



NOVEMBER 2023

Source List for *Priorities for California's Water: Stewarding the Wet Years*

This document provides background references for the PPIC policy brief, *Priorities for California's Water: Stewarding the Wet Years* (November 2023). If you have any questions about the information in the report or these sources, contact us at water@ppic.org.

Introduction

- **And Californians adore their state: an explosion of wildflowers—like this spring's superbloom—is enough to inspire a temporary mass migration to the state's most remote corners:** Goodyear, D. 2023. "The Superbloom is a Glimpse of California's Past." *The New Yorker*. May 12.
- **Californians care deeply about protecting the magic of this place we call home:** Baldassare, M., et al. 2023. *PPIC Statewide Survey: Californians and the Environment*. Public Policy Institute of California. July.
- **This year's unprecedented surge in global temperatures made the summer of 2023 the hottest in recorded history:** Paddison, L. 2023. "The world has just experienced the hottest summer on record – by a significant margin." *CNN*. September 6.
- **This year, the salmon fishing season experienced a full closure due to dwindling populations:** Bland, A. 2023. "No California salmon: Fishery to be shut down this year." *CalMatters*. March 15.
- **This year's:**
 - **...Epic snowpack...:** Mount, J. 2023. "An Epic Snowpack May Test Water Management in the San Joaquin Valley." *PPIC Blog*. March 13.
 - **...Dramatic flooding in the Central Valley...:** Bardeen, S. 2023. "The Toll of the San Joaquin Valley Floods: 'It's Not Pretty.'" *PPIC Blog*. April 26.
 - **...Tropical storm in the desert...:** Mount, J. 2023. "Tropical Storm Hilary Wallops Southern California." *PPIC Blog*. August 23.
- **The happy medium—never a common experience for the state—is shrinking:** Mount, J., Sencan, G., Dettinger, M. 2023. "The Weird Weather of 2023: Better Get Used to It." *PPIC Blog*. September 2023.
- **I have valued the center's research for many years—and collaborated with the center in the past:** Grenier, L., et al. 2021. "Advancing Ecosystem Restoration with Smarter Permitting." *PPIC Blog*. August 2021.

2023: The California Weather Gods Must be Crazy

- **California has been subject to large swings in precipitation, and some of these years have been the warmest in recorded history:** NOAA. n.d. *Climate at a Glance*. Accessed September 13, 2023.
- **The 2023 water year... is part of an overall trend of increasing precipitation volatility and rising temperatures:** Mount, J., Sencan, G., Dettinger, M. 2023. "The Weird Weather of 2023: Better Get Used to It." *PPIC Blog*. September 2023.
- **The 2023 water year... [mirrored] changes:**
 - **... across the U.S....:** National Oceanic and Atmospheric Administration. 2023. "U.S. saw its 9th-warmest August on Record." *NOAA*. September 11.
 - **... and around the world...:** Wu, H., and Su, X., and Singh, V. 2023. "Increasing Risks of Future Compound Extremes With Warming Over Global Land Masses." *Earth's Future*, 11(9).

- **The fall of 2022 was exceptionally warm and dry, with...**
 - **...low reservoir storage in California...:** California Department of Water Resources. n.d. [California Data Exchange Center – Reservoirs](#).
 - **...and record lows in the Colorado River’s main reservoirs, Lake Powell and Lake Mead:** Nilsen, E. and Ramirez, R. 2022. “‘The brink of disaster’: 2023 is a critical year for the Colorado River as reservoirs sink towards ‘dead pool.’” *CNN*. December 30.
 - **Seasonal forecasts—citing La Niña conditions—called for a continuation of drought conditions:** National Oceanic and Atmospheric Administration. 2023. “U.S. Winter Outlook: Warmer, drier South with ongoing La Nina.” *NOAA*. October 20.
- **California was hit by nine significant atmospheric rivers:** Scripps Institution of Oceanography at UC San Diego. n.d. [Center for Western Weather and Water Extremes](#).
- **Flooding affected 24 counties, and at least 22 people died:** Castleman, T., et al. 2023. “Tracking the deaths from California’s winter storms: At least 22 killed.” *LA Times*. January 18.
- **The Sierra Nevada snowpack in late January exceeded the April 1st average:** California Department of Water Resources. n.d. [California Data Exchange Center – Snow](#).
- **The historic Tulare Lake refilled for the first time since 1997:** Gauthier, R. and Gomez, M. 2023. “Tulare Lake’s ghostly rebirth brings wonder — and hardship. Inside a community’s resilience.” *LA Times*. July 6.
- **In late August, a rare tropical storm—the remains of Hurricane Hilary—made landfall in Southern California:** Mount, J. 2023. “Tropical Storm Hilary Wallops Southern California.” *PPIC Blog*. August 23.

Storing Water in 2023

- **Less than two years later, the state declared a drought emergency, with some reservoirs at near-record lows:** Null, S., et al. 2021. “Managing Water Stored for the Environment During Drought.” *California WaterBlog*. November 7.
- **Efforts to fill reservoirs dominated early-season operations:** California Department of Water Resources. n.d. [California Data Exchange Center – Reservoirs](#).
- **A surge in runoff also increased storage in Lake Powell and Lake Mead:** US Bureau of Reclamation. 2023. [Colorado River Basin](#). September 5.
- **Many overdrafted basins face the prospect of significant pumping cutbacks to comply with the Sustainable Groundwater Management Act (SGMA):** Escrivá-Bou et al. 2023. “Policy Brief: The Future of Agriculture in the San Joaquin Valley.” Public Policy Institute of California.
- **The California Department of Water Resources (DWR) estimates that approximately 3.8 million acre-feet of water was actively recharged by mid-summer...:** California Department of Water Resources. 2023. “DWR Captures and Stores Water from Record-Breaking Snowpack.” *DWR Updates*. July 19.
- **...principally in the heavily overdrafted San Joaquin Valley:** Confirmed through personal communication with DWR.
- **For perspective, [3.8 million acre-feet] is roughly the volume of water stored in Lake Oroville, the state’s second-largest reservoir:** California Department of Water Resources. n.d. [California Data Exchange Center – Reservoirs](#).
- **In early March of 2023, Governor Newsom issued the first of several executive orders (EO) that allowed managers to divert water for recharge without a permit:** State of California. 2023. [Executive Order N-4-23](#). March 10. Subsequent orders included [N-6-23](#) (March 31, providing additional support for flood response in the Tulare Basin) and [N-7-23](#) (May 17, extending the time period for authorized diversions).
- **By fall, the EOs enabled recharge of nearly 400,000 acre-feet:** Reporting is tracked on this [State Water Resources Control Board webpage](#). As of October 19th, 393,000 acre-feet of diversions were reported, of which nearly 245,000 in the Eastern Sierra (Inyo, Mono, and Kern Counties) and the remainder in the San Joaquin Valley.

- **The projects could have diverted more than 600,000 additional acre-feet of water:** Estimates by Greg Gartrell, using methods described in Gartrell, G., et al. 2022. *Technical Appendix* in *Policy Brief: Tracking Where Water Goes in a Changing Sacramento–San Joaquin Delta*. Public Policy Institute of California.
- **Another 1.2 million acre-feet of San Joaquin River flows could have been captured upstream of the Delta while meeting these requirements:** Estimates by Greg Gartrell, using methods described in Gartrell, G., et al. 2022. *Technical Appendix* in *Policy Brief: Tracking Where Water Goes in a Changing Sacramento–San Joaquin Delta*. Public Policy Institute of California.
- **Efforts were hampered by limited infrastructure to move water to suitable areas, time-consuming permitting requirements, and a dearth of landowners and local agencies sufficiently organized—or even willing—to take water:** These insights were obtained via meetings with agencies and water users in preparation of this report.
- **Partnership between Tulare Irrigation District, Self-Help Enterprises, and the community of Okieville:** Cahill, N. 2023. “California water agencies hoped a deluge would recharge their aquifers. But when it came, some couldn’t use it.” *Water Education Foundation*. February 16.
- **The need to do a better job of setting aside more water:** Null, S. and Mount, J. 2022. “Commentary: Newsom’s Water Strategy Needs to Go a Step Further.” *PPIC Blog*. September 8.

Managing Floods in 2023

- **The winter and spring saw local impacts from river flooding, with nearly...**
 - **...two dozen deaths...:** Castleman, T., et al. 2023. “Tracking the deaths from California’s winter storms: At least 22 killed.” *LA Times*. January 18.
- **...and...**
 - **...property damages estimated at \$4.6 billion:** Strong, R. 2023. “Space photos show over 1 trillion gallons of water flooding crop fields in California, and it could mean higher food prices.” *Business Insider*. July 16.
- **The damages from the summer flooding associated with Tropical Storm Hillary have not been fully assessed yet.**
 - Preliminary estimates for Riverside County are estimated at \$126 million. Reyes, Jesus, 2023. “Tropical Storm Hilary damages top \$126M in Riverside County, damage still being assessed.” *News Channel 3*, August 25.
- **The risk of significantly larger floods is increasing, meaning it’s critical to prepare for even bigger storms that what California experienced in 2023:** Huang, X., and Swain, D. 2022. “Climate change is increasing the risk of a California megaflood.” *Science Advances* 8(32).
- **Levees failed on the...**
 - **...Cosumnes...:** Anderson, C. 2023. “A Sacramento County levee has a hole the size of a football field — what it will cost to fix it.” *Sacramento Bee*. January 5.
 - **...Salinas...:** Miller, J. 2023. “The Salinas River and the foretold flood.” *High Country News*. February 8.
 - **...and Pajaro rivers:** KQED News Staff. 2023. “Breached Levee Floods Pajaro River Valley, Engulfing Towns as Communities Are Evacuated.” *KQED*. March 11.
- **The melting of the record snowpack in the headwaters led to the flooding of more than 100,000 acres of farmland:** Peterson, C., and Bardeen, S. 2023. “The Mad Dash to Save Dairy Cattle as Tulare Basin Flooded.” *PPIC Blog*. April 24.
- **A temporary return of what was once the largest freshwater lake west of the Mississippi River:** Mount, J. 2023. “An Epic Snowpack May Test Water Management in the San Joaquin Valley.” *PPIC Blog*. March 13.

- **In the Sacramento Valley, some reservoir operators used improved near-term weather forecasts—already recognized as a way to boost water supplies:** Information on this year’s actions was identified in our workshops with stakeholders. Information on this reservoir operation strategy is summarized in Pottinger, L. 2021. “[Operating Dams to Better Manage Big Storms Can Build Resiliency to Climate Extremes.](#)” *PPIC Blog*. March 8.
- **Experts we consulted cited the dual challenges of maintaining existing, aging infrastructure designed for mid-20th century hydrology and land use, while developing new infrastructure to cope with increasing flood risk:** Identified in our workshops with stakeholders.
- **Flood investments are “fiscal orphans” that face major funding hurdles, even with recent increases in federal and state funds:** Chappelle, C., Hanak, E., and Rosser, A. 2021, “[Paying for California’s Water System.](#)” Public Policy Institute of California. May.
- **Roles and responsibilities for flood management decisions were unclear:** Bergstrom, D., et al. 2023. “[Who’s in charge? Agencies deal with fragmented flood response in the south San Joaquin Valley.](#)” *Fresnoland*. April 20.
- **Recent studies have documented how low-income communities in California are both at higher risk of flooding and less equipped to recover once flooding occurs:** Sander, B. et al. 2022. “[Large and inequitable flood risks in Los Angeles, California.](#)” *Nature Sustainability* 6, 47–57.
- **[Lack of resources to meet federal cost-share requirements] is slowly beginning to change:** Bardeen, S. 2023. “[Fostering Fairness in Flood Risk Management.](#)” *PPIC Blog*. August 15.
- **As the Central Valley Flood Protection Plan highlights, such natural infrastructure can help reduce flood risk while meeting environmental objectives:** California Department of Water Resources. 2022. “[Central Valley Flood Protection Plan 2022 Highlights.](#)”

Priorities for Better Wet-Year Management

- **[We also saw a] near-record snowpack in the Sierra Nevada (and record summer precipitation in parts of Southern California) this year:** California Department of Water Resources. n.d. [California Data Exchange Center – Snow](#).
- **Some new reservoirs, such as Sites, may be built:** Sencan, G. 2023. “[Sites Reservoir’s Novel Approach to Storing Water for the Environment.](#)” *PPIC Blog*. March 20.
- **Although the federal government has made it easier for these communities to receive technical and planning support, much work is still needed to reduce their flood risk and improve their recovery capacity:** Bardeen, S. 2023. “[Fostering Fairness in Flood Risk Management.](#)” *PPIC Blog*. August 15.