

Water woes: Past, present and future

Professor of Sustainability and Economics Michael Hanemann, an expert in environmental and resource economics, explores this vital resource in the U.S. and around the world.

Tapping into water

The United States' water systems range in age, from pre-Civil War to the Civil Rights era. For instance, some of Philadelphia's water mains were installed in the 19th century – which makes sense because it's a colonial city on the East Coast. Phoenix, on the other hand, has newer water systems because its population grew during the mid-20th century.

Many water mains and pipes were laid in the early to mid-20th century with a lifespan of 75 to 100 years.

The U.S. Environmental Protection Agency regulates 155,000 drinking water systems across the United States.

There are more than 800,000 miles of public sewage pipes in the U.S.

There are 500,000 miles of private lateral sewers.

Over the next 20 years, 56 million new users will be connected to centralized treatment systems.

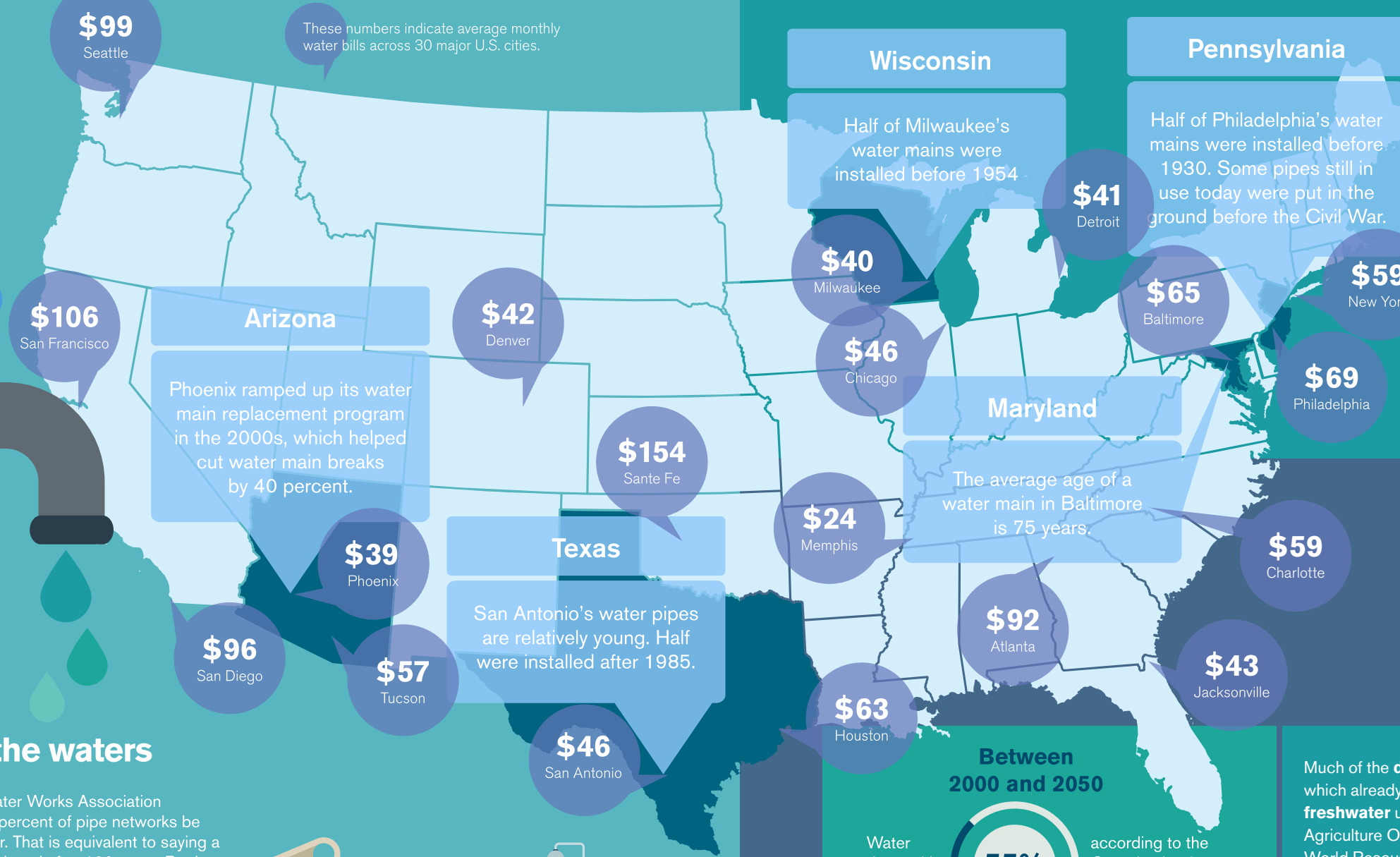
Testing the waters

"The American Water Works Association recommends one percent of pipe networks be replaced each year. That is equivalent to saying a pipe should be replaced after 100 years. But in some municipalities, to keep water rates down, the investment in maintenance is equivalent to replacing a pipe only after 1,000 years," Hanemann explains.

Each year in the U.S., 240,000 water main breaks occur.

Over the next 20 years, the cost to replace urban pipe networks may reach about \$1 trillion nationwide, says Hanemann. Water agencies will have to spend three or four times as much on replacing pipes as they do today. If anything, this might lower rather than raise property values.

These numbers indicate average monthly water bills across 30 major U.S. cities.



Arizona
Phoenix ramped up its water main replacement program in the 2000s, which helped cut water main breaks by 40 percent.

Texas
San Antonio's water pipes are relatively young. Half were installed after 1985.

Wisconsin
Half of Milwaukee's water mains were installed before 1954.

Pennsylvania
Half of Philadelphia's water mains were installed before 1930. Some pipes still in use today were put in the ground before the Civil War.

Maryland
The average age of a water main in Baltimore is 75 years.



Much of the **demand will be driven by agriculture**, which already accounts for **70 percent of global freshwater** use, according to the Food and Agriculture Organization of the United Nations. The World Resources Institute says food production must grow by 69 percent by 2035 to feed the growing population, which will expand agricultural water needs.

By 2035, the World Bank says the Earth's **energy consumption** will increase by **35 percent**. This will increase **water consumption** by **85 percent**, according to the International Energy Agency.



A gallon of gas costs a bit over \$2.
A gallon of milk costs about \$3.
A gallon of orange juice, about \$3.50.
Water comes directly into your home, and you pay only 2 or 3 cents for a gallon.



And, you have to make a trip from your home to get them.

Putting a price on water

Around the world, water is seen as something that should not be treated as a commodity. Instead, people see water as a human right, something that is provided but that should not have to be bought. "In 1821, a water activist in London said, 'Water must be considered one of the elements necessary to existence, the same as light and air; therefore, its supply to a great city ought not to be the subject of [commercial] trade,'" explains Hanemann.

"The economics ought to be simple. Water is not a man-made commodity; it falls from the sky."
– Hanemann

"But, in fact, the economics of water is surprisingly complex," explains Hanemann. "From an economic perspective, water is a difficult

commodity. It is free and yet costly. It is simultaneously a private good and a public good. It helped cities flourish financially, but now it is their financial burden. While water comes from nature at no charge, and three quarters of the earth's surface is water, people don't always live where water is located – in Phoenix, for example. And they need water year-round, not just when it rains. The cost of water is the cost of making it available at the right time, the right location, and the right quality – it is the cost of collecting, storing, transporting, and treating the water."

Residential water and wastewater bills have steadily increased by 5.7 percent annually over the past five years, outpacing average annual income growth (five percent) and inflation (1.9 percent), and magnifying the financial challenges facing municipal water utilities. Analysis of the 50 largest metropolitan areas in the U.S. show combined monthly water and wastewater bills averaging US \$91.06, based on standard household consumption by geography, according to a new U.S. Municipal Water and Wastewater Utility Bill Index from Bluefield Research.

"The cost of water is overwhelmingly a capital cost, much more so than electricity or gas or telephones. If you supply a bit more or a bit less water, the total cost hardly changes. Operating costs account for more than half the total cost of electricity supply, one third the total cost for natural gas, but only about one tenth of the cost for an urban water network."
– Hanemann

