JUNE 2014
IB:14-05-E

Water Reuse Potential in California

There is tremendous opportunity to expand water reuse in California. In most urban areas, water is used once, treated, and disposed of as waste. Reuse provides a reliable, local water supply that reduces vulnerability to droughts and other water-supply constraints. It can also provide economic and environmental benefits, for example, by reducing energy use, diversions from rivers and streams, and pollution from wastewater discharges.

Some progress is being made. An estimated 670,000 acre-feet of municipal wastewater is already beneficially reused in the state each year (SWRCB and DWR 2012). Onsite reuse—including the use of graywater—is also practiced in communities across California, although data are not available to estimate these volumes. More can and should be done.

PACIFIC INSTITUTE

NRDC
THE EARTH'S BEST DEFENSE

WATER REUSE

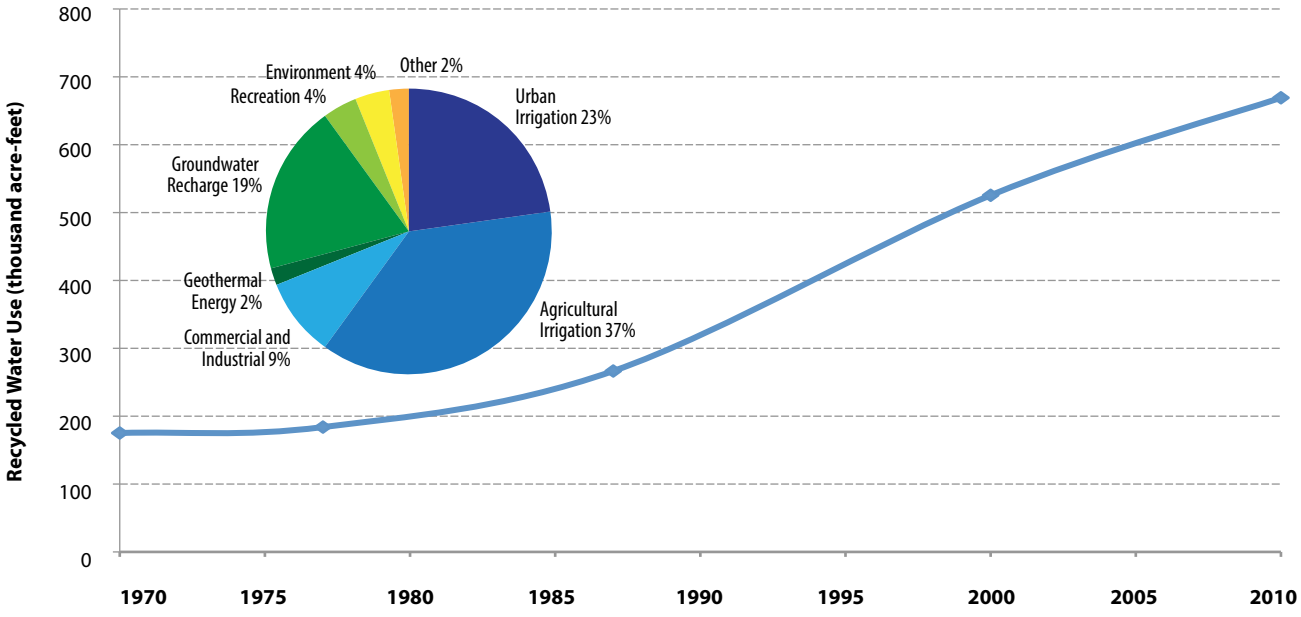
A variety of terms are used to describe water reuse, including water reclamation and water recycling. In some cases, wastewater is collected and conveyed to a nearby facility, where it undergoes treatment before being distributed to customers for reuse. This is commonly referred to as recycled water (or municipal recycled water). In other cases, wastewater is reused on site with little or no treatment, referred to as onsite reuse. For example, a home may be equipped with a graywater system that collects wastewater from a clothes washer and uses it to irrigate a garden.[1] Likewise, an office building may be equipped with a system that treats wastewater and reuses a portion for flushing toilets and other non-potable applications. In this analysis, we use the term water reuse to refer broadly to wastewater that is intentionally captured and used for another beneficial purpose, such as for irrigation, industrial processes, or augmentation of drinking-water supplies. It includes onsite reuse as well as municipal recycled water.

WATER RECYCLING AND REUSE TRENDS IN CALIFORNIA

Californians have been reusing water for more than 100 years. In 1910, recycled water was used for agriculture at nearly three dozen sites, and by the 1950s, more than 100 California communities were using recycled water for agricultural and landscape irrigation (SWRCB and DWR 2012). The earliest recycled water survey, conducted in 1970, found that an estimated 175,000 acre-feet of municipal wastewater was beneficially reused annually, about two-thirds of which was for agriculture (SWRCB 1990). The most recent statewide recycled water survey identified the annual reuse of 670,000 acre-feet of municipal wastewater, representing approximately 13 percent of the 5 million acre-feet of municipal wastewater produced each year in California (SWRCB and DWR, 2012). While the earliest uses of recycled water were for agriculture, there is currently a broader set of recycled water applications, including geothermal energy production, groundwater recharge, landscape irrigation, and industrial use (see Figure 1). Recycled water is used in nearly every county in the state but is concentrated in Southern California, with 60 percent of statewide recycled water use taking place south of the Tehachapi Mountains. Additionally, onsite reuse—including the use of graywater—is practiced in communities across California, although data are not available to estimate these volumes.

Water reuse is expanding, driven in part by the drought but also by efforts to develop a more reliable, local water supply. Water utilities in Northern and Southern California have already made investments in recycled water, and many are seeking to expand their recycled water supplies. For example, in Northern California, the city of Santa Rosa currently recycles between 90 and 100 percent of the 23,000 acre-feet of wastewater it produces each year (City of Santa Rosa 2011). In Southern California, the Inland Empire Utilities Agency currently recycles 50 percent of the nearly 60,000

Figure 1. Recycled water trends in California, 1970–2009, and (inset) recycled water use by end use in 2009



Source: SWRCB and DWR (2012)

Note: Urban irrigation includes the use of recycled water for irrigating large landscapes and golf courses. Groundwater recharge includes the use of recycled water for that purpose and as a seawater intrusion barrier.

acre-feet of wastewater produced annually for direct use and groundwater recharge and has a recycled water goal of 50,000 acre-feet by 2025 (IEUA 2013). Likewise, the Orange County Water District and Orange County Sanitation District operate a recycled water plant that produces up to 72,000 acre-feet per year; plans call for an increase in production to 103,000 acre-feet per year by 2015 (GWRS n.d.). These efforts are supported by several state agencies, including the State Water Resources Control Board and the Department of Water Resources—both of which have developed recycled water goals that represent a considerable increase over current levels.

CALIFORNIA'S WATER REUSE POTENTIAL

Previous Analyses

In 2003, the Recycled Water Task Force examined the water recycling potential in California. On the basis of detailed regional analyses for the San Francisco Bay Area and Southern California coastal region combined with surveys of utilities and data on wastewater discharges, the task force estimated that the recycled water potential in 2030 would range from 1.9 million to 2.3 million acre-feet per year, or about 23 percent of the estimated available municipal wastewater in 2030 (Recycled Water Task Force 2003). More recent estimates from DWR in the California Water Plan are similar: In a review of water management plans prepared by urban water agencies across California, DWR estimates that recycled water could augment water supply by 1.8 million to 2.3 million acre-feet per year by 2030 (DWR 2013).

Our Analysis

For this analysis, we assumed that the technical potential for water reuse in California is equivalent to the state's indoor water use. While it is unlikely that we will soon reuse all of the water used in our homes, much of this water could be captured and reused onsite or treated at a municipal wastewater treatment plant and distributed as recycled water. On the basis of data from DWR for 2001–2010, we estimated that indoor water use in California averages 4.2 million acre-feet per year. By implementing indoor efficiency improvements, indoor use could decline by 40 to 54 percent, thereby reducing the amount of water available for reuse. We therefore estimated that the water reuse potential is equivalent to our estimate of efficient indoor water use and ranges from 1.9 million to 2.5 million acre-feet per year (Heberger et al. 2014). Approximately 64 percent of the water reuse potential is from residences; the remainder is from commercial businesses and institutions (21 percent) and industry (15 percent). Some of this reuse is already occurring. According to the most recent state survey, current recycled water use in California is 670,000 acre-feet per year (SWRCB and DWR 2012). Thus, the potential for additional water reuse in California today is 1.2 million to 1.8 million acre-feet per year.

Two-thirds of the reuse potential is in coastal areas where wastewater is discharged into the ocean or into rivers that drain directly into the ocean. In these areas, expanding water reuse may provide water supply and water quality benefits. We estimated that 0.9 million to 1.1 million acre-feet per year could be reused in coastal areas. The remainder of the reuse potential (0.3 million to 0.7 million acre-feet per year) is in inland areas. While water reuse may not produce new supply in these areas because that water may already be reused by a downstream user, it can improve the reliability of water supplies, and by replacing the use of potable water, provide energy savings and environmental benefits, such as, requiring less water to be extracted from rivers and streams.

This is a conservative estimate for several reasons. First, it assumed a high degree of indoor water efficiency. In reality, indoor water efficiency is unlikely to reach its full technical potential, and thus the reuse potential may be higher. Second, it did not take into account population growth, which can increase the amount of wastewater produced and thus the reuse potential. Third, it assumed that all of this water is reused for irrigation or some other consumptive use and thus can be reused only once. However, if that water is used inside a home or business or to recharge a groundwater aquifer, it may be possible to reuse the water several times.[2] Finally, we did not include inflow and infiltration, which refer to rainwater and groundwater that enter the sanitary sewer system through cracked pipes, leaky manholes, or improperly connected storm drains and roof gutter downspouts and is transported to the wastewater treatment plant, where it is treated and discharged. Thus, the water reuse potential is likely to be higher.

CONCLUSIONS

Water reuse provides a reliable, local water supply that reduces vulnerability to droughts and other water-supply constraints. It can also provide economic and environmental benefits, for example by reducing energy use, diversions from rivers and streams, and pollution from wastewater discharges.

There is tremendous opportunity to expand water reuse in California. We estimate that the water reuse potential in California, beyond what has already been achieved, ranges from 1.2 million to 1.8 million acre-feet per year. Two-thirds of the reuse potential is in coastal areas where wastewater is discharged into the ocean or into streams that drain into the ocean. In these areas, expanding water reuse may provide both water supply and water quality benefits.

References

City of Santa Rosa. (2011). *2010 Urban Water Management Plan*, prepared in conjunction with West and Yost Associated and Maddaus Water Management.

California Department of Water Resources (DWR). (2013). *California Water Plan Update 2013*, Vol. 3, Chapter 1, Introduction. Draft report.

Groundwater Replenishment System (GWRS). (No Date). Technical brochure, www.gwrsystem.com/images/stories/AboutGWRS/GWRS%20Technical%20Brochure.pdf (accessed April 23, 2014).

Heberger, M., H. Cooley, and P.H. Gleick. (2014). *Urban Water Conservation and Efficiency Potential*. Pacific Institute and Natural Resources Defense Council.

Inland Empire Utilities Agency (IEUA). (2013). *IEUA Business Goals*, www.ieua.org/recycled/docs/FY2011_12_RWAnnualReport.pdf (accessed April 23, 2014).

National Research Council. (2012). *Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater*. Washington, D.C.: National Academies Press.

Recycled Water Task Force. (2003). *Water Recycling 2030: Recommendations of California's Recycled Water Task Force*. California Department of Water Resources, State Water Resources Control Board, and California Department of Health Services.

State Water Resources Control Board (SWRCB). (2013). *Recycled Water Policy*, revised January 22, 2013.

State Water Resources Control Board (SWRCB). (2008). *Strategic Plan Update 2008–2012*. Sacramento (CA): State Water Resources Control Board.

State Water Resources Control Board (SWRCB) and Department of Water Resources (DWR). (2012). *Results, Challenges, and Future Approaches to California's Municipal Wastewater Recycling Survey*.

Endnotes

1 Graywater is defined slightly differently around the world but generally refers to the wastewater generated from household uses like bathing and washing clothes. It is distinct from blackwater, which refers to wastewater that has come into contact with fecal matter and urine.

2 We note that salt loading may limit the number of times that water may be reused.

Authors and Acknowledgements

The lead author of this report is Heather Cooley, with additional contributions by Peter Gleick and Robert Wilkinson. Support for this work was provided by the Pisces Foundation. Numerous individuals provided comments on this report; we thank them for their input.

Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
212 727-2700
Fax 212 727-1773

Beijing

Chicago

Los Angeles

Bozeman

San Francisco

Washington, D.C.

www.nrdc.org

www.nrdc.org/policy
www.facebook.com/nrdc.org
www.twitter.com/nrdc

Pacific Institute
654 13th Street, Preservation Park
Oakland, CA 94612, USA
Phone: 510-251-1600
Fax: 510-251-2203

www.pacinst.org
www.californiadrought.org

www.facebook.com/PacificInstitute
www.twitter.com/PacificInstitut