be demineralized, alkaline, boron-poisoned; drainage was so poor the irrigation water turned fields into saline swamps; markets for the crops didn't exist; expensive projects with heavy repayment obligations were built in regions where only low-value crops could be grown. In the Bureau of Reclamation's quasi-official history, *Water for the West*, Michael Robinson (the son-in-law of a Commissioner of Reclamation) discreetly admits all of this: "Initially, little consideration was given to the hard realities of irrigated agriculture. Neither aid nor direction was given to settlers in carrying out the difficult and costly work of clearing and leveling the land, digging irrigation ditches, building roads and houses, and transporting crops to remote markets. . . ."

Robinson also acknowledges the political pressures that have bedeviled the Reclamation program ever since it was born. The attitude of most western members of Congress was quaintly hypocritical: after resisting this experiment in pseudosocialism, or even voting against it, they decided, after it became law, that they might as well make the best of it. "The government was immediately flooded with requests for project investigations," Robinson writes. "Local chambers of commerce, real estate interests, and congressmen were convinced their areas were ideal for reclamation development. State legislators and officials joined the chorus of promoters seeking Reclamation projects. . . . Legislative requirements and political pressures sometimes precluded careful, exhaustive surveys of proposed projects. . . . Projects were frequently undertaken with only a sketchy understanding of the area's climate, growing season, soil productivity, and market conditions."

Congress's decision, in passing the act, to ignore much of John Wesley Powell's advice made things worse. Powell had proposed that in those inhospitable regions where only livestock could be raised, settlers should be allowed to homestead 2,560 acres of the public domain—but allocated enough water to irrigate only twenty. The Reclamation Act gave everyone up to 160 acres (a man and wife could jointly farm 320 acres), whether they settled in Mediterranean California or in the frigid interior steppes of Wyoming, where the extremes of climate rival those in Mongolia. You could grow wealthy on 160 acres of lemons in California and starve on 160 acres of irrigated pasture in Wyoming or Montana, but the act was blind to such nuances. And by building so many projects in a rush, the Reclamation Service was repeating its mistakes before it had a chance to learn from them.

All of these problems were compounded by the fact that few settlers had any experience with irrigation farming—nor were they required to. They overwatered and mismanaged their crops; they let their irrigation systems silt up. Many had optimistically filed on more acreage than they had resources to irrigate, and they ended up with repayment obligations on land they were forced to leave fallow. From there, it was a short, swift fall into bankruptcy. Fifty years earlier, the ancestors of the first Reclamation farmers had endured adversity by putting their faith in God and feeding themselves on game. But this was the twentieth century; the game was vanishing, and government was replacing God as the rescuer of last resort. As Michael Robinson wrote, "Western economic and social determinants were changing rapidly. Nineteenth-century irrigation pioneers were better suited to endure

hardships than settlers who struggled to survive on Federal Reclamation projects after 1902. In the nineteenth century, wild game was plentiful, livestock could graze on the public domain outside irrigated areas, and the settlers were inured to privation." And so, after a few years of trial and a lot of error, the Reclamation Act began to undergo a long and remarkable series of "reforms."

The first reform was humble—a \$20 million loan from the Treasury to the bankrupt Reclamation Fund to keep the program from falling on its face. It was approved in 1910, the same year that Section 9—the ill-advised clause promoting the construction of projects where they couldn't work—was repealed. New projects were also required to have the explicit consent of the President before they were launched. A paper reform, however, is not necessarily a reform in real life. Every Senator still wanted a project in his state; every Congressman wanted one in his district; they didn't care whether they made economic sense or not. The Commissioner of Reclamation and the President were only human. If Congress authorized a bad project and voted funding for it, a President might have good reasons not to veto the bill—especially if it also authorized a lot of things the President *did* want. Congress caught on quickly, and was soon writing "omnibus" authorization bills, in which bad projects were thrown in, willy-nilly, with good ones. (Later, Congress would learn a new trick: attaching sneaky little amendments authorizing particularly wretched projects to legislation dealing with issues such as education and hurricane relief.) As a result, instead of weeding out or discouraging bad projects, the "reforms" began to concentrate on making bad projects work—or, to put it more bluntly, on bailing them out.

The first of these adjustments came in 1914, when the repayment period, which had been set in the act at a rather unrealistic ten years, was extended to twenty. It was quite a liberal adjustment, but failed to produce any measurable results. By 1922, twenty years after the Reclamation Fund began, only 10 percent of the money loaned from the Reclamation Fund had been repaid. Sixty percent of the irrigators—an astounding number—were defaulting on their repayment obligations, even though they paid no interest on irrigation features.

In 1924, Congress commissioned a Fact Finder's report on the Reclamation program, which recommended an even more drastic adjustment—raising the repayment period from twenty years to forty. No sooner was that done, however, than the most chronic and intractable problem of twentieth-century American agriculture began to appear: huge crop surpluses. Production and prices reached record levels during the First World War; when the war ended, production remained

high, but crop prices did not. The value of all crops grown on Reclamation land fell from \$152 million in 1919 to \$83.6 million in 1922—as morose a statistic as the number of farmers in default. With their profits shriveling, the beleaguered farmers were reluctant to pay for water they were beginning to regard as rightful recompense for attempting to civilize the desert, especially when the Reclamation Service, in most cases, didn't dare shut it off when they refused to pay. So Congress took further steps to bail the Reclamation program out, rerouting royalties from oil drilling and potassium mining to the Reclamation Fund on the theory that the West, while being stripped of its mineral resources, ought to get something in return. But even after all these measures had been adopted a number of projects continued to operate at a hopeless loss.

Nonetheless, the psychic value of the Reclamation farms remained high. The only relief in a pitiless desert landscape, their worth was computed in almost ethereal terms, as if they were art. And their investment value to speculators remained high, too. An acre which in pre-project years was worth \$5 or \$10—if that—was suddenly worth fifty times as much. At such prices, many farmers found the temptation to sell out irresistible; by 1927, at least a third of the Reclamation farmers had. The buyers were usually wealthy speculators who figured they could absorb some minor losses for a while—especially if they could convince Congress to give them tax breaks—as long as they could make money when agricultural prices went back up. The Salt River Project in Arizona was notable for having been all but taken over by speculators. Elwood Mead, who succeeded Newell and Arthur Powell Davis as Commissioner of Reclamation, called speculation "a vampire which has done much to destroy the desirable social and economic purposes of the Reclamation Act." But the big, distant new owners were often better at paying their water bills than the stone-broke small farmers, so the Reclamation Service, in a number of instances, turned a blind eye toward what was going on. It was a case of lawlessness becoming de facto policy, and it was to become more and more commonplace.

Part of the reason the Reclamation Service (which metamorphosed, fittingly, into the *Bureau* of Reclamation in 1923) seemed so hapless at enforcing its social mandate had to do with the Omnibus Adjustment Act of 1926, one of those well-meaning pieces of legislation that make everything worse. Intended to clamp down on speculation, the act demanded that landowners owning excess amounts of land sign recordable contracts in which they promised to sell such lands within a designated period, at prices reflecting the lands' pre-project

worth. But the contracts were to be signed with the local irrigation district acting as wholesaler of the Bureau's water—not with the Bureau itself. It was an ideal opportunity to camouflage acreage violations, since the same people who were in violation of the Reclamation Act often sat on the local irrigation district's board of directors.

A more important and insidious reason, however, had to do with the nature of the Bureau itself. "There was a tendency for some engineers to view public works as ends in themselves," admits Michael Robinson. "Despite official declarations from more sensitive administrators that 'Reclamation is measured not in engineering units but in homes and agricultural values' . . . the Service regarded itself as an 'engineering outfit.'"

That may have been the understatement of the year. To build a great dam on a tempestuous river like the Snake was terrifically exhilarating work; enforcing a hodgepodge of social ideals was hardly that. Stopping a wild river was a straightforward job, subjugable to logic, and the result was concrete, heroic, real: a dam. Enforcing repayment obligations and worrying about speculators and excess landowners was a cumbersome, troublesome, time-consuming nuisance—a nuisance without reward. Was the Bureau to abandon the most spellbinding effort of modern times—transforming the desert into a garden—just because a few big landowners were taking advantage of the program, just because some farmers couldn't pay as much as Congress hoped?

There were to be still more "reforms" tacked onto the Reclamation Act: reforms extending the repayment period to fifty years, setting water prices according to the farmers' "ability to pay," using hydroelectric revenues to subsidize irrigation costs. It wasn't until the 1930s, however, that the Reclamation program went into high gear. In the 1920s and early 1930s, the nation's nexus of political power still lay east of the Mississippi River; the West simply didn't have the votes to authorize a dozen big water projects each year. Western politicians who were to exercise near-despotic rule over the Bureau's authorizing committees in later years, men like Wayne Aspinall and Bernie Sisk and Carl Hayden, were still working their way up the political ranks. (In 1902, the year the Reclamation program began, Arizona was still ten years away from becoming a state.) Presidents Harding and Coolidge were ideological conservatives from the East who sternly resisted governmental involvement in economic affairs, unless it was an opportunity for their friends to earn a little graft. And even Herbert Hoover, though a Californian and an engineer, was not regarded by the western water lobby and the Bureau as a particularly loyal friend.

All of this was to change more abruptly than the Bureau of Reclamation and its growing dependency could have hoped. The most auspicious event in its entire history was the election to the presidency in 1932 of a free-wheeling, free-spending patrician. The second most auspicious event was the passage, during the five-term Roosevelt-Truman interregnum, of several omnibus river-basin bills that authorized not one, not five, not even ten, but dozens of dams and irrigation projects at a single stroke. Economics mattered little, if at all; if the irrigation ventures slid into an ocean of debt, the huge hydroelectric dams authorized within the same river basin could generate the necessary revenues to bail them out (or so it was thought). It was a breathtakingly audacious solution to an intractable problem, and the results were to be breathtaking as well. Between Franklin Roosevelt and the river-basin approach—which, in an instant, could authorize dams and canals and irrigation projects from headwaters to river mouth, across a thousand miles of terrain—the natural landscape of the American West, the rivers and deserts and wetlands and canyons, was to undergo a man-made transformation the likes of which no desert civilization has ever seen. The first, and perhaps the most fateful, such transformation was wrought in the most arid and hostile quarter of the American West, a huge desert basin transected by one comparatively miniature river: the Colorado.

CHAPTER FOUR

An American Nile (I)

Ours was the first and will doubtless be the last party of whites to visit this profitless locale.

—Lieutenant Joseph Christmas Ives,
on sailing up the Colorado River
to a point near the present location
of Las Vegas, in 1857

The Colorado is neither the biggest nor the longest river in the American West, nor, except for certain sections described in nineteenth-century journals as "awful" or "appalling," is it the most scenic. Its impressiveness and importance have to do with other things. It is one of the siltiest rivers in the world—the virgin Colorado could carry sediment loads close to those of the much larger Mississippi—and one of the wildest. Its drop of nearly thirteen thousand feet is unequaled in North America, and its constipation-relieving rapids, before dams tamed its flash floods, could have flipped a small freighter. The Colorado's modern notoriety, however, stems not from its wild rapids and plunging canyons but from the fact that it is the most legislated, most debated, and most litigated river in the entire world. It also has more people, more industry, and a more significant economy dependent on it than any comparable river in the world. If the Colorado River suddenly stopped flowing, you would have four years of carryover capacity in the reservoirs before you had to evacuate most of southern California and Arizona and a good portion of Colorado, New Mexico, Utah, and Wyoming. The river system provides over half the water of greater Los Angeles, San Diego, and Phoenix; it grows much of America's domestic production of fresh winter vegetables; it illuminates the neon city of Las Vegas, whose annual income is one-fourth the entire gross national product of Egypt—the only other

place on earth where so many people are so helplessly dependent on one river's flow. The greater portion of the Nile, however, still manages, despite many diversions, to reach its delta at the Mediterranean Sea. The Colorado is so used up on its way to the sea that only a burbling trickle reaches its dried-up delta at the head of the Gulf of California, and then only in wet years. To some conservationists, the Colorado River is the preeminent symbol of everything mankind has done wrong—a harbinger of a squalid and deserved fate. To its preeminent impounder, the U.S. Bureau of Reclamation, it is the perfection of an ideal.

The Colorado has a significance that goes beyond mere prominence. It was on this river that the first of the world's truly great dams was built—a dam which gave engineers the confidence to dam the Columbia, the Volga, the Paraná, the Niger, the Nile, the Zambezi, and most of the world's great rivers. The dam rose up at the depths of the Depression and carried America's spirits with it. Its electricity helped produce the ships and planes that won the Second World War, and its water helped grow the food. From such illustrious and hopeful beginnings, however, the tale of human intervention in the Colorado River degenerates into a chronicle of hubris and obtuseness. Today, even though the Colorado still resembles a river only in its upper reaches and its Grand Canyon stretch—even as hydrologists amuse themselves by speculating about how many times each molecule of water has passed through pairs of kidneys—it is still unable to satisfy all the demands on it, so it is referred to as a "deficit" river, as if the river were somehow at fault for its overuse. And though there are plans to relieve the "deficit"—plans to import water from as far away as Alaska—the twenty million people in the Colorado Basin will probably find themselves facing chronic shortages, if not some kind of catastrophe, before any of these grandiose schemes is built—if, indeed, one is ever built.

One could almost say, then, that the history of the Colorado River contains a metaphor for our time. One could say that the age of great expectations was inaugurated at Hoover Dam—a fifty-year flowering of hopes when all things appeared possible. And one could say that, amid the salt-encrusted sands of the river's dried-up delta, we began to founder on the Era of Limits.

In terms of annual flow, the Colorado isn't a big river—in the United States it does not even rank among the top twenty-five—but, like a forty-pound wolverine that can drive a bear off its dinner, it is unrivaled for sheer orneriness. The virgin Colorado was tempestuous, will-

ful, headstrong. Its flow varied psychotically between a few thousand cubic feet per second and a couple of hundred thousand, sometimes within a few days. Draining a vast, barren watershed whose rains usually come in deluges, its sediment volume was phenomenal. If the river, running high, were diverted through an ocean liner with a cheesecloth strainer at one end, it would have filled the ship with mud in an afternoon. The silt would begin to settle about two hundred miles above the Gulf of California, below the last of the Grand Canyon's rapids, where the river's gradient finally moderated for good. There was so much silt that it raised the entire riverbed, foot by foot, year by year, until the Colorado slipped out of its loose confinement of low sandy bluffs and tore off in some other direction, instantly digging a new course. It developed an affection for several such channels, returning to them again and again—Bee River, New River, Alamo River, big braided washes that sat dry and expectant in the desert, waiting for the river to return. The New and Alamo channels drove into Mexico, then veered back north into the United States, a hundred-mile semi-loop, and ended at the foot of the Chocolate Mountains, where the delinquent river would form a huge evanescent body of water called the Salton Sea. After a while, the New and Alamo channels would themselves silt up and the Colorado would throw itself back into its old bed and return to the Gulf of California, much to the relief of the great schools of shrimp, the clouds of waterfowl, and the thousands of cougars, jaguars, and bobcats that prowled its delta. The Salton Sea would slowly evaporate and life would return to normal, for a while. The river went on such errant flings every few dozen years—a vanishing moment in geologic time, but long enough so that the first people who tried to tame it had no idea what they were in for.

The first of these tamers was an eastern developer with a grandiose imagination, a bulldog chin, a shock of steel-wool hair, and a name suggestive of his temperament. In 1892, Charles Rockwood saw the Colorado River for the first time and became obsessed. Sitting north of it, an appendage of the vast Sonoran Desert of southern California and Arizona, were hundreds of thousands of absolutely flat acres built by its ancient delta, fertile land where you could grow crops twelve months of the year. All that stood in the way of cultivation was an annual rainfall of 2.4 inches, about the lowest in the United States. Despite the imposing nature of the task, the temptation to play God with the river and turn this brutal desert green was too much for Rockwood to resist. After traveling halfway around the world for financial support, he seduced the most famous private irrigationist of his day, George Chaffey, into joining forces with him. By 1901, Rock-

wood and Chaffey had cut a diversion channel, and a good portion of the river was pouring over fields in what had once been called the Valley of the Dead (in grand nineteenth-century fustian tradition, Rockwood renamed it Imperial Valley). Within eight months, there were two towns, two thousand settlers, and a hundred thousand acres ready for harvesting.

By 1904, however, the artificial channel had already silted up, and a bypass had to be cut. It silted up. Another bypass was cut; it too silted up. Finally, after much negotiation, the developers persuaded the Mexican government to let them cut still another channel below the border. Because it was meant as a temporary expedient while the original channel was cleaned out in advance of the spring floods, the Mexican channel had the flimsiest of control gates. As luck would have it, the spring floods arrived two months early. In February, a great surge of snowmelt and warm rain spilled out of the Gila River, just above the Mexican channel, and made off with the control gate. For the first time in centuries, the river was back in its phantom channel, the Alamo River, heading for its old haunt, the Salton Sink. As the surge advanced across the Imperial Valley, it cut into the loamy soil at a foot-per-second rate, forming a waterfall that marched backward toward the main channel. Even as their fields were being eaten and as their homes swam away, the valley people came out by the hundreds to see this apparition, a twenty-foot falls moving backward at a slow walk. By summer, virtually all of the Colorado River was out of its main channel, and the Salton Sink had once again become the Salton Sea.

Chaffey had had some differences with Rockwood and got out of the California Development Company a short while earlier with his reputation intact, leaving his erstwhile partner ruined. But the Southern Pacific Railroad had already invested too much money in a spur line to the valley to watch it abandoned to fate, so it took Rockwood's company into receivership and set about trying to tame the river. For the next two years, Edward H. Harriman, the railroad magnate, and the Colorado River fought nose to nose. Southern Pacific trains crawled back and forth across the valley like caterpillars, carrying rock and gravel to plug the half-mile breach. But 1905, 1906, and 1907 were some of the wettest years in the Colorado Basin's history. In 1907, the river sent a record twenty-five million acre-feet—eight quadrillion gallons—to the gulf. The floods, one following another, casually ripped Harriman's brush weirs to shreds; his miles of driven piles were uprooted and washed away. Finally, in February of 1907, after laughing away the railroad's best efforts, the river decided to lull. With mad

energy, the SP crews finally secured the breach. When the next surge came down, the weirs held, and the river, dumping silt ten times faster than the trains, began rebuilding its own confinement.

Victory or no, the Colorado River was a rampant horse in a balsa corral. The only way to control it effectively, and to give the farmers some insurance against its countervailing tendency to dry up, was to build a dam—a huge dam—to lop the peaks off the floods and provide storage during droughts. The problem with such a dam, from the point of view of the basin at large, was that California was then the only state in a position to use the water. Wyoming, Arizona, Nevada, and New Mexico were still mostly uninhabited. Colorado and Utah had a few hundred thousand people each, but they had scarcely begun to tap the Colorado River and its tributaries; most of Utah's irrigation had been developed in another basin. California, on the other hand, was gaining people like no place on earth, and most of the growth was occurring in the south. The Imperial Valley could have immediately used three or four million acre-feet of the river, the consumption of all the upper-basin states and then some. The Coachella Valley, farther north, and the Palo Verde and Yuma projects could swallow another million acre-feet. Los Angeles, growing like a gourd in the night, would soon overrun its Owens Valley supply; the next logical source of water—the *only* logical source—was the Colorado River. Under simple appropriative-rights doctrine, the water would belong to California as soon as it began to use it. If California perfected its rights in court, it would, in effect, monopolize a huge portion of the river for itself. And the *real* injustice in all of this was that California contributed nothing to the river's flow. Nearly half the runoff came from Colorado and another third from Wyoming and Utah. Arizona and New Mexico contributed very little; Nevada and California, nothing at all. California's efforts to get the dam authorized by Congress were soon beaten back. Finally, it realized that if it wanted the dam and a reliable share of the river, it would have to sit down with its neighbor states and divide it up.

The negotiation of the Colorado River Compact took place in 1922 under the guidance of Commerce Secretary Herbert Hoover at Bishop's Lodge, a swank resort outside Santa Fe, New Mexico. For the time spent debating and drafting it—about eleven months—and its reputation as a western equivalent of the Constitution, the compact didn't settle much. Using the Reclamation Service's estimated average flow of 17.5 million annual acre-feet, the delegates from the seven states divided the river arbitrarily at Lee's Ferry, Arizona—a point just below the Utah border—into two artificial basins. California, Arizona, and

Nevada were the lower basin; the other four states were the upper basin; pieces of New Mexico and Arizona were in both. Each basin was allotted 7.5 million acre-feet. How they were to divide that among themselves was their problem. Of the remainder, 1.5 million acre-feet were reserved for Mexico, and the final million acre-feet were apportioned, with extreme reluctance on the part of some, as a bonus to the lower basin, whose delegates had threatened to walk out of the negotiations if they didn't get a better deal.

The compact was signed by the delegates in November of 1922; they then took it home for ratification by the voters or legislatures of their respective states, which quickly tore it to shreds. California wouldn't ratify without a conjugal authorization of Boulder Canyon Dam and a new canal running exclusively through American territory to Imperial Valley, a demand that gave the upper basin fits. Arizona wanted to divide the lower basin's apportionment before it ratified anything. Harry Chandler, probably the most influential human being in the Southwest—he talked through his vast wealth and his newspaper—was delighted by the compact and the authorization of the dam, but he was too greedy to tolerate an All-American Canal, which would divert the river right above his 860,000 acres in Mexico, so he ended up opposing everything. George Maxwell, the head of the National Reclamation Association, should have been in favor of Boulder Dam, but out of principle he opposed anything Harry Chandler liked.

In 1928, after six years of paralysis, Congress took matters into its own hands. It authorized Boulder Dam and the All-American Canal on the condition that at least six of the seven states ratify the compact, and that California limit its annual diversion to 4.4 million acre-feet per year. That implied only 2.8 million for Arizona (Nevada got 300,000 acre-feet), which was less than it wanted. Arizona, as a result, became the one state that refused to ratify, an act of defiance that would muddle things for another thirty-five years. At the time, however, its vote wasn't needed, and the other states' ratification led forthwith to the California Limitation Act and, subsequently, to passage of the Boulder Canyon Project Act. All of this appeared to settle matters: the basin could now embark on an orgy of growth the likes of which the West had never seen. And it did settle things, temporarily at least, except for one small matter: the average annual flow of the Colorado River was nowhere near 17.5 million acre-feet.

In 1930, the American West had a population of eleven million people, about the population of New York State. Half of the people were in California, by far the most populous and modern of the western states.

When Californians traveled, however, they went mainly on dirt roads. The drive from San Francisco to Lake Tahoe, which is now done in three or four hours, was a two-day adventure or ordeal, depending on one's point of view. The city's great bridges had not yet been built. San Jose was not yet a city of thirty thousand, Silicon Valley a stronghold of orchards and roaming mountain lions. In some of the other states, the usual means of locomotion was still a horse and wagon. Electricity and telephones were unknown in most rural communities, and didn't reach the more remote ones until the 1950s. In the midst of this same depopulated, untrammled region, however, the engineering wonder of all time was about to rise.

In Oakland, California, an egomaniacal small-time construction tycoon named Henry J. Kaiser had followed the passage of the Boulder Canyon Project Act with consuming interest. Obsessed with his niche in history, Kaiser was still enough of a realist to know that he could not begin to build such a dam alone. So he called up his friend W. A. Bechtel to ask if he was interested in making a joint bid. Dad Bechtel was a horse-drawn Fresno-scraper kind of contractor; most of his business was road paving, his most noteworthy innovation a folding toothbrush which he carried on trips. Outside of northern California, and even there, the Bechtel Corporation was all but unknown. "I don't know, Henry" was Bechtel's response when Kaiser, flushed with excitement, got him on the phone. "It sounds a little ambitious to me."

A thousand miles away in Utah, two sheep-ranching Mormon brothers named W. H. and E. O. Wattis were as captivated by the Boulder Canyon Project as Kaiser, and just as unable to undertake it themselves. The Wattises' other business, the Utah Construction Company, specialized in something as mundane as Bechtel's paving contracts: laying railroad bed. Lately, however, they had taken on a new partner, a maverick Mormon banker with Keynesian leanings who talked about deficit financing while candidate Franklin Roosevelt was still promising a balanced budget. His name was Marriner Eccles, and the reward he was about to receive for his ideological flexibility was an influential position on the Federal Reserve Board. The Wattises had also been in contact with Harry Morrison and Morris Knudsen, two engineers formerly with the Bureau of Reclamation who had gone into business together in Boise, Idaho. And they had spoken with Frank Crowe, another former Bureau engineer whose enthusiasm for Boulder Dam was as obsessive as Kaiser's. Morrison had just returned from a trip east, where he had tried to influence the financial community to back a bid on the dam. He was told by the western bankers that there wasn't a company west of the Mississippi they would trust to take on

something like this. But one thing would lead to another. Before long, the Wattises were talking with Bechtel and Kaiser, and Henry and Dad were in touch with some other firms—J. F. Shea Construction of Los Angeles, McDonald and Kahn of San Francisco, General Construction of Seattle. In February of 1931, during a meeting at the Engineers Club in San Francisco, the first of the West's supercompanies was born. There were eight firms altogether, but Kaiser couldn't resist borrowing a name from the tribunal before which the tongs, the Chinese equivalent of the Mafia families, took their grievances. At his insistence, the executives agreed to call their joint venture Six Companies, Inc. Hocking everything but their shirts, they could barely scrape together the few million dollars they would need to buy enough equipment to begin the job. When the Bureau auctioned off the job, however, it was Six Companies' amazingly low bid, in the amount of \$48,890,995.50, that won. Once again, sang the *Los Angeles Times*, the West had "laughed at logic and driven [its] destiny over obstacles that rational minds deemed insuperable."

The first eighteen months of work on Boulder Canyon Dam involved the construction of a new Colorado River. Four diversion tunnels were blasted through the rock of the box canyon, two on the Nevada side and two on the Arizona side, each of them three-quarters of a mile long. Their diameter was spacious enough to accommodate a jumbo jet shorn of its wings—a capacity that was needed mainly as insurance against an errant flood of 200,000 cubic feet per second, or more. The task required the excavation of three and half million tons of rock with enough dynamite to level Toledo. On November 13, 1932, four tremendous explosions blew out the entrances and exits of the two Arizona tunnels. The dust had not yet settled when a caravan of trucks lumbered onto a trestle bridge built downstream from the tunnel entrances and began dumping rocks and earth in the river's path. Finding itself blockaded, the Colorado slowly roiled and rose in frustration; sensing an escape route, it rode off into the tunnels. In a matter of hours, the river had been lured out of a bed it had occupied since the Grand Canyon was formed.

No sooner was the Colorado flowing through the canyon walls than the crews began replacing the flimsy trestle dam with a far more substantial cofferdam; then, for good measure, they built another below. Made of earth and rock and faced with concrete, the upper cofferdam measured 450 by 750 by 96 feet. Half a century earlier, it would have been the largest dam in the world, but its usefulness was to be measured in months.

When the cofferdams were finished, the engineers turned to the next task—stripping the canyon abutments to expose fresh clean solid rock. Because the dam would rise more than seven hundred feet, there was no crane big enough to do the job; it would have to be done by hand. The four hundred men whose job it was to clean the walls were known as high-scalers. Those who persevered—seven were killed on the job—spent months hanging four or five hundred feet in the air, drilling holes in the rock, inserting dynamite, and praying they would be hauled to safety before it exploded. Because the canyon was so tight, they also had to blast out space for portions of the huge powerhouse, the intake towers, and the penstock headers. Some of the rock amphitheaters they created could have held an orchestra.

Besides the hazards of the construction work (the falling rock, the explosives, electrocution, behemoth machines); besides the hazards of off-hours (fist fights, drunken binges, social diseases from the whores who camped about); besides all this, there was the heat. The low-lying parts of the Colorado and Sonora deserts are the hottest corner of North America, and we are speaking of temperatures in open, ambient air. The Colorado's box canyon held heat like an oven with the door open about an inch. Workers sometimes sacrificed eggs to see if they would actually fry on a sun-fired rock. The first death from heat prostration occurred a few days after construction began, and so many men collapsed that some of the crews finally forced a shutdown, demanded a pay raise, and ultimately staged a strike. The strike, however, did no good. Next to Boulder City was an encampment of tents and shanties known as Ragtown, where the unemployed waited by the hundreds for someone to give up, be fired, or die. "One of the myths about the Depression," Arthur Miller, the playwright, once said, "is that it brought everyone closer together. Actually, it just made everyone more voracious." "They will work under our conditions, or they will not work at all," proclaimed W. H. Wattis. And they did, at a base pay of \$4 per day.

It was in 1933 when the explosive din suddenly stopped and an eerie silence descended on Boulder Canyon. The canyon walls were finally clean, the abutments sculpted, the cofferdams in place. Nearly three years after work had begun, the dam was still a figment of the imagination. Now it was time to dig down to bedrock.

The bed of the Mississippi River is hundreds, even thousands, of feet deep in silt. The Columbia and the Missouri flow over alluvial wash as thick as Arctic glaciers. On the Colorado, however, to everyone's amazement, bedrock was struck at forty feet. A milled piece of sawtimber was found resting at the bottom of the muck, obviously of

very recent origin. Since white men had begun to settle the region, perhaps eighty years before, a huge flood had evidently washed the entire channel clean. No one seemed bothered by the certainty that all of the silt constantly being relocated along the entire 1,450-mile length of the river would be forever imprisoned behind Hoover and the other dams soon to be built.

In June of 1933, the foundation was finally ready, and the first of the wooden forms that would be used to lay concrete was being built. The concrete—sixty-six million tons of it—created one of the most vexing problems the engineers had faced, a problem peculiar to large dams. The dam's size and weight would generate superpressures and insulating mass that would both generate and retain heat. Though the dam would appear solid, it would be, in reality, a pyramid of warm pudding. Left to its own devices, Boulder Dam would require 100 years to cool down. Moreover, the cooling would be uneven, and the resultant shrinkage and warping would leave the structure fissured and cracked. After weeks of wondering what to do, the engineers finally agreed on a solution. As each form was poured, one-inch pipe would be laid through it at five-foot intervals; frigid water from a cooling plant would then be run through the pipes until convection cooling had lowered the temperature of the concrete to forty-three degrees near the base and seventy-two degrees near the crest. Since the amount of pipe required, if it had been laid out in a straight line, would have reached to Big Sur on the central California coast, this was no mean refrigeration plant. Converted to ice-making, it could have chilled a couple of million cocktails a day. Instead, it reduced a century of cooling time to something like twenty months.

When visitors were led to the canyon rim to watch Boulder Dam on the rise, there was usually a long moment of silence, a moment when the visitors groped for something appropriate to say, something that expressed proper awe and reverence for the dazzling, half-formed monstrosity they saw. The dam defied description; it defied belief. Standing on the upstream side of it, two on each flank, were the intake towers, marvelous fluted concrete columns rising 395 feet from platforms that had been blasted halfway up the canyon walls. The towers were as high as forty-story buildings, and someone who had never been to New York or Chicago or Philadelphia would never have seen a man-made structure that high. But the crest of the dam rose nearly to the tops of the towers, and its foundation was *hundreds of feet* below their base. Its seamless curve swept across the canyon and imbedded itself in each side, a gigantic but somehow graceful intrusion. The men working on top were not even ants; they hardly qualified as fleas.

Stretching overhead, from canyon rim to canyon rim, was a thick cable on which hung suspended a sixteen-ton bucket that lowered fresh concrete into the forms. Although it was big enough to accommodate a Buick, the bucket seemed incapable of ever filling the dimensions of Hoover Dam—the name it was ultimately to acquire. But twenty-four hours per day, 220 cubic yards an hour, it did. After two years of pouring, the dam was finally topped out. On March 23, 1935, it stood 726 feet and 5 inches tall.

When the engineers surveyed what they had built, it seemed impossible to believe that anything so immense could fail to hold back the Colorado River under every conceivable circumstance. Between 1907 and 1917, however, the wettest period on record, the river had discharged nearly enough water to fill the reservoir during several years: twenty-four million acre-feet; twelve million; twenty-five and a half million; fourteen million; twenty million; nineteen million; twenty million. Hidden within the figures were big floods, periods when the river flowed at 100,000 or 200,000 cubic feet per second for weeks in a row. If such a flood happened to hit when the reservoir was full, the full force of it would have to be spilled; the penstocks leading to the power plant would never be able to handle it. But 200,000 cfs sent over the top of the dam could erode it like a seawall in a storm. The dam, therefore, required spillways on either side, and to allow for the unforeseen and the incredible they were to be built to handle 400,000 cubic feet per second—nearly twice the Columbia River's flow. The spillway troughs were excavated on the canyon sides of the intake towers and led into the vast diversion tunnels hollowed through the walls. Like everything else about the dam, they were designed curvilinear and graceful, with immense brass drum gates shaped like diamond heads. Set down in a spillway channel, the *Bismarck* would have floated clear. Some of the project engineers wistfully suggested that turbines be installed at the spillway outlets, even if they operated only during floods. With the penstocks and the outlet works both generating power, the dam, during brief periods, could have electrified the state of California.

Nothing, however, was more astonishing than the speed with which all of it was built. As the nation languished in the Depression, as plant after plant remained idle and company after company went bankrupt, Hoover Dam was being built at a breathtaking pace. The eyes of the country were fixed on it in awe. A landmark event—the completion of a spillway, the installation of the last generator—was front-page news. The initial excavations for the diversion tunnels had begun on May 16, 1931. The river was not detoured from its channel

until November, and the cofferdams were not completed until April of 1933. But two years later, all the blocks in the dam were raised to crest elevation, and a year later everything was finished: spillways, powerplant, penstocks, generators, galleries, even the commemorative plaque in the frieze alongside U.S. Highway 93, which ran across the top. The first electrical power, from what was then the largest power plant in the world, was produced in the fall of 1936. The greatest structure on earth, perhaps the most significant structure that has ever been built in the United States, had gone up in under three years.

The difference in climate between the eastern and western United States—the fact that the East generally gets enough rainfall to support agriculture, while the West generally does not—is easily the most significant distinction between those two regions. It is also obvious that there are significant distinctions within each region as well. For example, oranges grow well in central Florida; they do not in South Carolina, a few hundred miles north. The climate in Duluth, Minnesota, is quite different from that in Chicago, a mere day's drive away.

In the West, however, climatic differences far more striking than these may occur within the same state, even within the same county. In the Willamette Valley of Oregon, a farmer can raise a number of different crops without irrigation; there is usually a summer drought, but it is short, and even if he decides not to depend entirely on rainfall, a few inches of irrigation water—instead of the hundred inches used by some farmers in California and Arizona—will usually do. Two hours away, on the east side of the Cascades, rainfall drops to a third of what the Willamette Valley ordinarily receives; not only that, but the whole of eastern Oregon is much higher than the section west of the Cascades, and lacks a marine influence, so the climate is far colder as well. It can be forty above zero in Eugene and ten below zero in Bend, a two-hour drive to the east. In eastern Oregon, not only must a farmer irrigate but he is extraordinarily limited, compared to his Willamette Valley counterpart, in the types of crops he can grow.

Around Bakersfield, California, an irrigation farmer can raise the same crops that one sees growing in Libya, southern Italy, Hawaii, and Iraq: pistachios, kiwis, almonds, grapes, olives, melons, crops whose value per cultivated acre is astonishingly high. An hour's drive away, across the Tehachapi Mountains, lies the Antelope Valley, a high-desert region with a cold interior climate that can bring frost in May, and where little but alfalfa and grass can be grown. Both Bak-

ersfield and the Antelope Valley are within Kern County, whose climatic extremes are rather typical of California, and, for that matter, of many counties throughout the West. Air conditioners and furnaces in two relatively nearby towns—Phoenix and Flagstaff—may be running at the same time; one end of a county may be plagued by floods while another is plagued by drought.

The reason for all this is mainly topographic: the mountains that block weather fronts and seal off the interior from the ocean's summer cooling and winter warmth (the prevailing westerly winds of the northern hemisphere give the ocean a much wider influence in the West than in the East, reaching as far away as Idaho); the tectonic upheavals that pushed much of the interior West, even the flat mountainless sections, to elevations higher than a mile. The significance of it, from the standpoint of water development, is that it makes infinitely greater economic sense to build dams and irrigate in warmer regions than in colder ones—even if it makes infinitely greater *political* sense to do otherwise.

When John Wesley Powell explored the American West, he duly noted these bewildering extremes of climate. Powell knew that irrigation was an expensive proposition, and that a few inches of extra rainfall or a couple of thousand feet of elevation difference would mean a project that was worth developing or, on the other hand, a project that would require heavy subsidization. A farmer raising fruit or two annual crops of tomatoes in the Imperial Valley might earn ten times more per irrigated acre than a farmer raising alfalfa at six thousand feet in Colorado; yet it might cost far more to deliver water to the Colorado farmer because his water might have to be pumped uphill, out of deep river canyons, while the Imperial Valley lay near sea level below Hoover Dam. The Imperial Valley farmer could pay enough for water to allow the government to recoup its enormous investment in dams, canals, and other irrigation works; the Colorado farmer might be able to repay, at best, a dime on every dollar.

What Powell did not foresee, however, was the Colorado River Basin arbitrarily divided, with each half given an equal amount of water. To him, such a false partitioning might have seemed absurd, for it made far better sense to irrigate in the lower basin than in the upper. But he could not imagine that the blind ambition of the Bureau and the political power of the upper basin would join forces to try to pretend that a mile of elevation difference, and the staggering climatic difference such a disparity implies, did not exist.

Simply stated, the problem with most of the upper basin was that it was too high, too dry, and too cold. Land that was well suited to

irrigation in a topographic sense—meaning that a river flowed through a wide valley with good soil which lay below a natural damsite somewhere in the mountains above—often sat at altitudes above five thousand feet. Virtually the whole state of Wyoming, for example, lies at an altitude of six thousand feet or higher. Much of Colorado is over a mile high; most of Utah is over four thousand feet. In Cheyenne, Wyoming, the frost-free season is barely four months. In such a climate, one can grow only low-value crops—alfalfa, irrigated pasture, wheat—which require much acreage to produce a meager income. Not only that, but some such crops—irrigated pasture in particular—require a lot of water, up to three times more than some high-value crops: oranges, tomatoes, nuts, even lettuce.

In 1915, it made sense to build a few economically ill-advised projects in the interior West anyway, in order to reduce its abject reliance on imported food and offer some economic stability to the region. And, in fact, dozens of marginal projects were built in the Rocky Mountain and northern plains states during the first thirty years of Reclamation's reign. But it began to make less and less sense by 1945, after tens of billions of dollars had been invested in an efficient transportation system that forever ended the isolation of places like Cheyenne and helped bring them into the nation's economic mainstream. And it made even less sense by 1955, when the nation was burying itself under mountains of surplus crops—often the same crops (wheat, barley, corn) that had to be grown in the high, cold intermountain West.

What all of this meant—to the taxpayers, anyway—was that the overwhelming share of the cost of any so-called self-financing project in the upper Colorado Basin would end up being subsidized by them. The cost of the projects would be so great, the value of the crops so low, and the irrigators' ability to pay for water so pitiful that to demand that they repay the taxpayers' investment in forty years, even allowing for the exemption from interest payments, would be to lead them into certain bankruptcy. Some of the older, *better* projects had already had some of their repayment contracts sneakily extended by several decades, and there was absolutely no evidence that they could be repaid even then. But, on the other hand, to imagine Congress booting farmers off Reclamation projects because they couldn't meet their payment obligations was unthinkable. The taxpayers would have to bail them out, even if bailing them out meant a long-term bill of billions and billions of dollars.

How well the Bureau's leadership understood this is a good question—although the secret correspondence in the Bureau's files reveals

that they knew a lot more than they let on in public. (In the 1920s, Federick Newell, the former Reclamation commissioner, was already decrying the "sentimentality" of the federal irrigation program, through which, he said, money was "deftly taken from the pockets" of the taxpayers.) What is *true*, of course, does not necessarily *matter* in a political sense, and that was particularly the case in the American West, and even more so in the upper basin. By the 1950s, California was already using its full 4.4 million acre-foot entitlement to the Colorado River and planning batteries of new pumps that would allow it to suck up 700,000 acre-feet of additional flows. The Bureau, having built Hoover Dam mainly for California's benefit, was now embarking on the Central Valley Project, a project of absolutely breathtaking scope that was exclusively for California. As far as the upper basin was concerned, it was time for some equity. And equity was only the half of it. If there was surplus water in the river—water which the upper basin owned but wasn't yet able to use—and California began "borrowing" it, would that imperial-minded state deign to give it back? The imperative for the upper basin was to develop its share of the Colorado River as fast as possible, whether the projects that could be built there made sense or not. And it was the basin's unbelievably good fortune that in the 1940s, Congress would give it a money-making machine that would allow it to do so—a machine that became known as the cash register dam.

A cash register dam was to be a dam with an overriding, if not a single, purpose: to generate electricity for commercial sales. If electricity would bring in many millions of dollars in annual revenues which could be used to subsidize irrigation projects that hadn't a prayer of paying back the taxpayers' investment. The dams were an invention spawned by something the Bureau of Reclamation called river-basin "accounting," which was itself spawned by something it called river-basin "planning."

River-basin planning, at least, made a certain amount of sense. A river like the Arkansas, which rises in the Colorado Rockies and empties into the Mississippi in an utterly different time zone and topography and climate, invites competing and potentially incompatible uses. Upstream, it is valuable for irrigation; downstream, it is valuable for inland navigation. If the Bureau diverts too much water for upstream irrigation, there won't be enough water available downstream to justify the Army Corps of Engineers' efforts to turn the lower river into a freeway for barges—an obsession it has been pursuing on virtually every large river in the country. The dilemma could also work

in reverse; if the Corps got a head start on the lower sections of a river, the Bureau could find itself unable to get any upriver projects authorized. The creation of the Tennessee Valley Authority marked the first time a major river system was "viewed whole," even if the natural river virtually disappeared as a result. The TVA was regarded as such a success by the administration of Franklin Roosevelt that it began to demand, if not more quasi-dictatorial authorities like the TVA, then at least a coordinated plan of development between the Bureau and the Corps. This was river-basin "planning," and, except for the fact that no one ever spent more than a minute or two thinking about the value of a river in its natural state, it made some degree of sense.

River-basin "accounting" was a horse of a different color, though the Bureau developed a propensity to use "planning" and "accounting" interchangeably. With river-basin accounting, one could take all the revenues generated by projects in any river basin—dams, irrigation projects, navigation and recreation features—and toss them into a common "fund." The hydroelectric dams might contribute ninety-five cents of every dollar accruing to the fund, while the irrigation features might contribute only a nickel (and cost three times as much to build and operate as the dams), but it wouldn't matter; as long as revenues came in at a pace that would permit the Reclamation Act's forty-year repayment schedule to be met, the whole package could be considered economically sound. It was as if a conglomerate purchased a dozen money-losing subsidiaries while operating a highly profitable silver mine—a case of horribly bad management which, nonetheless, still leaves the company barely in the black.

Michael Robinson, the Bureau's semiofficial historian, exhibits no compunction about admitting any of this in the Bureau's authorized history, *Water for the West*:

By the late 1930s, the high cost of projects made it increasingly difficult for Reclamation engineers to meet economic feasibility requirements. In the early 1940s, the Bureau devised the plan of considering an entire river basin as an integrated project. It enabled the agency to derive income from various revenue-producing subfeatures (notably power facilities) to fund other works not economically feasible under Reclamation law.

Thus, by offsetting construction and development costs against pooled revenues the Bureau was able to demonstrate the economic feasibility for the entire, pooled program. In 1942 this method was used for the first time in planning a basinwide development program for the Bighorn River in Wyoming. All

benefits and income from producing units were lumped together to establish overall feasibility. In 1944, the Bureau's "Sloan Plan" for the development of the Missouri River followed the same formula . . . [and] encouraged the Bureau to *enthusiastically prepare basinwide plans for several western rivers*. . . . [Emphasis added]

"Enthusiastically" is a bit of an understatement. The beauty of river-basin "accounting," from the Bureau's point of view, was that it would be literally *forced* to build dams. The engineering mentality which, Robinson himself admits, came to dominate the Bureau's thinking in the 1930s and 1940s created an institutional distaste for irrigation projects. They were a necessary nuisance that provided the rationale for what Bureau men really loved to do: build majestic dams. In the past, however, the infeasibility of many projects put a damper on their ambitions, because if a project didn't make economic sense, they lost the rationale they needed to build a dam to store water. With river-basin accounting, the equation was stood on its head: a lot of bad projects—economically infeasible ones—created a rationale for building *more*, not fewer, dams. The dams—all with hydroelectric features, of course—would be required to compensate for the financial losses of the irrigation projects; the losses would miraculously vanish in the common pool of revenues.

River-basin "accounting," then, was a perversion of a sensible idea—that idea being to plan the "orderly" (a favorite Bureau word) development of a river basin from headwaters to mouth. But even if it subverted logic, economics, and simple common sense, it was essential to the Bureau's survival as an institution and to the continued expansion of irrigation in the high, arid West. On the other hand, it was something akin to a blanket death sentence for the free-flowing rivers in sixteen states.

What the upper basin of the Colorado lacked, because of its elevation, in feasible irrigation projects it more than made up—for the same reason—in sites for cash register dams. High and mountainous, geologically young, the basin had deep valleys and tight plunging gorges ideal for dams—gorges in which ran rivers that fed the main Colorado and could be included, under the bizarre new logic of river-basin accounting, in any grand basinwide scheme. The rivers, draining arid and semiarid regions, may not have held much runoff, but a very high dam on a small river can yield as much hydroelectricity as a low dam on a much larger one; that is the beauty of what dam engineers call hydrologic head: velocity of falling water does the work of volume,

of mass. There was Glen Canyon on the main-stem Colorado, Powell's favorite riverine haunt, an ideal site for a six-hundred-foot dam. There was Flaming Gorge on the Green, and Red Canyon—each a perfect site for a gigantic curved-arch, thin-wall dam approaching Hoover in size. There was the Black Canyon of the Gunnison, an almost sheer thousand-foot gorge with several sites for high dams. The Dolores, the Yampa, the White, even smaller streams like the Animas and San Miguel and Little Snake—each had at least one site for a cash register dam. Since the dams would have to be large compared to the meager river flows, they would be expensive to build. But that wouldn't matter; the Bureau had the Treasury at its disposal.

All the upper basin needed, then, was Congressional clout—that, and a Reclamation Commissioner who believed in dams for dams' sake. And it was the upper basin's further good fortune that, near the end of his third term, Franklin Roosevelt would appoint such a man as his Commissioner of Reclamation. His name was Michael Straus.

Mike Straus was the unlikeliest commissioner the Bureau ever had. For one thing, he was an easterner; for another, he was a newspaperman. On top of that, he was rich. By temperament, Straus was an exact opposite of the slide-rule engineers who had guided the Bureau during its forty-odd years. He was an anomaly down to his very genes. Straus had married into the Dodge family, and his brother-in-law was Eliot Porter; he had wealth and social connections, too. While typical Bureau of Reclamation families spent their vacations on houseboats cruising the reservoirs that Daddy built, Straus went to the family retreat at Spruce Head Island, on Maine's Penobscot Bay. It was their island—all of it. Straus could have spent his life clipping coupons, safari hunting, or writing the hyperventilating prose that was his second love. But there was nothing on earth that gave Mike Straus quite as much boyish, exuberant satisfaction as erecting dams. In eight years as Commissioner of Reclamation, he would become responsible for as many water projects as any person who ever lived.

Straus had been selected at the close of the war by Harold Ickes, himself a newspaperman, after the Roosevelt administration had endured twelve years of relatively plodding Bureau leadership under Elwood Mead, Harry Bashore, and John Page. Straus was Ickes's alter ego—a newspaperman, a liberal, a fighter, a curmudgeon. Franklin Roosevelt, who equated wealth with energy and idealism, heartily endorsed the appointment. It was a brilliant stroke. For all his man-of-the-people reputation, FDR felt paranoia about the common man. His secret fear was that the Depression would begin anew after the war, and the returning veterans would be unable to find jobs; ulti-

mately, they might revolt. In the Bureau of Reclamation, FDR had a vast job-creating engine, an agency that remade the western landscape into a place where the dispossessed could go. In Mike Straus, he had a commissioner who would stoke the engine until the rivets began to pop.

Like a lot of people who inherit or marry wealth, Straus viewed money abstractly. A million was a number, budgets were a nuisance, feasibility reports were a waste of time. And, having abandoned a career that asked for a constant objective adherence to facts, he soon acquired an easygoing way with the truth. "Facts," said one of his successors as commissioner, Floyd Dominy, "didn't mean a god-damned thing to him."

Straus was a spectacle. He was shambling, big as a bear, a terrible dresser, and a slob. "The characteristic Mike Straus pose," remembered Dominy, "was for him to plant his feet on his desk, almost in your face, and lean back in his swivel chair flipping cigarette ashes all over his shirt. At the end of the day, there was a little mound of ash behind his seat. He was an uncouth bastard! He carried one white shirt with him on trips. I remember one night when Reclamation was throwing a party, and a cub reporter came by and asked me where to find Mike Straus. I just said, 'Go upstairs and look for the guy who reminds you of an unmade bed.'"

There was something else about Mike Straus: his arrogance. Once, in the very early 1950s, he got on a plane without reconfirming his reservation, which one was required to do in those days. The plane turned out to be overbooked, and since Straus had not reconfirmed, he was the one who was supposed to be bumped. The flight attendants invited him off the plane, but Straus refused to budge; he pretended not to hear. As a whole plane full of passengers cursed him under their breaths, Mike Straus sat there like a pig in goo. Finally, the captain had to ask for volunteers to bump themselves so that the plane could take off. There weren't a lot of flights in the early 1950s, and the passengers would have to wait a long time for another one. But Straus appeared unmoved; he wasn't even embarrassed. "It didn't faze Mike a bit," said a Reclamation man who was with him. "He thought he was performing the greatest work in the country, and he felt like the holiest bureaucrat in the land."

Cavalier, arrogant, mendacious, and whatever else he was, Mike Straus was also an idealist. A good stalwart liberal in the New Deal tradition, he believed in bringing the fruits of technology to the common man. He bore a ferocious grudge against the private utilities of the West, who denied reasonably priced power (or power at all) to

rural areas struggling against adversity on every side, and who bought space in magazines and (he was convinced) bribed reporters to rail against the Bureau's public-power dams. Straus also made some tentative efforts to crack down on the big California growers who were setting up dummy corporations and trusts in order to farm tens of thousands of acres illegally with subsidized Bureau of Reclamation water. In so doing, he infuriated the growers' and the utilities' friends in Congress, and a group of them finally decided to get rid of him. Since Straus served at the President's whim and had Harry Truman's blessing, it was useless to demand he be fired, so the politicians tried another tack. In 1949, they pinned an obscure rider onto the public-works appropriations bill that specifically withheld the salaries of Michael Straus and his regional director in California, Richard Boke. The independently wealthy Straus remained as commissioner—without pay. His enemies were upset, and that is putting it mildly. "Straus made them so mad I thought they might put out a contract on his life," says Floyd Dominy. "I have done what no good Republican has been able to do," Straus wrote to his friend Bill Warne, a former assistant commissioner then in Iran, "and that is to unite the Republican party on at least one platform and provide them with one program—to wit, who can fire Straus first."

However, as the big growers in California and the private western utilities were trying to get rid of Mike Straus, the upper basin was cultivating him just as assiduously. The population of the basin had grown substantially since the Colorado River Compact was signed, but the growth of irrigated agriculture had remained well behind. Most irrigation was by simple diversion, without benefit of reservoir storage. During droughts, the farmers were flirting with disaster; during floods, they watched millions of acre-feet escape to the lower basin unused. The farmers on the other side of the Front Range, on the perfectly flat expanse of the plains, had topography working for them; they could easily lead a diversion channel out of a river such as the Platte, fill a small offstream basin, and have a ready-made storage reservoir for a fraction of the cost of an on-stream dam. The West Slope farmers—those sitting in the Colorado River drainage—were at a terrific natural disadvantage, having no way to store their water and (in the case of some) being at a higher elevation besides. Meanwhile, California was now using up its entire entitlement and still growing by leaps and bounds. If the upper basin didn't hurry and begin using its own entitlement, California seemed certain to try to "borrow" it; if it succeeded, and millions of people then depended on that water, how would the upper basin ever get it back? But how, on the other hand,

were Colorado, Utah, and Wyoming ever to use their share of the river if they couldn't afford to build dams themselves and if high-altitude Reclamation projects could never pay themselves back?

The answer, frantically conceived by Mike Straus's Bureau during the last days of his reign—much of it was laid out in the weeks after Eisenhower, who was certain to fire Straus, was already President-elect—was the Colorado River Storage Project. Behind the innocuous name was something as big as the universe itself. In a press release that accompanied the legislation's transmittal to Congress in early 1953—days before Ike's inauguration—Straus described it rather modestly as "a series of ten dams having a storage capacity of 48.5 million acre-feet." What he failed to mention was that 48.5 million acre-feet was more than all the existing reservoirs on the main-stem Colorado and all the tributaries could hold—more than the combined capacity of Lake Havasu, Theodore Roosevelt Lake, Apache Lake, Bartlett Reservoir, San Carlos Reservoir, Painted Rock Reservoir, plus the then largest reservoir on earth, Lake Mead. The ten dams would, according to Straus, capture "several times the total annual flow of the river." In fact, with the lower basin reservoirs already holding close to forty million acre-feet, between *five* and *eight* times the long-term annual flow of the river would be captured, depending on whose estimate you believed—a storage-to-yield ratio that was not approached by any other river in the world, no matter how used. The annual evaporation from all these huge, exposed bodies of water, languishing under the desert sun, would itself exceed the storage capacity of all but a few reservoirs in the nation.

It wasn't, however, the mere magnitude of the project that set it apart. What set it apart was the way irrigation and power production were linked. The earliest projects were designed exclusively as irrigation projects; if any power was incidentally generated, it was sold to project farmers at bargain rates. With Hoover Dam, the Bureau took a big plunge into public power; nearly two-thirds of its hydroelectricity went to light Los Angeles. However, when Angelenos paid their power bills, they weren't subsidizing the farmers in the Imperial and Coachella valleys who were irrigating with Lake Mead water; they were merely paying back the cost of the dam.

The Colorado River Storage Project would be utterly and fatefully different. Anyone who bought electricity at market rates from the dams—and 1,622,000 kilowatts, an enormous amount at that time, was planned—would be subsidizing irrigation in the upper basin. *Eighty-five cents* of every dollar spent on irrigation features would be subsidized by power revenues. Every time they flicked a switch, elec-

tricity consumers in the region would be helping a farmer plant alfalfa at six thousand feet to feed a national surplus of beef.

The Bureau was strikingly candid about the dismal economics of irrigation in the upper basin. "The [upper basin] farmers can't pay a dime, not one dime," lamented the Bureau's chief of hydrology, C. B. Jacobsen, to a Congressional committee. And as if to demonstrate how far Congress had come in accepting the subsidization of an entire region, Jacobsen's words fell on sympathetic ears. Western members, even those whose districts were well outside the basin, lined up to support the bill—perhaps because they expected their own uneconomical projects to be supported in return. For the first time, a majority of eastern members seemed indifferent, neutral, or even sympathetic—perhaps because *they* had Corps of Engineers projects they wanted built which might require the western members' support. Even the Eisenhower administration decided to give the Colorado River Storage Project lukewarm support, though it violated every conservative principle Ike had ever espoused.

The most effective opposition, by far, came from Paul Douglas, the urbane Senator from Illinois, who, ironically, had played a pivotal role in the creation of the New Deal. When World War II broke out, Douglas was fifty years old, a former economics professor at the University of Chicago who had become a reform-minded Chicago alderman. He promptly enlisted in the Marines, talked himself out of a desk job, and got to the front lines of the Pacific theater. He was gravely wounded at Peleliu and again at Okinawa, and was lucky to return alive. Elected to the Senate after the war, Douglas brought all of his determination and iconoclastic, brilliant thinking to Washington with him. He was—perhaps because of his economics background—the first architect of the New Deal who seemed to sense that something had gone drastically wrong. And the worst perversion of the New Deal ideas that *he*, at least, had in mind was the Reclamation program, subsidizing high-altitude desert farmers so they could grow the same crops some of Douglas's farmer constituents were being paid *not* to grow—so serious had America's crop-surplus problem become now that Europe was back in production again.

In a series of memorable debates on the Senate floor, Douglas, tall, athletic, and white-haired, went after the Colorado River Storage Project hammer and tongs. At Glen Canyon Dam, he told his colleagues, the cost of hydroelectricity per kilowatt would be \$463; at Echo Park Dam, it was over \$600; at Central Utah, it was \$765; at Flaming Gorge, it was more than \$700. "Let us compare that cost with the average cost in the Tennessee Valley of \$166 per kilowatt of capacity. At Bonne-

ville, the average cost was only \$115. At Hoover, the cost was only \$112. At Grand Coulee, the cost was only \$90. . . . [I]t is extraordinary that an administration which has declared public power to be creeping socialism, which has put the lid on additional dams on the Columbia, should go up into the mountains of Colorado and there locate public power projects where the cost will be three, four, or five times what they would be at these other locations. . . . I am not saying that the administration wishes to have this project fail. But I will say that if the administration had wished to discredit the public power system, it could not have proceeded in any better fashion than it has done in this instance." And he couldn't help noticing, said Douglas sarcastically, that certain Senators who opposed public power in the Tennessee Valley and the Columbia Basin had suddenly emerged as great champions of public power when it was to come from cash register dams in the mountains of Colorado.

The power features, however, were, as Douglas knew, not the worst aspect of the storage project, but the best. The worst, by far, was the irrigation. "The original projects," he lectured his colleagues, "tended to be at low altitudes and in fertile soil, and to involve low costs. . . . Now we are being asked to irrigate land in the uplands, at altitudes between five thousand and seven thousand feet, where the growing season is short and the chief products will be hay, corn, livestock, and alfalfa. . . . There exists an interesting tendency for Senators in those States to congregate on the Committee on Interior and Insular Affairs and the Committee on Appropriations, which consider irrigation and reclamation bills. There is a sort of affinity, just as sugar draws flies." For the benefit of his colleagues and the Bureau, whose economists had labored mightily to put the CRSP in the best possible light, Douglas had sat down and figured out the per-acre costs of the various projects himself. The Silt River Project in Colorado, for example, would cost \$674 per acre; the Paonia project, \$873 per acre; the Central Utah Project, the most expensive of the lot, \$1,757. If one calculated interest, Paonia would go up to \$2,135 per acre, Central Utah to \$3,953 per acre. These were the mid-1950s, when land prices in the West were still dirt-cheap. Most of the land whose conversion to irrigation would cost thousands of dollars an acre was not worth more than \$50 per acre, and that, in many cases, was being generous. "In my state of Illinois," Douglas pointed out, "the price of the most fertile natural land in the world is now between \$600 and \$700 per acre. In the largest project of all, the Central Utah Project, the cost would be nearly \$4,000 an acre—six times the cost of the most fertile land in the world."

If an investment of \$2,000 an acre could create reclaimed land worth \$2,000 an acre, that would be one thing. But even after being supplied with irrigation water, the upper-basin lands would be worth nowhere near that. "What is to be grown on the land?" asked Douglas. "Of the sixteen projects reported, eight of them were stated as being suitable for livestock only, through the raising of alfalfa and pasture. Seven were stated as being primarily for livestock, but with some fruit and vegetable production. . . . 95 percent of the projects contemplate the production of alfalfa or grain or are directly or indirectly for the feeding of cattle. As a consequence, this land, *after irrigation*, will not be worth very much, probably not more than from \$100 to \$150 per acre—\$150 per acre at the outside. Yet we are being asked to make an average expenditure of \$2,000 an acre on land which, when the projects are finished, will sell for only \$150 per acre."

Douglas's western colleagues, of course, had no answer to this; his math was correct, his reasoning impeccable. All they could do was stand the rhetoric of their nineteenth-century predecessors on its head; instead of praising the fertile soil and glorious climate of the West, they talked about how miserable and uninhabitable their home states were. "The Senator from Illinois has correctly stated that we have little rain," said Joseph O'Mahoney of Wyoming. "I say to him, 'Pity us. Let us store the rainwater which for thousands of years has been rolling down the Colorado River without use. Please have some pity on the area, which is the arid land area of the country. It wants to conserve the great natural supply of water which the Almighty placed there, for man to use, if he has the intelligence and the courage to use it.'"

All of Paul Douglas's eloquence and logic, as it turned out, were a poor match for appeals such as O'Mahoney's and the growing Congressional power of the arid West. O'Mahoney and Clinton Anderson of New Mexico, representing Colorado Basin states, were powerhouses on the Senate Interior Committee; Carl Hayden of Arizona ruled Appropriations; Wayne Aspinall of western Colorado was the ascendant power at the House Interior Committee. The Colorado River Storage Project also enjoyed overwhelming public support, not just among the western farmers, but among their city brethren, too; conservatives, liberals, Democrats, Republicans—ideology meant nothing where water was concerned. The only serious public opposition came from southern California (which was expected) and from conservationists, who were horrified at the prospect of watching three of the most magnificent river canyons in the West filled by giant, drawn-down reservoirs: Glen Canyon on the main Colorado and Flaming Gorge and Echo

Park on the Green. Each of these reservoirs would be as long as smaller eastern states; Glen Canyon would stretch back for nearly two hundred miles behind the dam, not even counting tentacles of water that would reach up side canyons and tributary streams. But in those days conservationists didn't count for much. The Sierra Club had just one full-time person, whose name was David Brower, on its paid staff.

The outcome was foreordained. California had gotten Hoover Dam, Parker Dam, Davis Dam, the Imperial and Coachella projects, and water and power for Los Angeles. Now the upper basin would get its share. After minimal debate on the floor, the CRSP bill passed both Houses and was signed into law by Eisenhower in April of 1956. The estimated cost of everything was around \$1.6 billion, but it would, of course, be substantially more. Never in U.S. history had so little economic development been proposed at such an exorbitant public cost, for all the billions were buying, besides extremely expensive public power, were a few patches of new irrigated lands whose composite size was smaller than Rhode Island. The subsidies, it turned out later, would be worth as much as \$2 million per farm, perhaps five times as much as the farms themselves were worth. But even if the Colorado River Storage Project seemed like utter folly, the Bureau of Reclamation and its sometime collaborator and arch-rival, the Army Corps of Engineers, were on a tear.