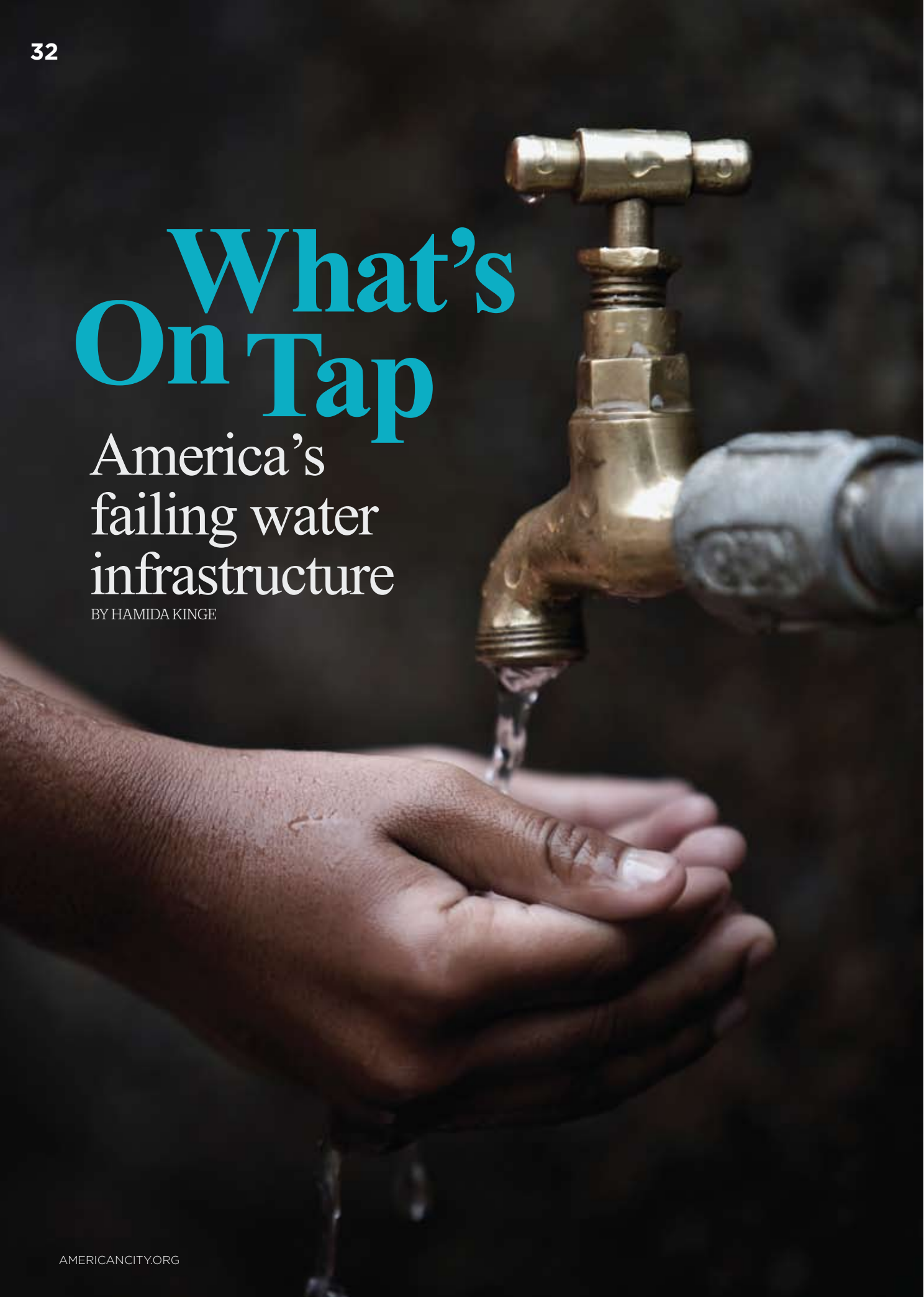

What's On Tap

America's failing water infrastructure

BY HAMIDA KINGE

All over the country, in cities especially, buried water infrastructure — the underground pipes and systems that distribute drinking water and take sewage and stormwater away — is failing. The innumerable effects include poor water quality, contamination of the watershed and the costly impacts of repairing the damage. Experts say water infrastructure has for too long been out of sight, out of mind.

Without the Chattahoochee River, Atlanta would not be the massive city it is today. The river is the area's primary source of water for drinking, industry and recreation. And yet the river was becoming a wasteland by the '70s: The city had grown so rapidly that it began overloading its sewer system, so when it rained heavily, raw sewage flowed into city creeks and the river, "leaving toilet paper hanging in trees and human waste rotting in stagnant pools," as reported in 1996 in *Stormwater: The Journal for Surface Water Quality Professionals*. Atlanta, like approximately 2,500 cities and municipalities in the U.S., has a combined sewer system, so stormwater can flow into pipes that carry domestic waste. Although the city treated water before it flowed to residential taps, that treatment did not completely remove fecal coliform, which was sickening residents. For decades Atlanta's water was a danger to public health, to the Chattahoochee and to the entire watershed. Finally, in the late '90s, several entities, including the U.S. Environmental Protection Agency (EPA), the Georgia Environmental Protection Division and the Upper Chattahoochee Riverkeeper, sued the city for water-quality violations. The lawsuit was settled in 1998 and 1999 with a federal consent decree, which gave the city until 2007 to fix the problem.

In 2002 newly elected mayor Shirley Franklin tasked herself with the complete rehabilitation of Atlanta's water and sewer infrastructure, dubbing herself "the sewer mayor." She created a panel of environmental experts to chair a comprehensive plan called Clean Water Atlanta, and after an outreach campaign in which she went to every neighborhood explaining the need to repair and replace buried water infrastructure, Franklin convinced three-fourths of residents to vote for a four-year, one-cent sales tax increase to fund the effort. Overall, Atlanta will spend $3.9 billion — a combination of the penny tax, low-interest state loans, the sale of local bonds, higher water and sewer rates, and a $1.2 billion line of credit. By 2025 the city will have separated its wastewater systems from the ones that handle stormwater runoff, and built a new treatment plant. Once the combined water is treated, it will be released back into the Chattahoochee.

"I think the critical take-home message from Atlanta is that local leadership makes a huge difference," says Steve Allbee, a gap analysis specialist in the EPA's division on sustainable water infrastructure. "You have a city that didn't do much for 40 or 50 years regarding its buried assets. The outcome was devastating. Obviously, pressure was brought to bear through a consent decree, but the real difference is that new city leadership decided to take ownership and tackle the problem head on."

Tom Curtis, deputy executive director for government affairs at the American Water Works Association, has a similar response. "Local leadership was stellar and remarkable in that case. They really stepped up to the issue, owned it and went out to the voters with a sophisticated and highly visible campaign to build support for what they had to do."

Most buried water infrastructure in the U.S. is more than 100 years old. Starved of the funding required to sustainably manage, maintain, repair and rehabilitate their assets, the vast majority of water utilities across the country are watching them crumble. Upgrades and maintenance are astronomically expensive and extremely disruptive, and since utilities have very little knowledge of water main condition, it can be hard to find leaks before they become breaks. Each year there are 250,000 water main breaks — close to 700 a day. This year the American Society of Civil Engineers gave a D-minus grade to the country's water and wastewater systems — the lowest grade of any infrastructure category. Failing buried infrastructure has grown to epidemic proportions nationally, and has reached a point where it is putting public health and the environment at risk. The "fix-on-failure" approach, experts say, is no longer working.

SICK PEOPLE, SICKER ECOSYSTEMS

Aging water infrastructure can pose risks to public and environmental health. June Swallow, a drinking-water infrastructure expert at the Rhode Island Department of Health, explains that breaks, leaks, worn spots and holes can introduce pathogens from soil into drinking-water mains (the reason for "boil-water" alerts during main breaks). Those pathogens generally disappear after repair, but there is a possibility, Swallow says, of them "finding a home" in biofilm, or slime, that sometimes exists inside a main. Even when pipes do not break, they can develop tuberculation, corrosive buildup resembling barnacles, caused by a chemical reaction between treated drinking water and metal pipe. According to the EPA, bacteria growth in tubercles can cause health problems. Swallow says that tuberculation is not the most pressing issue in water mains — the issue is that so many mains are "reaching the end of their useful life" simultaneously, creating an epidemic of failure.

The environment also suffers when buried infrastructure fails; breaks can pollute an entire watershed. Last June the Washington Suburban Sanitary Commission spilled 30,500 gallons of raw sewage into the Piscataway Creek, a tributary of the Potomac River, in turn a tributary of the Chesapeake Bay, an already severely ailing coastal water body undergoing extensive ecosystem rehabilitation. A month prior the agency spilled 30,000 gallons of raw sewage into the same creek, and last year it spilled more than 7 million gallons of raw sewage into Broad Creek/Piscataway Creek.

And then there was the disaster in Bethesda, Md., just before Christmas last year; Americans may recall the dramatic rescue video of helicopters pulling indi-

viduals from their cars after a 66-inch main burst on a busy road, putting dozens of lives at risk. That incident alone lost 55 million gallons of water and cost the commission more than $1 million.

MAPPING THE PROBLEM

The majority of America's drinking-water pipes were built around World War II, as cities and suburbs expanded rapidly. But basic information about the pipes — their location, depth and materials — was never recorded, and today the vast majority of cities and communities lack the technology needed to monitor and maintain buried assets. Today's water authorities don't know if a pipe below, say, a street in Brooklyn is made of cast iron, who manufactured it, how old it is, which elements in the surrounding soil may affect its condition, whether it was installed properly and so on.

AMERICA'S WATER INFRASTRUCTURE ONCE SERVED AS INSPIRATION FOR THE WORLD; EUROPEAN ENGINEERS AND CITY PLANNERS WOULD COME TO PLACES LIKE PHILADELPHIA TO GET A LOOK AT HOW WATER WAS DELIVERED.

"The challenge we are facing is not like the transportation department's," says Dr. Sunil Sinha, a professor of civil and environmental engineering at Virginia Tech University and co-director of the university's Institute for Critical Technology and Applied Science. "They have 50 DOTs. We have 40,000 water utilities." Sinha leads a research project called SWIM, or Sustainable Water Infrastructure Management. The center is working with the EPA, national laboratories, the water industry and utilities to develop a sustainable way to manage and monitor buried infrastructure and teach water utility managers this new practice. "In transportation they have a standardized national database," Sinha says. "Every DOT does what it does as an independent DOT, but at least they can access a database from everywhere. They can tell you how much bridge is there, etc., but in pipe infrastructure, that doesn't exist."

Sinha's team is creating an Internet-based GIS (Geographic Information System) to help cities map their existing networks of underground pipes, based on data collected from 17 U.S. cities, including Seattle, Atlanta, Miami and Dallas. (Las Vegas and Chicago are among cities already effectively using GIS to manage their assets.) Sinha says utilities cannot predict pipe failure without proper data. "Some 30-year-old pipes are falling apart and 80- or 90-year-old pipes are perfectly fine. Fifty percent of the pipes they are pulling out of the ground have life left." Because inspecting every inch of pipe is virtually impossible, the GIS system would literally act as a map, helping a water utility or municipality rate the condition and performance of its pipelines, and be able to develop a standardized program for monitoring, maintenance, replacements and expansion. The logic extends beyond safety to simple financial sense: If you replace an asset too early, the EPA's Allbee explains, you've forfeited its extended service value, but if you address it too late, you waste money.

Pipe failure is not determined simply by age; Sinha's research shows that up to 70 factors can affect the failure of certain pipe materials, such as PCCP, or Prestressed Concrete Cylinder Pipe, which is what the infamous Bethesda water main was made from. A pipe's longevity can be affected by its materials, proper installation, water pressure, corrosive soil and soil erosion, groundwater and temperature, among other things. Water "load," the amount of water running through a pipe at a given time, has increased in areas with growing populations; if pipes have not been upgraded, they can become overstressed and prone to degradation.

Of course, before a utility can fix a pipe it has to make sure it owns it. "It's not like telephone service," Allbee says, "where from the household all the way up to the company, it's owned by the same entity ... We just have a massive number of organizations involved in the delivery of water and wastewater services. It's an extremely decentralized industry." In the Washington, D.C., area alone, for example, there are three water utilities: The Washington Suburban Sanitary Commission (WSSC) manages water for Montgomery and Prince George's counties in Maryland; the Fairfax County Water Authority manages water in Fairfax County, Va.; and the DC Water and Sewer Authority controls the city's water. The WSSC has six commissioners: three from Montgomery County and three from Prince George's County. In the last few years commissioners from the two counties have engaged in ongoing disputes, and Maryland Senate President Thomas V. Mike Miller Jr. recently insisted on an overhaul of the agency, calling it an embarrassment. In 2007 alone the agency reported 2,100 main breaks within its jurisdiction.

FALL INTO THE (FUNDING) GAP

Tom Curtis of the American Water Works Association (AWWA) does not believe the WSSC's interagency issues indicate a widespread problem among other utilities across the country, or that they have much of an effect on the failure to address aging buried infrastructure. "It can be an issue locally," he says, "and it's got to be solved locally." He says the real issue is funding.

At one time America's water infrastructure was the most advanced in the world. The film *Liquid Assets: The Story of Our Water Infrastructure*, which aired on public television last year, describes Philadelphia's water delivery system, the first in an American city. Engineers created technology to pump water from the Delaware River into the city as early as the 1800s, a system which served as a prototype for many cities, including New York City, which has one of the country's most sophisticated water distribution systems (it pumps its water via aqueducts from the Catskills, a watershed it has protected by buying up land around it). America's water infrastructure once inspired the world; European engineers and city planners would come to places like Philadelphia to get a look at how water was delivered. (Philly now gets its

water from the Schuylkill River.)

But the lack of funding, the "out of sight, out of mind" approach of water authorities and rapid population growth and development are making it difficult for water infrastructure to meet modern public health standards. Water is cheap, and that cheapness, experts including Allbee, Sinha and Curtis say, explains the lack of funding to fix crumbling buried assets. Americans pay less than other developed countries for water — $2.50 per 1,000 gallons of tap water — which covers only the operation of water utilities, not the extravagant costs of maintenance, upgrades, replacements and expansions required to treat and deliver clean water and take away and treat dirty water. The funding gap has created a "replacement backlog" for water infrastructure all over the country.

Historically, about 90 percent of all current buried infrastructure was built with local funds. Allbee and his department at the EPA are attempting to fundamentally shift public and water utility thinking on water costs. The EPA has developed a pricing structure called "full-cost pricing" to represent the expenses associated with sustainably treating and delivering water for the long-term.

The AWWA also touts the importance of full-cost pricing. "People have to accept that fact," says Tom Curtis, "and they have to be led to it; it's going to take leadership and outreach. People can be helped to understand that the utility business is expensive and it's our obligation to pay the full cost of it so we don't leave these run-down, worn-out water systems to the next generation." The Obama administration has dedicated $6 million to water infrastructure, a small percentage of what is actually needed for the repairs backlog.

Another solution, at least from the perspective of the AWWA, is a water infrastructure bank, which the organization will soon propose to Congress. The bank would have access to the federal treasury system and could borrow money from the federal treasury on the same low-rate terms that commercial banks have. The bank would then lend money to states that want to leverage their state revolving funds and directly to large projects for water and wastewater systems that have capital needs beyond what the state revolving fund can handle.

"The cost to the federal treasury is neutral to the federal deficit over the long run," asserts Curtis. "Your community pays for what it needs and you don't pay for what some other community needs to do." He says that borrowing at the federal treasury rate and passing that low rate on to water projects would save anywhere from 10 to 20 percent on financing costs compared to selling municipal bonds at current rates.

"There are few problems in the nation that are more significant than this issue of water over the long term," says Allbee. "This is a really big question for us. And there is a lot of good thinking going on right now regarding how we can do this better, but managing water over the long-term is right at the top of the list of things you've really got to pay attention to." ✖