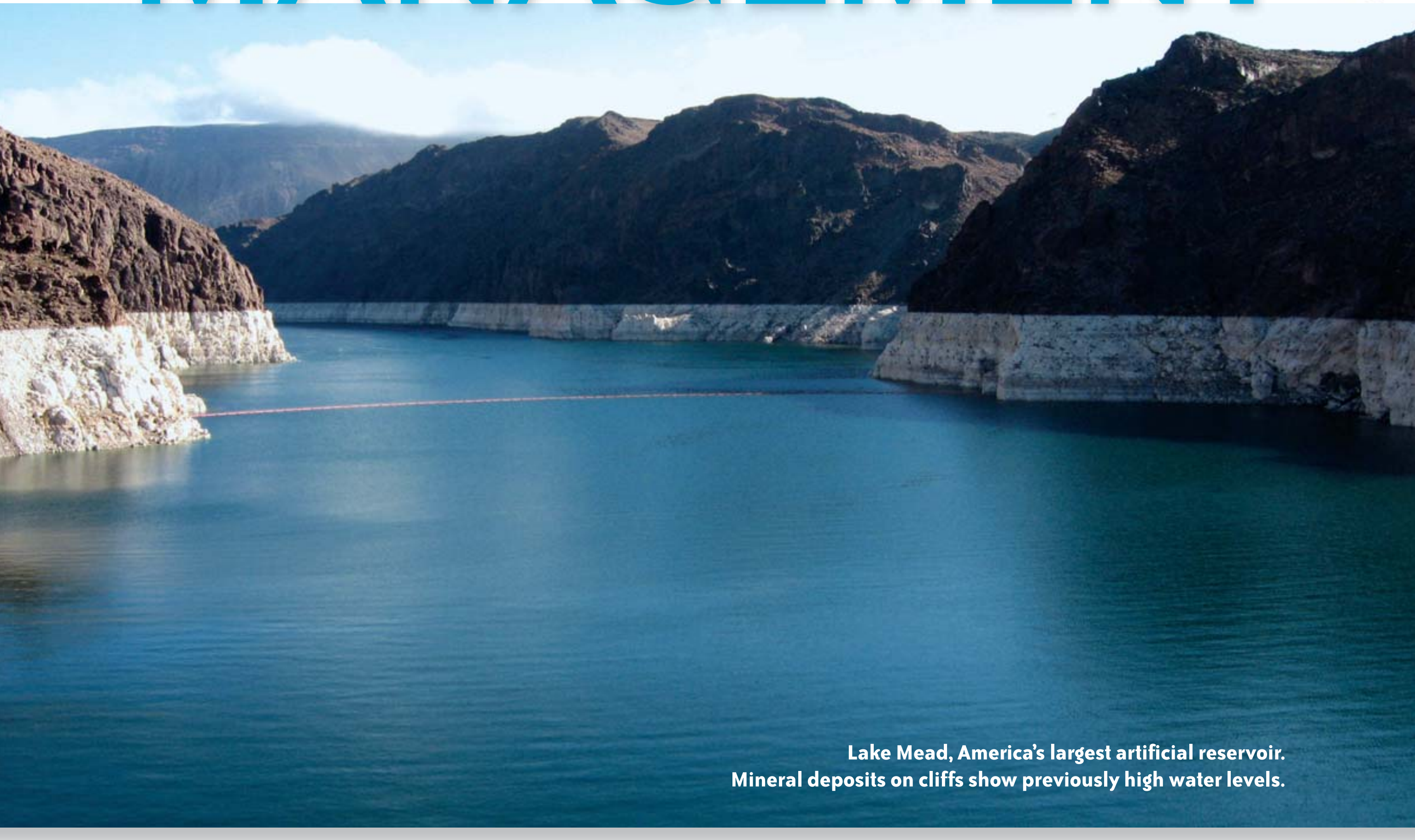
WATER MANAGEMENT



Lake Mead, America's largest artificial reservoir.
Mineral deposits on cliffs show previously high water levels.

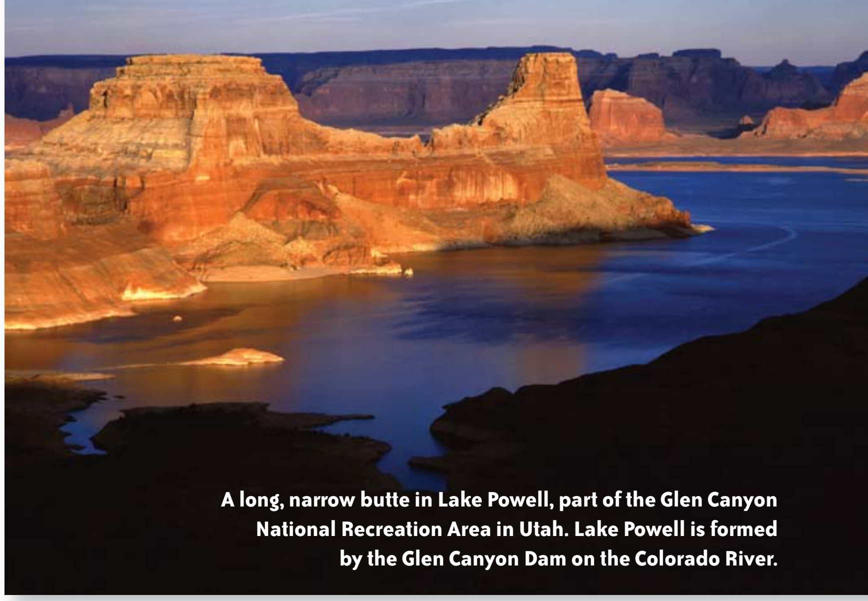
WATER, WATER EVERYWHERE?

By G. Tracy Mehan, III

One day this past May, more than 100 journalists gathered on the docks of Barcelona, Spain's second-largest city, to observe the arrival of a most precious shipment.

A Panamanian-flagged tanker loaded with water arrived. The ship was part of a small fleet of six vessels providing emergency relief to Barcelona until the city's new desalination plant was completed.

Barcelona's situation is not uncommon. Lengthy droughts, a changing climate, water-intensive agriculture, population shifts and economic growth all contribute to a staggering problem that plagues not just the capital of Catalonia, but much of the developed world, including the U.S.



A long, narrow butte in Lake Powell, part of the Glen Canyon National Recreation Area in Utah. Lake Powell is formed by the Glen Canyon Dam on the Colorado River.

A Perennial Problem From Southwest Europe to the Southwest U.S.

The general consensus among water managers in the U.S. is that it is imperative to adapt to droughts and changing climate patterns regardless of the actual cause. The General Accounting Office (GAO, now the Government Accountability Office) surveyed state water managers in 2003[1] and found that, under normal or non-drought conditions, 36 states anticipated water shortages in localities, regions or statewide in the next 10 years. Under drought conditions, 46 states expected shortages in the same time frame.

The Colorado River Basin covers 240,000 square miles, seven states and parts of Mexico. It provides water for millions of people from San Diego to Las Vegas to Denver.[2]

The National Research Council (NRC), part of the National Academies, issued a riveting study in 2007, prompting the *New York Times* to offer this headline: "That 'Drought' in Southwest May Be Normal, Report Says."[3]

The NRC reviewed data from tree-ring studies in the area going back 300, 500 and 800 years. Tree rings provide a much longer-term picture of weather and climate patterns than stream gauges, which extend back only a hundred years. The study concluded that average annual water flows vary more than was previously thought from year to year.

Extended droughts are not uncommon, and future droughts across the Colorado River Basin may be longer and more severe because of an evident regional warming trend. Rising temperatures will reduce the Colorado River's flow and water supplies.

The Colorado River Compact, established in 1922, allocated water between the Upper and Lower Basin states. Though the compact was negotiated based on the anticipation of higher flow, the years from 1905 to 1922 were exceptionally wet ones, hardly a solid foundation for calculating water availability over the long run.

Moreover, demand for water in the Colorado River Basin has been on the rise, despite improved conservation efforts. Since 1990, Arizona's population has increased 40%, and Colorado's population has risen 30%. Clark County, Nev., home to Las Vegas, doubled its water consumption between 1985 and 2000.

Las Vegas gets its water from Lake Mead, America's largest artificial reservoir. Researchers[4] at the Scripps Institution of Oceanography believe that there is a 50% chance Lake Mead will run dry by 2021 and a 10% chance it will run out of usable water by 2014, depending on whether the drought worsens and water use increases.

"We were stunned by the magnitude of the problem and how fast it was coming on us," says Tim Barnett, a marine physicist with the Scripps Institution.

Impact of a Changing Climate

A 2006 report by the American Water Works Association Research Foundation and the University Corporation for Atmospheric Research[5] highlights the effect of climate change and variability on water utilities.

The science suggests that the global climate cycle will become more intense. There will be longer periods of drought alternating with spells of heavy rainfall and more-polluted runoff.

What does this mean in concrete terms?

- Greater variability in runoff makes it difficult to maintain appropriate levels in reservoirs and reduces the reliability of water storage.
- Shorter periods of snow accumulation in mountainous regions result in reduced snow pack and earlier spring melting, which reduces water flows in late summer when water is scarce, demand is higher and flows are most needed.
- Treatment costs increase due to heavier runoff of pollutants such as sediments. The Denver water utility now involves itself in land management issues to reduce forest fires and their resulting sediment runoff throughout its source water area. Its aim is to save the millions of dollars it would otherwise spend to dredge its reservoirs.
- More floods, droughts, hurricanes and wildfires, with resulting soil erosion, threaten water quality and utility infrastructure.
- Rising sea levels cause saltwater intrusion into freshwater sources and inundated infrastructure.

The Nexus Between Energy and Water Efficiency

Energy and water efficiency are inextricably linked to one another since the treatment and movement of water is inherently energy-intensive. When a water customer takes a shorter shower or a water utility reduces leakage in its water mains and installs high-intensity pumps, they reduce both water and energy use and limit the amount of greenhouse gases (GHGs) released into the atmosphere.

According to the U.S. Environmental Protection Agency (EPA), water and wastewater utilities spend about $4 billion a year to pump, treat, deliver, collect and clean water. This can amount to as much as one-third of a municipality's energy bill. Energy-efficient practices and technologies can result in water savings over time.

Desalination, which removes salt from seawater or brackish groundwater, is a promising technology that illustrates the interaction between water, energy and cost considerations.[6]

Cities from Algiers to Tampa, Fla., are pursuing desalination as a solution to water scarcity. In 2006, worldwide online desalination capacity was roughly 10 billion gallons a day, or 0.3% of the total freshwater used in the world. From 2000 to 2005, U.S. desalination capacity grew by roughly 40%, accounting for about 0.4% of freshwater used in this country.

Water transfers and conservation will be cost competitive, given lower energy costs. Thus, the decision to use desalination will be a local affair dependent on the circumstances.

According to Gretchen W. McClain, president of ITT Fluid Technology, a company that has been involved in the water business for over a hundred years, there has been "significant progress" in developing new technologies and practices generally, especially those focused on the use of salt water and the reuse of water through enhanced treatment and purification, rather than the drilling of additional wells or the construction of large diversion or storage projects.

"These technologies, though still developing rapidly, have become much more efficient and cost effective in recent years," says McClain. "For example, in desalination, advances in membrane technology have dramatically increased the performance of reverse osmosis systems in removing salts and other contaminants from water, especially when that water is prefiltered."

In California, Drawing Life From Waste

Orange County, Calif., where water demand is expected to increase 16% by 2030, has implemented an ambitious, world-class water recycling system.

Assisted by new technologies, the county has transformed wastewater into a valued asset and natural resource. This is typical of the evolving approach to water management in the 21st century.

This operation yields 70 million gallons of water a day for 500,000 people a year. It cost $481 million to build and costs $29 million per year to operate.

Orange County's operation starts with treated wastewater and serves up, essentially, distilled water. Utilizing micro-filtration, reverse osmosis, ultraviolet light and hydrogen peroxide, it provides indirect potable water that is pumped into a groundwater basin. From here, the new water takes a year to move through sand, gravel and clay to a drinking water well.

Nutrients and Dead Zones

Coastal waters and estuaries across the globe are plagued by "dead zones," which are areas deprived of oxygen due to over-enrichment by nutrients, nitrogen and, in some cases, phosphorous. This makes it difficult for marine life — fish, crabs or other creatures in the food chain — to survive.

Nutrients from agricultural fertilizer, wastewater and industrial treatment plants and even air deposition stimulate the growth of algae that then die off, leaving organic matter on the ocean floor and using up all the available oxygen.

There are more than 400 dead zones globally, including dead zones in the Baltic Sea and in the Gulf of Mexico. Dead zones cover approximately 95,000 square miles, and the number of coastal dead zones has almost doubled every decade since the 1960s.[7]

This same problem has degraded the Chesapeake Bay and Long Island Sound. Municipal and industrial discharges are key contributors of nutrient pollution in these bodies of water. The EPA estimates that 22% of phosphorus pollution and 19% of nitrogen pollution in the Chesapeake Bay comes from municipal and industrial wastewater facilities.[8]

Removing nutrients from a wastewater stream with advanced technology is expensive and energy-intensive, resulting in GHG emissions and a larger carbon footprint. Physical space limitations can be another cost issue since many treatment operations are located in urban areas and do not have room to expand. This is an area where new, innovative technologies could make a difference.

Who Will Pay for Solutions?

There are a variety of proposals floating around Washington that would require the federal taxpayer, as opposed to the local ratepayer, to bear a greater share of the necessary investments in water and wastewater infrastructure.

Indeed, full-cost pricing, borne by utility customers, is a hard sell. A 2002 GAO survey[9] of several thousand utilities indicated that 29% and 41% of water and wastewater systems, respectively, were not generating enough revenue from user rates and other local revenue sources to cover their full cost of service.

Wetlands area along Florida's Gulf Coast

The Congressional Budget Office stated in a 2002 report that U.S. households were paying, on average, only 0.5% to 0.6% of their income for water and sewer bills.[10]

It is no accident that the EPA estimated that an investment gap over more than 20 years (2000-2019) would amount to over $220 billion for capital needs alone, assuming rates remain steady.[11]

"Unfortunately, a significant obstacle to improving our water shortage lies in the very price we pay for water," says ITT's McClain. "Artificially low prices encourage greater consumption and restrict the funds necessary for new investment in infrastructure and technology."

Greater investments in water infrastructure by consumers, utilities, industry and government are necessary if our society is to adapt to climate variability and water scarcity. Water managers will have to aim for resilience in their management strategies, utilizing the best practices and technological innovations available.

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Sustainable Water Management In the Business Sector

Elevate water efficiency and conservation, including water reuse, on your list of corporate priorities.
There is a strong business case to be made for sustainable water management. Doing it well can yield cost savings, avoid legal entanglements and generate goodwill in the community and among government officials. For some companies, a focus on water sustainability can be a source of creative and innovative ideas for new products or services.

Assess your company's water use or "footprint" and look for opportunities to reduce waste.
A sharper management focus on water use or losses will usually identify low-hanging fruit such as leaks, faulty valves or obsolete processes that needlessly waste water.

Work with your supply chain to promote sustainable water management.
The time is past when a company can overlook the practices of its suppliers. Work with them to improve water management in their operations, whether they are in the industrial, agricultural or services sector.

Pay attention to the nexus between energy and water use.
Saving water also saves the energy needed to collect, pump and treat it. Identifying the energy dollars saved by managing water more efficiently creates incentives within the business organization for doing the right thing on both counts. Conversely, some water reuse or recycling techniques may be energy intensive and not cost effective. This, in turn, increases carbon emissions.

Treat storm water runoff as a resource to be conserved on site.
Roofs, parking lots and sidewalks are all impervious surfaces over which water runs, picking up pollutants while increasing its temperature and velocity along the way. Rain gardens, green roofs, vegetated swale and tree cover will retain water on site and allow it to reduce its velocity and infiltrate into the ground, while filtering out pollutants and recharging groundwater.

Become involved with your local drought-planning committee.
The time to plan for a drought is now rather than later. Get to know the local officials and other players in your community who set the rules during water shortages. Avoid needless conflict in the midst of a crisis. Look for win-win solutions before problems become unmanageable.