Rebuild, Expand U.S. Water Supply System

by Marcia Merry Baker and Arthur Ticknor

Over the past 25 years, U.S. water infrastructure has not been expanded and repaired at rates required to provide for needed economic purposes (industry, agriculture, residential, navigation, flood control) in terms of amount, quality, and distribution. Over the 15 years from 1980 to 1995, the population grew 16%, while water use declined 10%! Just "efficiency" or "wise use"? Not at all. **Figures 1-3** show how the U.S. economy is "drying up." The data, shown from 1950 to 1995, are from the U.S. Geological Survey (USGS), a division of the Interior Department, which began water-use estimates after World War II, for purposes of planning how to expand supplies for the future.

Figure 1 shows that U.S. total daily water withdrawals (water diverted for use, from streamflow, groundwater, and any other sources) grew each year from 180 billion gallons per day in 1950 up to 440 bgd in 1980. Then total daily withdrawals fell back to 399 bgd in 1985; reached 408 bgd in 1990; and fell back to 402 bgd in 1995. The graph also differentiates major uses of water in the economy. Since the 1970s, less water is being used for industrial purposes, for thermoelectric power uses, and for irrigation. The categories for which water use has grown are "public supply" (urban residential, commercial, and amenities), and "rural domestic and livestock," most of which reflects non-urban sprawl, in both residential and commercial use.

On a per-capita basis, the overall decline in water in use in the economy, has dropped dramatically since the mid-1970s. To put this into perspective, note that the U.S. economy in 1900 averaged about 500 gallons per day per capita, rising to nearly 2,000 as of 1975, and falling to 1,505 in 1995.

Figures 2 and 3 show what this means for industry and agriculture. Over the 1950s and 1960s, daily average water use in U.S. industry per capita varied, but mostly stayed at a level of 240 gpd, reflecting the impact of certain technological advances in obtaining more output of product per unit input of water required. However, as of 1995, the rate of industrial water per capita had fallen to 109 gpd. This reflects the shutdown of U.S. industry, and the shift into the "post-industrial" era of outsourcing and increasing import dependence.

The use of irrigation water, in Figure 3, likewise shows a sharp decline from a high of 653 gpd in 1980, down to 543 gpd in 1990, and 502 gbd in 1995.

These drops in water use directly reflect the way that the U.S. market basket for consumption and capital goods has been made dependent on foreign water utilization associated with the imports of goods and food. For example, it takes 10,000 gallons to produce an automobile; 26,450 gallons to tan a ton of hides for shoe leather; 6,340 gallons to produce a ton of fruits, vegetables, and juices. Multiply these water factors by the quantities of cars, shoes, and food items being imported into the United States, and you see how the U.S. is "getting by" with using less and less water in the economy: by looting foreign trade partners, and cheating the future.

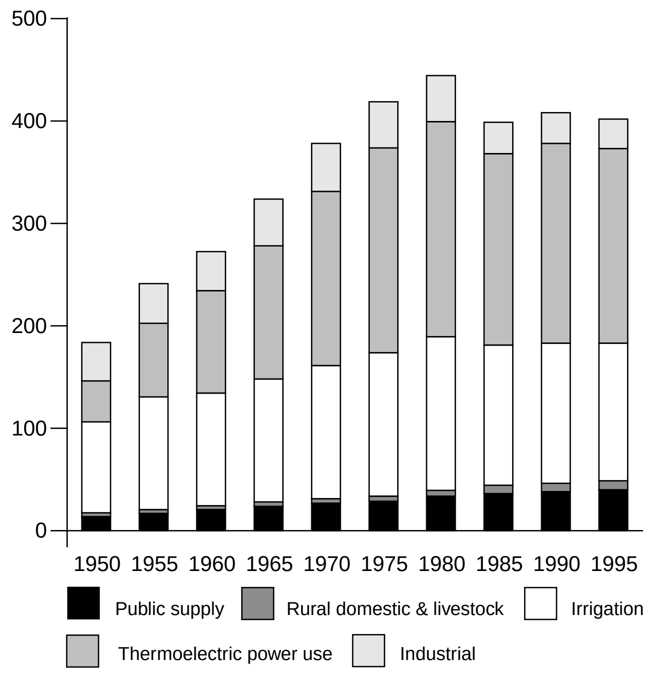
The volume of water in use for manufacturing of all kinds in the United States, as of 1995, was way lower than in 1950, the year the USGS began keeping records!

Deficit in 'National Water Budget'

Most people erroneously think of "natural resources" as a given, when in fact, they are man-made. Intervening with infrastructure expands and improves the resource base. Hydrologists use a helpful term: the "water budget."

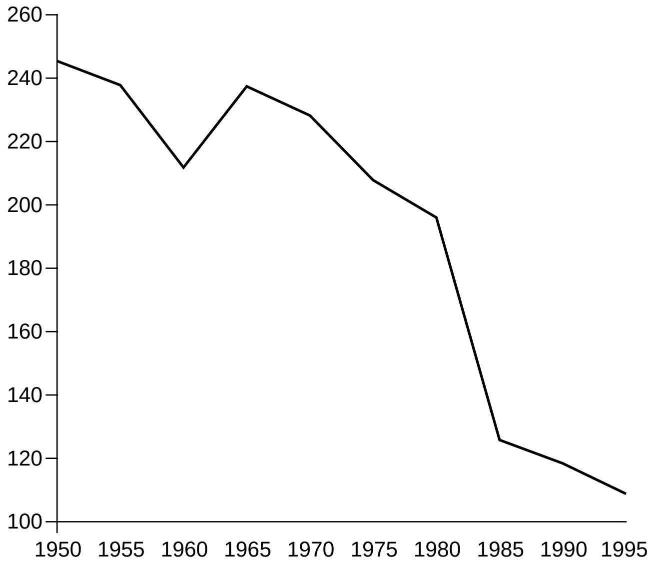
In all of North America, the annual precipitation amounts to an estimated average of 4,200 bgd. Of that, about 1,200

FIGURE 1
U.S. Water Withdrawals, Total and by Sector, 1950-1995
(Billions of Gallons per Day)



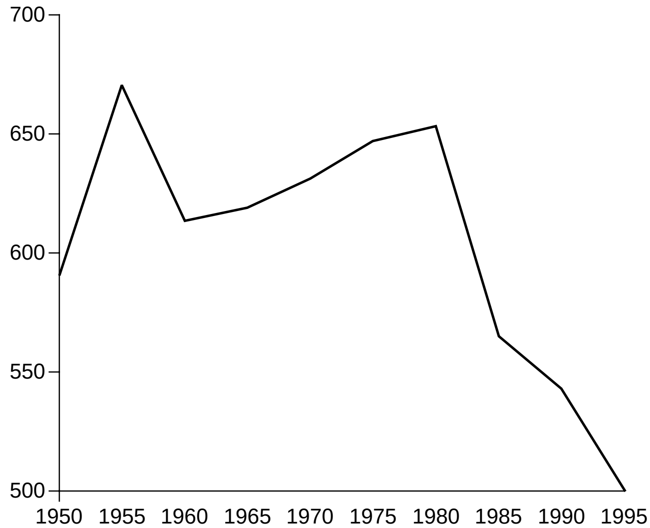
Source: U.S. Geologic Survey.

FIGURE 2
U.S. Per-Capita Industrial Water Use, 1990-1995
(Gallons per Day)



Source: U.S. Geologic Survey.

FIGURE 3
U.S. Per-Capita Irrigation Water Use, 1950-1995
(Gallons per Day)



Source: U.S. Geologic Survey.

bgd reaches the 48 states, where man's intervention over the past 200 years has directly affected what water engineers call the "average dependable supply of runoff." In recent decades, this dependable supply has totalled about 515 bgd for the United States. It is not a fixed figure, but the result of man's activities to clear channels, drain swamps, prevent evaporation, and create storage capacity.

As of the mid-1960s, the United States had a "budget surplus" of water. With over 190 million people, the nation was using about 308 bgd, which was 60% of the average dependable supply of 515 bgd. This supply reflected the dam-building of the inter-war period—the Grand Coulee and the Hoover dams, the Colorado River development, the Tennessee Valley Authority, and the post-war California Water Plan (adopted in 1957).

In the 1950s and 1960s, there were engineering plans to continue large-scale water projects to provide for the future. It was projected then that the 1990 U.S. population would be about 250 million, and the economic base would require 588 bgd of average dependable water supply.

Where would the "new" water come from? From continuing the geo-engineering, continental-scale water projects—the priority one being the North American Water and Power Alliance (NAWAPA), shown on p. 33; from finishing and undertaking other, smaller-scale projects in and across other river basins; and also, from creating fresh water by desalting sea water with nuclear-powered desalination plants.

Overall, NAWAPA would add at least 135 billion gpd to the U.S. "water budget," and additional water supplies would be available to Canada and Mexico as well. For the United States, this would be a 20% increase in supply, concentrated in the Western, arid states. Had such programs been pursued, we would not have the water problems that are common today. But these projects were blocked.

Therefore, when the U.S. population in 1990 did reach some 252 million, there were many regions where water supplies were inadequate, even though the economy was only using about 408 bgd, and nowhere near the previously projected 588 bgd. This means that whenever an episode of extreme weather happens—such as the current El Niño phenomenon affecting the Pacific Rim lands—the regional effects are acute, because of the lack of infrastructure.

Drought is now parching over half of the United States, and causing vast damage in Mexico and the Canadian Prairies. Even in "good weather," saltwater intrusion in coastal regions—on the Atlantic, and in the Gulf of Mexico—is now a problem.

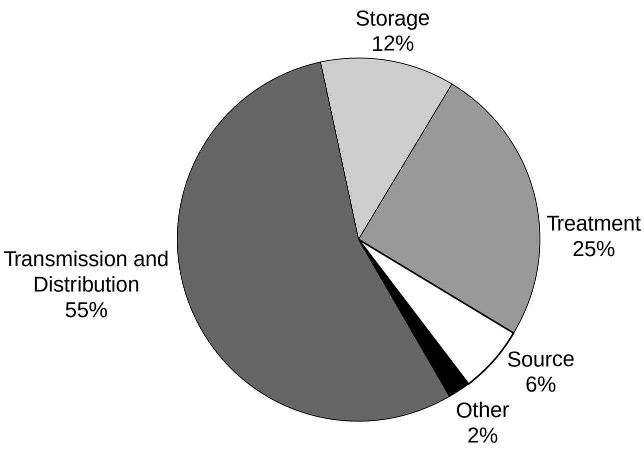
In this context, it is particularly outrageous that the governments of the United States and Mexico are today at odds over how to fix blame for non-compliance with the bilateral 1940s water-sharing agreement—in other words, how to share non-existent Rio Grande River Basin water! Here water resources have been below requirements for decades, yet this region was targetted for locating *maquiladoras*—slave labor factories, just over the border, inside Mexico—and also free trade "factory farms." The lower Rio Grande Basin has become a biological breakdown zone because of lack of safe and sufficient water. Water-borne diseases, including dysentry and hepatitis, are spreading; cholera has appeared; the West Nile virus arrived this Summer.

Already in 1975, based on its prior surveys, the U.S. Geological Survey forewarned against any more population influx, or expansion of economic activity in the Rio Grande region, until and unless new volumes of water and water treatment systems were provided. The 1975 USGS warning said: "Water quality is a serious problem in the lower Rio Grande Valley and precludes or inhibits expanded use of the valley under present conditions. . . . 20% of the lower valley population is not served by a public water supply system. This situation is likely to be aggravated by the increasing population in that area." The engineers' warnings were ignored. The U.S.-based multinationals moved in and set up shop, *without infrastructure.*

If real accounts are kept, a huge *repayment for water debts* is owed to Mexico by the U.S. consumption of *maquiladora* goods! What is required is to launch NAWAPA in the mutual interests of Canada, Mexico, and the United States, and act on other sister projects that have already been mapped out.

FIGURE 4

Pipes and Mains Are Biggest Area of 20-Year Restoration Projects for U.S. Drinking Water Systems



Source: Environmental Protection Agency Drinking Water Infrastructure Needs Survey, 1999.

Overhaul Aging Water Treatment Systems

Besides building infrastructure to increase water supplies, it is urgent to overhaul and expand the aged treatment and distribution systems. There are about 237,600 water-main breaks each year—650 per day—and chronic leaks in pipes losing 20% of the water carried by many aging city systems. Boil-water alerts and sewage overflows are now common. By 2016, the Environmental Protection Agency (EPA) projects, more than 50% of the 700,000 miles of pipes will be in poor condition, or broken.

For drinking water, there are four categories of concern—source, transmission (to the purification plant) and distribution, treatment, and storage. A 1999 EPA "Drinking Water Infrastructure Needs Survey" gave an overview. Replacing aging and deteriorated water mains and installing pumping stations, represent the largest category of need (**Figure 4**). Three generations of water mains are in need of replacement or upgrade: cast-iron pipes of the 1880s, with a life expectancy of about 120 years; thinner conduits of the 1920s, that last up to 100 years; and post-World War II tubes, the most numerous, good for about 50-75 years.

Next in order of need, is to repair or replace aging treatment plants, to reduce contamination. Plant components need to be replaced after 25-40 years or less, while the concrete structures last 50-70 years. The third largest need is to repair or replace finished water storage tanks, which are prone to rupture as they age.

The nation's municipal wastewater system is also in a big mess, as raw sewage spews out of pump stations and manholes, into streets and waterways, whenever rainfall or snowmelt fills crumbling sewers to overflowing. About 770 of the nation's older cities and towns face a health threat from overflows of combined sewer systems (CSO), the single-pipe sewers that move both sewage and storm water to treatment plants, built around the turn of the 19th to 20th Century. Only about one-third of the communities comply with minimum Federal CSO controls.

New or improved secondary wastewater treatment, such as replacing or upgrading overburdened treatment plants, the basic statutory requirement of the 1987 Clean Water Act Amendments, represents 27% of the total cost. New collector and interceptor sewers, which carry sewage to the treatment plant, make up 16% of the need.

What is required is a coordinated approach to bring decaying systems up to standard, while identifying high-tech water and power for new development sites on priority corridors. Cost estimates for refurbishing drinking water systems (not for growth or operations), range from the very low figure of $253 billion by the EPA (1999 survey), to $325 billion by the American Water Works Association (December 1998 study), for a 20-year period. For wastewater infrastructure investment (again, not for growth or operations), EPA estimates only $140 billion over the next 20 years—with states estimating an additional $34 billion.

Only an FDR-scale public works projects approach, can address this situation. "We need something like the Manhattan Project in World War II," was the plea this year, by John Hertel, chairman of the Macomb County, Michigan Board of Commissioners, referring to his area, where $52 billion of work is required for local sewerage and water over the next 20 years. "Like the Manhattan Project, this is something that only the Federal government could handle."