

# **RENEWING THE WORLD:**

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## **CASEBOOK FOR LEADERSHIP IN WATER**



***A Companion to *Renewing the World: Water****

**K. Lusk Brooke**

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Water is a natural element, renewing through a repeating system driven by feedback and use. Our present water infrastructure often interrupts natural circularity. How can we rebuild water systems with renewal at the heart?

*For: Water Systems Everywhere*

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## ***Preface***

*Renewing the World: Water* offers a window — and a door.

The Reference book is a window that looks at how climate change may affect our world's water, views problems we might face, and provides a glimpse of emerging solutions and innovations.

This Leadership Casebook offers a door to step forward — and to take action.

It is time to open the door.

K. Lusk Brooke  
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## ***Why a Casebook?***

Following the revered and effective Socratic method, the case method was initiated at Harvard and has proven useful in encouraging analysis and innovation. Cases are important in educational and organizational environments, yet there are relatively few that address problems and emerging opportunities in climate change and water sustainability.

Traditionally, cases often present a problem set in a theoretical organization. In *Renewing the World: Casebook for Leadership in Water*, the organizations are real, and you are invited to choose among several. For example, the case offered here, “Leaking or Lacking,” presents water systems in Beijing, China; Cairo, Egypt; Cape Town, South Africa; Jackson, Mississippi, USA; and Mexico City, Mexico. Water quality, equity, sustainability, and renewal are the goals for action and innovation.

Other cases in the book explore water in agriculture, energy, insurance, investment, marine environment, even the fashion industry.

Explore and enjoy this sample from *Renewing the World: Casebook for Leadership in Water*.

## **Case 1. LEAKING OR LACKING**

### **Water—When and Where You Need It**

*For: Municipal Water, Filtration, Public Health, Engineering, Water Justice*



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## Case 1. LEAKING OR LACKING

### **Water—When and Where You Need It**

*For: Municipal Water, Filtration, Public Health, Engineering, Water Justice*

**POINT OF VIEW:** *You are the new manager of a large water purification and distribution system for a city (take your pick from the list below). The former water manager was fired after failing to fix leaks in the water pipe system. Now you're in charge of your city's water system, full of old pipes that you are expected to fix. It's a big problem, especially in an era of water scarcity. Household leaks lose about one trillion gallons of water (more than 3 million liters) per year.*

*Funding for pipe replacement has been obtained, and you are ready to begin rebuilding your water distribution system. You sent out social media messages to your city's residents and businesses to promote "Fix a Leak Week," modeled on the U.S. Environmental Protection Agency (EPA) campaign. Raising awareness will help introduce your city's residents to the importance of fixing the water system, especially given disruptions and costs to come.*

*But, during your first week on the job, you receive a message marked "URGENT." A new problem has arisen: your water supply shows signs of harmful bacteria. As you rebuild your city's water pipes to fix leaks, now you will also have to address contaminants. One of your colleagues worked in Flint, Michigan, USA, during that city's water crisis when lead was found in drinking water. When Flint asked for some additional help, you took a couple of your vacation weeks to lend a hand. At that time, you heard about some promising filtration innovations using nanotechnology. Could filters be added to your city's new water system?*

*As part of your leadership vision, you are committed to environmental justice. You are thinking about a way to offer service opportunities to your teams to bring their expertise to help those who do not (yet) have sustainable water access.*

*As you reflect on many world areas that need water systems improvement, you are certain that your organization should help. "Clean Water and Sanitation for All" is United Nations Sustainable Development Goal #6. One approach you have heard about is WaterCredit, a microfinancing system providing people with loans so they can arrange access to a water utility. In *The Worth of Water*, Gary White and Matt Damon, co-founders of Water.org, estimate there are millions of people who must still be reached to get safe water to their homes and families.*

*Further, you've been impressed by water-outreach initiatives sponsored by sports leagues like the National Football League (NFL) and National Basketball*

*Association (NBA). American football star Chris Long launched Waterboys in 2015 as a signature initiative of the Chris Long Foundation. That program inspired the NBA's Malcolm Brogdon to create Hoops.O in 2018, now affiliated with Waterboys. A team of the "Starting 5," recruited by Brogdon, brought Justin Anderson, Joe Harris, Garrett Temple, and Anthony Tolliver into the mission to provide clean water to East African communities. You continue thinking about these programs, and other paths to water justice. In a few weeks, you'll need to present your ideas for your city's immediate water priorities, and also suggest future needs. How will you present your plan?*

## **Executive Briefing**

Your participation in Flint, Michigan's problem taught you some painful but valuable lessons. Pursuing what was deemed a temporary (at the time) cost-cutting measure, former city authorities in Flint made a decision in 2014 to obtain city water from the nearby Flint River rather than from the more distant Lake Huron via Detroit. That decision was an attempt to reduce the city budget. Despite the fact that Flint River water was known for high levels of corrosive minerals, during the switchover no filters or safeguards were applied. When Flint River water began flowing through aged pipes, interior coatings dissolved, leaching lead into city water. Residents quickly noticed changes of color and altered taste as they drew water. Pediatrician Dr. Mona Hanna-Attisha began to observe increasing instances of lead poisoning among children in Flint.

Despite such evidence, and urgent calls by medical professionals and others for immediate action, it was more than a year before any actions were taken. By then, a new generation already faced an uncertain future. Medical treatment was estimated to cost \$100 million, and fixing the pipes would cost \$1.5 billion. The amount city authorities believed would have been "saved" by switching from Lake Huron water to the Flint River water? \$5 million over two years.

The situation in Flint was a wake-up call to the growing problem of aging water infrastructure. The United States Environmental Protection Agency (EPA) monitors lead levels in water and sets guidelines. Lead is measured in parts per billion (ppb): levels over 5 ppb are cause for concern; over 15 ppb means action is necessary. In nearby Troy, Michigan, drinking water measured 1.0 ppb and in Detroit just over 2.0 ppb. In contrast, Flint samples tallied 27 ppb, 158 ppb, 397 ppb, 1,000 ppb, 5,000 ppb (the level that defines toxic waste), and even 13,000 ppb.

Flint was not alone. With additional investigations, more than 2,000 water systems in the United States were found to contain levels of lead higher than local regulations allowed. More than 350 such systems served children's daycare centers or schools.

There are some 155,000 different water systems in the U.S., so testing is not easy. More than 75 million American houses and apartment buildings were built



before 1980 when legislation regulating lead pipe use and prohibition was enacted. The oldest pipes are in Connecticut, Massachusetts, Pennsylvania, and Rhode Island. The matter is further complicated by EPA regulations that allow intervals between testing of up to three years, and sampling rather than complete evaluation. However, that could change. In 2021, the United States government proposed the Drinking Water and Wastewater Infrastructure Act, following a 2020 revision of the Lead and Copper Rule. You are a strong advocate for such improvements.

Similar problems are present in aging water systems worldwide. Mexico's water situation is serious as well. It might seem ironic that the capital, Mexico City, was built on what was once Lake Texcoco, yet the city suffers chronic water shortages. This occurs because the aquifer is rapidly draining away as the city's population continues to grow; in 2022, more than 20 million people lived there. Mexico City is one of 11 cities participating in the ominous-sounding "Day Zero," a term first used in South Africa to predict the day when water would be so scarce that the government would have to turn off taps. Hospitals would still get water, but most people would have to leave their homes, line up, and receive personal allotments of 6.6 gallons (3.79 liters)—all under surveillance of armed guards. Now, Day Zero means a time when an area may likely run out of water. Unfortunately, it's becoming a threat widespread around the globe.

Western Europe's water serves 390 million people in 17 countries. Europe is known for leadership in handling water issues: think Roman Aqueducts or the Fountains of Rome. But water networks, once built, only last about 100 years before needing major repair. In 2001, the European Union sent warnings to Austria, Belgium, Denmark, France, Greece, Luxembourg, Portugal, Spain, and Sweden regarding failure to file updates on safety and purity of national drinking water.

Europe spends a considerable amount of its water infrastructure budget on rehabilitation. Germany has invested more than €100 billion to improve its water, wastewater collection, and treatment systems. The European Union gave direction and future guidelines regarding drinking water safety in its Council Directive 98/83/EC on 3 November 1998. When the European Water Framework Directive (WFD) began in 2000, it set 2027 as the year to attain a rating of "good" or higher. Now WFD is uncertain whether achievement of a 2027 goal is possible. A 2021 assessment by the European Environment Agency revealed that "60% of surface water bodies were failing to achieve good ecological status" (EEA, 2021).

In Asia, also, water leaks are a problem. According to the Asian Development Bank (ADB), Asia loses 38 billion cubic yards (29 billion cubic meters) of urban treated water every year, valued at US\$9 billion annually. Institute of Water Policy (Lee Kuan Yew School of Public Policy at the National University of Singapore) found that fixing water leakage is a high priority in many cities. For example, as much as 50% of Dhaka, Bangladesh's water is lost in leaks, intensifying supply strain during peak use hours. Similar problems plague New Delhi, India; and Pakistan's Karachi Water & Sewage Board found that 30% of its water is lost as a result of problems with its water pipe system.

Africa has water pipe problems, too; coupled with wide variations in access. In South Africa, 99% of urban citizens have access to piped water; in Liberia, only 9%. In Accra, Ghana, the closer you are to the center of town, the better access you have to drinking water and piped sanitation. Lagos, Nigeria has piped water, but only 15% of city residents enjoy an uninterrupted flow. Overall, one in three people in Africa may suffer from water scarcity. Recently, some coastal communities have begun to explore using seawater via desalination powered by solar.

The above review is troubling; water systems don't last forever and will eventually begin to leak and need repair and rebuilding. But this water availability problem does not even include one of the most urgent drinking water problems: those who do not have plumbed water at home, who must carry water from afar for their families. This task often requires many hours per day: adults, usually women, have no time left to work at paying jobs; if water haulers are children (and, too often, they are), those kids and teens have no time to attend school. Perhaps most alarming: not all water carriers can even reach a clean well; some must take water from ditches and ponds.

As you reflect on many world areas that need water systems improvement, you are certain that your organization should help. "Clean Water and Sanitation for All" is the United Nations Sustainable Development Goal #6. One approach you have heard about is WaterCredit, a microfinancing system providing people with loans so they can arrange access to a water utility. In *The Worth of Water*, Gary White and Matt Damon, co-founders of Water.org, estimate there are millions of people who must still be reached to get safe water to their homes and families.

For those without water infrastructure (yet), or for piped water that they do have but is subject to contamination, there is another area of innovation: filters. In fact, it's a critical area now for your own city, with this new development of bacterial contamination.

### **Sift for Success—Filtering the Future**

Askwar Hilonga, a chemical engineer from Tanzania, won the Africa Prize for Engineering Innovation by successfully combining something old (sand) and something new (nanotechnology) to create an innovative water filter. The sifter removes bacteria, copper, and even pesticides. Hilonga's aim is to help 70% of Tanzanians who lack clean drinking water, but the concept is scalable to any similar situation.

Nanotechnology also inspired a team of professors and scientists to combine that new technology with the time-honored use of two clays. *Iro* and *Ewuya* clays have excellent flexural strength, fracture toughness, and thermal shock resistance (Annan, et al., 2016).

Worldwide, one in ten (660–700 million people) lack safe drinking water, a figure predicted to expand to one billion as populations increase. Filters will become important, not only for those who gather water, but also for those whose water from pipes is contaminated. Bacteria and toxic substances are one concern. But there are other, newer, contaminants.

## **Pharmaceuticals and Household Products in Drinking Water**

The U.S. Geological Survey tested drinking water from American rivers, and found that 80% contained 21 hormones, 103 pharmaceuticals, and other medical chemicals. Global figures are similar. Consider this: you may be showering in water that contains your neighbor's face cream, since cosmetics wash into the water supply. In one city, various medical pharmaceuticals showed up in the water of people who did not take these medications. Perhaps even more deleterious to one's health could be the residue of cleaning chemicals. Scrub your bathroom or kitchen sink with household cleaners? Those chemicals also enter the drinking water supply.

Of great concern are 'forever chemicals,' sometimes called PFAS (Per- and Poly-Fluoroalkyl Substances). There are more than 9,000 PFAS formulations found in many food-related packaging including some pizza take-out boxes with PFAS to stop grease from leaking. And it's not just containers; one study found that more than 60% of bedding and children's clothing may have these forever chemicals. But food packages may list ingredients of the food product, but rarely are chemicals in the packaging itself detailed. Clothing labels may list fabrics and properties as "water-resistant" but not show the chemicals that contribute to those properties. Yet these PFAS chemicals are there and end up in water, including drinking water. Water actually prolongs the life of these toxic chemicals. PFAS chemicals have been found to cause increases in thyroid illness, kidney problems including cancer, and developmental delays in children. You know you'll have to rebuild your city's water system. Maybe the 2023 3M settlement could give you some guidance. You know you'll also have to address bacteria recently discovered.

All these things are on your mind as you take leadership of your city's water system. You have to consider what actions you can take now, and what future plans you will need to develop. Choose your city:

### **YOUR CITY OPTIONS (pick one)**

#### **Beijing, China**

<https://www.gov.cn/english/>

#### **Cairo, Egypt**

[www.cairo.gov.eg/en/](http://www.cairo.gov.eg/en/)

#### **Cape Town, South Africa**

<https://www.capetown.gov.za>

#### **Jackson, Mississippi, USA**

<https://www.jacksonms.gov>

#### **Mexico City, Mexico**

<https://www.cdmx.gob.mx>

## Window On the Economy

Drinking water systems are important for public health as well as for the economy. Clean and reliable drinking water and sanitation systems for all of sub-Saharan Africa could be worth \$35 billion per year. Plug the leaks in Asia's water? \$9 billion. Supply safe drinking water to homes so no one has to carry it in? You alleviate bacteria-carried disease and reduce medical costs by \$30 billion per year. Freeing up time lost by water carriers, thus enabling them to pursue education and employment would add enormous benefit. Total economic benefits of reduced disease and increased productivity, brought about by clean drinking water and safe sanitation, could reach \$150 billion per year. Of course, the true benefits are priceless.

Here's another issue you have to figure out. In your city, many people resort to bottled water. How could your new water system promote superior quality of your improved tap water? Will you get backlash from bottled water companies who sell a lot of product in your city? The industry grew 73% from 2010 to 2020. The global bottled water market value was \$302 billion in 2022, expected to grow to \$332.85 billion by 2028, and some estimates predict sales of bottled water to generate \$500 billion by 2030. According to the UN's Institute for Water, Environment and Health, some people buy bottled water because they believe it is safer than tap water. Over one million bottles of water are purchased around the world—every minute.

### ***VOICES OF THE FUTURE***

**Gary White and Matt Damon**

“More than 800 million people don't know where their water is going to come from on any given day. Some have to find it and carry it; others pay up to 25% of their income for water. But the problem actually contains its own solution.”

—Gary White and Matt Damon, co-founders of Water.org

Source: VIDEO: Gary White and Matt Damon. “Transforming Lives,” *Daily Show*, interviewed by Trevor Noah, 25 March 2018. <https://youtu.be/Sqeh-ycjiFU>

This case is an excerpt from *Renewing the World: Casebook for Leadership in Water*. Material is subject to copyright and presented here for illustration. If you enjoyed this excerpt, the book is available for purchase.

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