Watershed Climate Studies Demonstrate Vulnerability, Climate Adaptation and Multi-Sector Benefits

HIGHLIGHTING THE VALUE OF PARTNERSHIPS AND INNOVATION

While all corners of the state are facing increasing climate risks, San Joaquin Basin communities, economies, and ecosystems are uniquely vulnerable to climate-driven drought and flood impacts. Constrained and inadequate flood infrastructure, significantly over-drafted and subsiding groundwater basins, degraded ecosystems, and declining aquatic species, all contribute to the region's substantial climate vulnerabilities. The increasing climate risk will be intractable, if not insurmountable, when addressed narrowly by individual sectors. Adapting to climate change and intensifying extreme events requires innovative levels of integrated project planning, implementation, and operation, especially in vulnerable landscapes like the San Joaquin Basin.

To better understand these vulnerabilities and how to address them, the California Department of Water Resources (DWR) is conducting watershed climate studies for the Merced and Tuolumne rivers. DWR has also received funding to conduct these cutting-edge climate vulnerability assessments and adaptation strategy evaluations for the remaining tributary watersheds of the San Joaquin Basin (Calaveras, Stanislaus, and Upper and Lower San Joaquin watersheds), all of which can be integrated into a basin wide assessment.

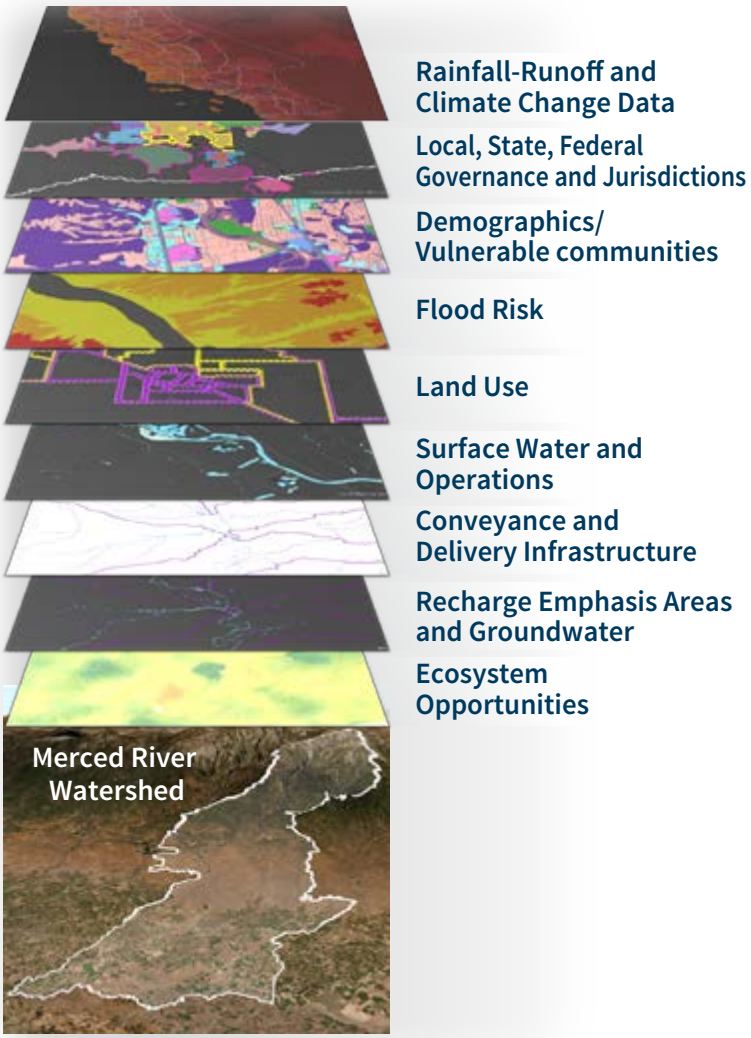
The watershed studies are demonstrating that at a watershed scale, Flood Managed Aquifer Recharge (Flood-MAR) and related adaptation strategies such as Forecast Informed Reservoir Operations (FIRO) can effectively reduce vulnerabilities in the face of climate uncertainty. They predict that we can concurrently replenish aquifers, reduce flood risk, and improve ecosystems in the San Joaquin Basin with:

- Strong multi-sector partnerships to collaboratively plan, implement, and co-manage projects
- Re-operation of local and federal flood protection and water supply reservoirs
- Use of high flows for groundwater recharge on agricultural, working, and natural managed lands
- Improved local conveyance infrastructure to move surface and alternative water supplies to groundwater recharge locations (farms, working landscapes, and natural managed lands)
- Better information about land use patterns, soils, and subsurface geology using AEM technology

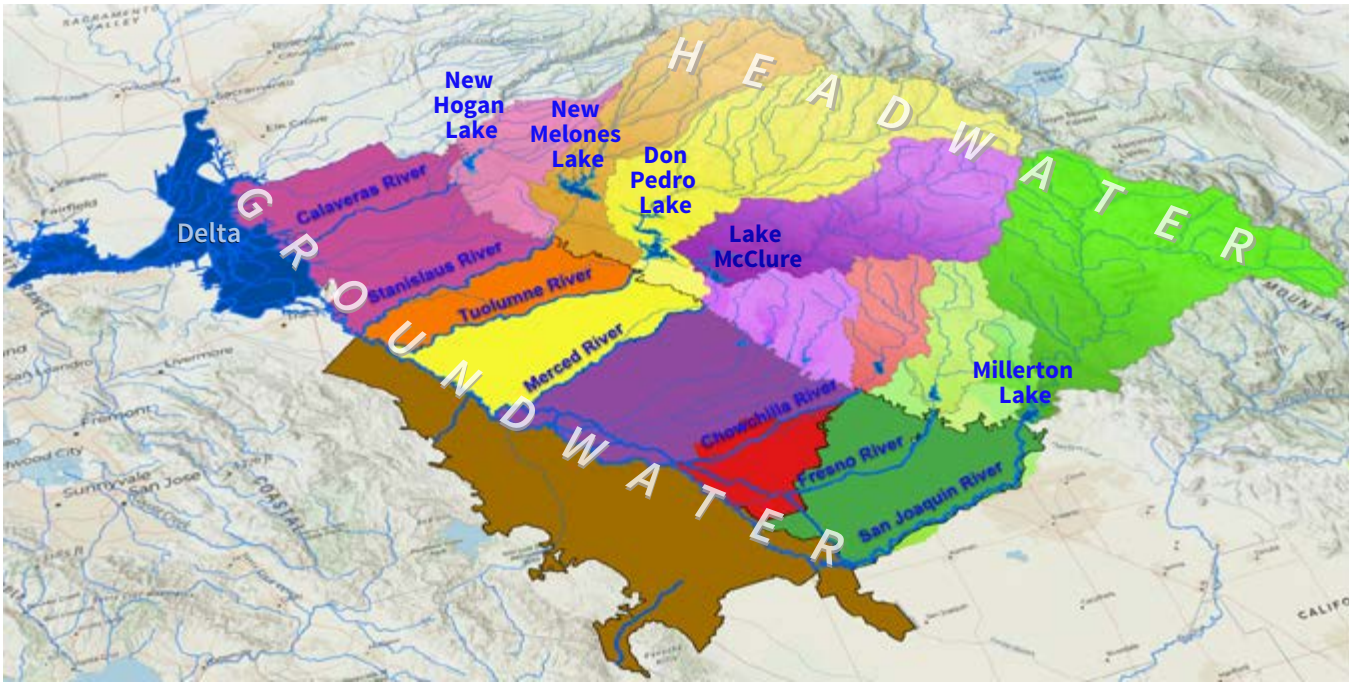
For example, the completed Merced Flood-MAR Watershed Study has generated compelling findings about substantial climate vulnerability to all water sectors within the Merced watershed. Key findings of a likely 2070 climate change scenario vulnerability assessment are:

- 600% increase in peak flood flows in the Merced River
- 20% increase in average annual groundwater overdraft within the basin
- 10% fewer months with depth to groundwater less than 30 feet, impacting groundwater dependent ecosystems
- 8% reduction in end-of-irrigation-season average annual storage in Lake McClure
- 7% increase in agricultural water demand from higher temperatures

Watershed Studies Integrate Data and Analytics



Headwater to Groundwater Watershed Climate Studies in the San Joaquin River Basin



The Merced Study also demonstrates that multi-sector watershed management headwater to groundwater adaptations can significantly reduce these vulnerabilities for communities and terrestrial and aquatic ecosystems. Key findings for the same climate future above:

- With current facilities and operations, 79,000 acre-feet average annual additional groundwater recharge; half using existing canals and half from on-farm recharge.
- With a combination of Flood-MAR and FIRO, average annual recharge increased to 105,000 acre-feet; climate change induced peak flood flows in the Merced River were reduced by 65%; overdraft was reduced by 50%.
- With more aggressive reservoir reoperation along with Flood-MAR, average annual recharge increased to 134,000 acre-feet; Merced River peak flood flow was reduced by 85%; overdraft was reduced by 70%.
- Half of the recharged water moved to and benefited neighboring groundwater sub-basins, a third remained in the Merced groundwater sub-basin, and the remaining sixth flowed into adjacent streams as baseflow.
- Adaptation strategies provided a broad array of other related benefits, including subsidence mitigation, habitat improvements for salmonids, shorebirds, and groundwater dependent ecosystems, and improved groundwater conditions for disadvantaged communities.

Headwater to Groundwater Watershed Climate Studies in the San Joaquin River Basin

The San Joaquin River Basin watershed climate studies focus on innovation to transform existing and future vulnerabilities into climate adaptation opportunities. When developed cooperatively, watershed adaptation strategies can simultaneously reduce flood risk, replenish aquifers, and help aquatic and terrestrial ecosystems. For example, a depleted groundwater aquifer can provide additional storage for local flood flows and water supplies. A review by the Public Policy Institute of California (PPIC) of Groundwater Sustainability Plans found that out of 2,000 listed local projects, about half are related to groundwater recharge, a difficult task in such a drought-prone and water-scarce region. These studies can demonstrate the potential for groundwater recharge under current and future conditions in each watershed.

Study teams comprised of DWR and local partners are formulating each watershed climate study to promote and advance multi-sector water management at a watershed scale, from headwater to groundwater. Each study employs a risk-based method for assessing climate change effects to water management infrastructure and systems across multiple water sectors (flood, water supplies and ecosystems), warranting participation from those local water sectors, including reservoir owners and operators. The integrated vulnerability and adaptation approach central to these studies, which are both cost effective and information rich, are positioning State and local, federal, and tribal partners to collaboratively steward the basin's water resources.