

SUSTAINABLE CITIES



THE DEMAND FOR WATER

Faced with climate change and population growth, more cities work to ensure the well does not run dry

By Cathy Chatfield-Taylor

Water is essential for life, but most people take it for granted until there's not enough — or too much. When reservoirs evaporate and water is rationed, people tend to take notice. When storm waters overwhelm sewer systems and pollutants float to the surface, they become alarmed. How to manage water has become a pivotal challenge, not only in regions plagued by droughts and floods but also in metropolitan areas where once-abundant supplies are becoming scarce.

It would not be an exaggeration to say water is a matter of national security. If a water supply is cut off, it can leave a nation in peril. Throughout the world, lack of clean water devastates the human health and economic prosperity of vast regions. Water, or the lack of it, can render a city of any size uninhabitable.

The Mother of Invention

Driven by challenges such as water scarcity, population growth and uncertain threats from natural disasters and climate change, city leaders and those in the water sector are rethinking how to ensure adequate supplies of clean water are available to sustain urban growth and development. New models are emerging that close the loop on water use and create an efficient city water cycle.

"Many cities in the world get water from the river far upstream, use the water, pollute it, clean it and put it back in the river far downstream. That is the linear paradigm," says Paul Reiter, executive director of the London-based International Water Association (IWA). "In that process, water is used once. It doesn't get used efficiently. The nutrients don't get recovered, and we consume a lot of energy."

The alternative envisioned by the IWA Cities of the Future program reengineers water, wastewater and stormwater management systems to minimize water use and maximize service-area coverage. Best practices in water management are now at work around the world.

In Australia, the decade-long drought has spurred a \$26 billion investment in reducing water use and developing new water sources. Nationwide consumption is down 20 percent, water recycling is targeted to hit 30 percent by 2015, and six desalination plants — which extract salt from water to make it drinkable — will start-up in major cities by year-end 2012.

At the community level, a neighborhood-scale wastewater treatment facility serving a Seattle-area complex of 5,000 housing units will discharge water that is clean enough to be reused for flushing toilets and watering lawns. The plant will not only lower water use by 50 percent and reduce wastewater flows by 70 percent, it will cost less to operate than paying for regional water and sewer service.

Singapore, in a global model of efficiency, now operates a nearly closed-loop water management system that supplies almost 5 million people with 60 percent of their water needs. But its ambition is "water independence" — to be self-sustaining within 50 years. Then the island nation will no longer be dependent on water from Malaysia.

Steve Moddemeyer, coordinator of Cities of the Future and a principal with Seattle-based architectural firm CollinsWoerman, notes that the most sustainable strategies are integrated, breaking through the silos of city management. "An integrated solution looks beyond the silo to the whole range of needs of the city," he says. "We look at economy

Water Management Spurs Job Creation

Water managers solve pressing problems related to scarcity, flooding and pollution, all while supplying clean water today and planning how to meet water demand in the future. It takes a water workforce to do the job — protecting the watersheds that are the source of water supplies; upgrading and expanding the water, wastewater and stormwater infrastructure; and introducing new technology to make it all run more efficiently.

In Louisiana, where devastating floods have impacted the state's economy, Louisiana Economic Development (LED) has made water management a target industry for job development. Addressing the Baton Rouge Rotary Club in January, LED Secretary Stephen Moret forecasted the potential for 10,000 to 20,000 new state jobs in the water management sector, which he named as one of several high-growth industry sectors that the state is aggressively targeting.

LED is responsible for strengthening the state's business environment and creating a more vibrant Louisiana economy. The Baton Rouge-based agency aims to build a world-class water management industry that would make Louisiana the "Netherlands of the U.S." State officials and industry leaders have been in "Dutch Dialog" with the Netherlands for more than three years to learn more about the country's water management practices, credited as a model for flood protection, coastal restoration and economic recovery.

There is good reason to believe that water management is big business for city and state economies looking for a burgeoning growth sector, a sector that is spurring job creation in Louisiana and elsewhere.

of scope, not the economy of scale. It's the triple bottom line idea."

Feeling the Pressure

It may take the forces of nature to bring about the sweeping changes in governance, regulation and financing needed to integrate urban water management. Natural disasters such as drought and flood draw attention to the dire consequences of water mismanagement. Depleted aquifers, saltwater intrusion and polluted watersheds hammer home the long-lasting impacts of poor practices.

But it is the global impact of climate change that may tip the balance toward a fresh respect for water. As rising sea levels impact coastal communities, and global storm activity increases in severity and frequency, water management will take on new

urgency. Global warming may also intensify the dry spells and evaporate water reserves.

"What has not been well reported is the expectation that not only will there be more intense storms around the U.S., but there will be more severe periods of drought," says Maureen McAvey, executive vice president, Policy & Practice at the Urban Land Institute (ULI) in Washington, D.C. In western states, diminished snow packs will cause water scarcity that affects farmers, ranchers and city dwellers alike — resulting in rationing, constrained growth and heightened conflicts. "With climate change, no one is sure what the water picture will look like," she says.

Water scarcity may put the kibosh on wasteful practices like planting lush landscapes and green lawns in desert climates. "Americans are profligate in their use of water," McAvey says. "We use more water than anyone else in the world." In fact, the U.S. water footprint is huge — 656,000 gallons per person per year, compared to China's 186,000 gallons per person.

Bad habits are not the only culprit in water waste. Leaks are to blame for losing 14 percent of the water in the U.S. system. McAvey advises, "We need to think about conserving water, reducing the leakage, and building in responsible ways so we use appropriate landscaping and materials."

Rapid Urbanization

The pressure to change is most intense in major metropolitan areas where population growth is outstripping water supplies. In California, water suppliers are operating and maintaining systems designed to serve a total of 18 million people, but they now serve 38 million — with 12 million more people anticipated by 2040, according to ULI's report, Infrastructure 2010.

For the first time in history, one half of all people on the planet now live in cities. Rapid urban population growth is upsetting the balance of water supply and demand in vast regions of the world. If unchecked, two to three billion people could face an acute shortage of fresh water by 2020. By 2050, two out of three countries will experience water scarcity.

In developing nations, where 90 percent of population growth is occurring, the challenge is to build resilient water supply systems at an affordable per capita cost. In developed countries, antiquated water infrastructure is grossly inadequate to meet 21st century demands. To keep pace, municipalities will have to repair or replace rusting and dilapidated systems, and modernize treatment technology to improve water quality.

Water quality issues plague major metro areas in the U.S., despite 40-plus years of progress under the Clean Water Act. On a global scale, more than 2 million people die each year from diseases associated with unsafe drinking water, inadequate sanitation and poor hygiene, according to the United Nations.

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At the U.N.'s Millennium Summit in 2000, 191 member states made a commitment to reduce by half the proportion of people worldwide who do not have access to safe drinking water. They set 2015 as the target deadline. By 2005, participating nations had developed integrated water resource management and efficiency plans. Since then, non-governmental organizations have joined with government agencies around the world to achieve the agreed-upon development goals and stop the unsustainable exploitation of water resources.

Integrated Planning

Whether replacing antiquated infrastructure or building supply systems from scratch, cities are planning cost-effective solutions that will be resilient over time, flexible in response to growth and adaptable to changing usage.

At a Cities of the Future demonstration project in Xing Dao, China, a community of 50,000 homes is clustered around a highly efficient, integrated system for water and wastewater treatment, water reuse and energy production. The semi-centralized system facilitates the recycling of greywater (wastewater from domestic activities such as laundry or dishwashing) and is expected to reduce residential water use by 50 percent. At the same time, the plant will generate twice the energy it needs to operate.

In New York City's Battery Park, residential condominiums have become increasingly water and energy efficient since The Solaire became the first sustainable high-rise in 2003. Now The Visionaire, a LEED Platinum Certified condo completed in 2009, is considered one of the greenest residential high-rises in the U.S., with water-saving measures that will reduce potable (drinking) water use by 55 percent and recycle 25,000 gallons of greywater per day.

Changing development patterns are also conserving water resources. Dense development that groups houses closer together controls runoff and reduces water wastage. According to the Infrastructure 2010 report, a tract of land with eight homes on eight acres loses 149,000 cubic feet of water per year, while eight homes on one acre produces only 39,000 cubic feet of runoff per year. Reducing runoff not only lightens the load on wastewater treatment facilities but also prevents contaminants from entering the water system.

On a regional scale, multi-jurisdictional watershed management areas are coming together to make decisions about water use. The Great Lakes Basin Compact, a model of cooperation since 1968, commits the eight member states to jointly promote the "orderly, integrated" use and conservation of the Basin's water resources. Other regions — around the Colorado River and Chesapeake Bay, among others — are avoiding water wars by making regional plans that connect water use and land development. As McAvey observes: "The water doesn't know where the jurisdictional boundaries are."

Proven Practices

Australia's water-saving success is attributed, in part, to user fees that are "staggeringly high" by U.S. standards, according to Infrastructure 2010. Most U.S. water districts don't charge customers enough to cover the cost of operating and maintaining their systems, and some districts don't meter water at all. But that's changing.

"Now, a majority of cities have metered rates, tiered rates and allocations," says Chris Brown, executive director of the California Urban Water Conservation Council in Sacramento, Calif. "There are a wide variety of pricing structures designed to promote conservation. There's renewed interest in finding the most efficient pricing structure to get the best response from customers." Allocations, for example, are typically based on customers' historical usage, adjusted to meet conservation goals.

In Los Angeles, drought-induced conservation measures dropped water use by 20 percent in 2009, with premium rates that penalize over-use. Apparently, when people learn how their usage patterns compare to average usage patterns, and pay accordingly, they become motivated to fix leaks, install low-flow toilets and shower heads, and water sparingly.

Cities are also slowing the drip-rate on urban irrigation. From corporate campuses to suburban landscapes, planting vegetation that requires artificial irrigation is becoming taboo. Instead, developers are installing sustainable landscapes that use more native plants and plants that need little or no water, especially in dry regions. Rain gardens and other green stormwater infrastructure are also becoming part of the cityscape.

Sustainable Systems

As cities overhaul aging water works and expand their supply systems, initiatives such as rainwater harvesting and greywater recycling are supplementing traditional water management approaches. These strategies may not replace the pipes, pumps and treatment plants that make up a water system, but they can make traditional infrastructure more efficient.

Instead of planning urban development as if water were abundant — considering it only as an afterthought — leaders are beginning to recognize the link between their city's growth and water management. In the interagency turf wars that inevitably arise when government policies and procedures are evolving, the definition of sustainable is often hotly contested.

"Many people disagree about what 'sustainable' is, but most people agree about what isn't sustainable," says IWA's Reiter. "We're moving away from what is not sustainable."

Cathy Chatfield-Taylor writes about sustainable infrastructure for publications such as CE News, Pipeline & Gas Journal, Roads & Bridges and V1 Magazine.

