Sustainable Management of Water Resources

by Kenneth J. Warren*

Maintaining a healthy ecosystem requires sustainable use of water resources. The tools traditionally used to manage water for public use involve construction of water supply dams and reservoirs, tapping of groundwater aquifers, and diversion of surface water and groundwater from areas of abundance to areas of need. After use, wastewater is treated and discharged, most often to the nearest waterbody. Water efficiency, conservation, or recycling measures historically have taken a back seat.

For decades, this approach has provided sufficient water for drinking, irrigation, hydroelectric power, industrial production, recreation and other uses. Unfortunately, disrupting natural hydrological conditions produced harmful environmental consequences. Reservoirs compromised healthy habitat for riverine species, diminished water quality, and impaired transport of nutrients and sediments. Evaporation from reservoirs reduced the water available to support aquatic species.

In recent years, the environmental consequences of our water supply systems and their adequacy and vulnerability have become a concern. A system reliant on dams and reservoirs or groundwater recharge may not be sustainable under changing climate conditions. Water levels in western reservoirs including Lake Mead have dropped drastically and may reach “dead pool” curtailing water supply and hydroelectric functions. Reservoir systems in the eastern United States are challenged by alternating drought and floods. Groundwater resources throughout the nation are stressed from overuse and drought. As a result, water managers are now looking beyond infrastructure and water diversions to conserve and make better use of existing resources.

Water conservation, efficiency, and reuse are important components of a more modern paradigm. An example of a more sustainable management approach is the Great Lakes-St. Lawrence River Basin Resources Compact ("Compact") which became law in 2008. The Great Lakes hold approximately 20% of the world's fresh water supply. In response to the threat that this water would be diverted out of the Great Lakes Basin to drier regions of the nation, the eight Great Lakes states agreed to, and Congress approved, the Compact. Article 4.8 of the Compact prohibits the diversion of water out of the Great Lakes Basin except in very limited circumstances.

In addition to erecting barriers to out-of-basin transfers of basin water, the Compact establishes ambitious goals for water conservation and efficiency: sustainably using the waters of the basin, improving the basin's waters and water-dependent resources, protecting and restoring the basin's hydrologic and ecosystem integrity, retaining the quantity of surface water and groundwater within the basin, and promoting efficient use and reducing losses and waste of the basin's water. The Compact mandates that each basin state develop and implement its own voluntary or mandatory water conservation and efficiency program consistent with the Compact's goals. The states must also create a program to manage new or increased withdrawals and consumptive uses to avoid significant impacts to the waters and water-dependent resources of the basin.

The Compact embraces adaptive management techniques by requiring annual program assessments. Every four years, the basin states evaluate the cumulative impact of withdrawals, diversions, and consumptive uses from the waters of the basin. Program modifications must be made every five years based on new demands and the potential impact of cumulative effects and climate.

State programs developed to comply with the Compact must promote "environmentally sound and economically feasible water conservation measures." These may include best management practices and state of the art conservation and efficiency technologies. The Compact identifies demand-side and supply-side measures or incentives to reduce water use, and science and research to improve and apply technological solutions, as beneficial conservation measures.

The U.S. Environmental Protection Agency publication *Best Practices to Consider When Evaluating Water Conservation and Efficiency as an Alternative for Water Supply Expansion* identifies best practices that water utilities can undertake. A supply-side audit using the methodology developed by the American Water Works Association (AWWA) can identify leaks and other losses of water. Utilities may install meters to measure water usage, establish rate structures that encourage water conservation, analyze water conservation and efficiency by end-users, and develop water conservation and efficiency plans with goals and associated metrics.

These and other conservation and efficiency practices are utilized by the Great Lakes states to meet their Compact obligations. Pennsylvania, a Great Lakes basin state, implements the water conservation and efficiency goals through its State Water Planning Program authorized by the Water Resources Planning Act. These goals include voluntary state-wide conservation programs for water users and to reduce water loss, utilization of practices and technologies to conserve water and encourage groundwater recharge, voluntary water use reduction plans in critical water planning areas, and education programs. The Pennsylvania Department of Environmental Protection (PADEP) requires water users who withdraw or purchase more than an average of 10,000 gallons per day to report their water use. PADEP's data base of water use can help identify inefficient systems and those lacking effective conservation measures.

Pennsylvania also issues water allocation permits under the Water Rights Law to public water supply agencies utilizing surface water sources. These permits impose requirements for water conservation and efficiency. When setting utility rates, the Pennsylvania Public Utilities Commission considers whether water withdrawers implement source and service metering, standards for plumbing fixtures and fitting and leak detection and repair practices, retail water pricing and AWWA water audits. In the Delaware River Basin, the Delaware River Basin Commission requires these measures.

A key component of the programs in other Great Lakes states such as Wisconsin and New York is submission of a water conservation plan with applications for a water supply permit. The New York Department of Environmental Conservation has issued permitting guidance to ensure that water withdrawers implement water conservation practices to maintain aquatic habitats and avoid significant or cumulative adverse impacts to the quantity and quality of the water source and water dependent natural resources including aquatic life.

Michigan solicits public input through a multi-stakeholder water use advisory council that recommends measures for data collection, modeling, research, assessing withdrawals and promoting water conservation and efficiency. Michigan also requires a large quantity water withdrawer to utilize an online assessment tool to evaluate whether the proposed withdrawal will result in individual or cumulative adverse impacts. Depending on the impact or withdrawal rate, a permit must be obtained and water conservation measures implemented. Michigan tracks the cumulative effects of large quantity withdrawals at sub-watershed scale and maintains integrated data bases.

The most ambitious examples of water conservation and efficiency measures involve treating and reusing sewage. Treated sewage, termed gray water, is most commonly used for irrigating crops and golf courses. But much greater opportunities for reuse exist.

In his book *Purified*, journalist Peter Annin describes water systems in various regions of the nation that recycle wastewater into drinking water. The most prominent example Annin cites, Orange County, California, recycles up to 130 million gallons per day. The County filters the wastewater to remove bacteria and viruses, conducts reverse osmosis to remove chemical contaminants, and employs hydrogen peroxide and ultra violet light for additional purification. The purified water is injected into the ground and added to the groundwater used as a source of drinking water.

Annin explains that Orange County's system is not unique. San Diego is constructing a water purification facility after rejecting that option years earlier. Among the water systems sourcing or planning to source their drinking water from purified wastewater are Norfolk, Virginia (thereby protecting the Chesapeake Bay from wastewater discharge), and systems in Northern Virginia and in Big Spring, Wichita Falls, and El Paso, Texas.

Conservation and efficiency measures are important components of modern water management. They reduce adverse impacts to ecosystems, lessen stress on water supply sources, and often provide an economical alternative to constructing reservoirs or diversions. As technologies improve and utilities instill confidence that the treated water is safe to drink, recycled water may become a widespread component of public water systems.

*Kenneth J. Warren is a founding partner of Warren Environmental Counsel LLC. He is the immediate past president of the American College of Environmental Lawyers and is a former chair of the American Bar Association section of environment, energy and resources, where he led the section's 10,000 members. He serves as general counsel to the Great Lakes Compact Council. The views expressed in this article are his own and should not be attributed to the Council. He can be reached at *kwarren@warrenenvcounsel.com*.