Intersecting Flood Control and Recharge: Transforming a Liability into an Asset

ATUR Workshop Brief: Arizona Flood Control Districts **March 2024**

INTRODUCTION

Drought conditions exacerbated by climate change threaten water availability in Arizona, where over 95% of precipitation is lost through evaporation before it can be recharged to support communities and ecosystems. Meanwhile, more intense precipitation events are expected to contribute to increased flooding across the state. These climatic phenomena present an opportunity for researchers and practitioners to explore ways of managing risk through enhanced capture and recharge of flood waters. Members of the Arizona Tri-University Recharge and Water Reliability Project (ATUR) research team met virtually with practitioners from Flood Control Districts (FCD) across the state in March 2024 to discuss barriers and opportunities at the intersection of flood control and groundwater recharge. Regulatory, funding, and data availability constraints were highlighted as major barriers, while opportunities discussed included taking better advantage of existing FCD authorities, collaboration with multi-stakeholder coalitions, articulating community and ecosystem benefits, and identifying areas for future research such as water balance modeling and mapping within specific watersheds. This brief further details discussions of the barriers and opportunities to transform flood waters from a liability into an asset.

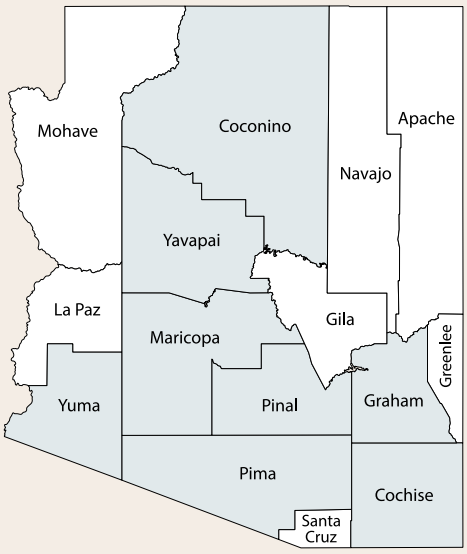

Figure 1. Arizona Flood Control Districts are organized by county. Counties with representation among the workshop participants are highlighted in blue.

IDENTIFIED BARRIERS

Regulatory Barriers

Environmental laws and regulations inhibit the use of floodwaters for recharge in some areas. Examples highlighted in the workshop include:

- In some cases, the "on the ground" application of *surface water law* remains unclear in the context of floodwaters.
- The current *underground storage credit system* does not allow agencies to acquire storage credits for recharging flood waters.
- *Land access issues*, including easements and right-of-way restrictions, pose challenges to recharge efforts.
- *A disconnect exists between flood control policies and priorities and groundwater recharge requirements*. Current flood control policy prioritizes threat mitigation; recharge is not a primary goal or a co-benefit typically considered of current stormwater management practices.

Funding Barriers

There is a general lack of funding available for recharge within the context of flood control and insufficient staff to integrate recharge considerations into stormwater management projects.

Data Availability

Appropriate data for analyzing recharge opportunities are limited. While ALERT data are useful for real-time decision-making, FCDs require higher resolution geospatial data over longer periods of record to justify integrating recharge objectives into flood control projects.

Figure 2. Flooded Santa Cruz River in Tucson, AZ. Photo: M. Durson / Adobe Stock.

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OPPORTUNITIES

Authority of Flood Control Districts

The Arizona Revised Statutes (ARS) provides FCDs with the authority to "construct, operate, and maintain artificial groundwater recharge facilities" and collaborate with other stakeholders engaged in recharge activities (Ariz. Rev. Stat. § 48-3602, 2024).

Co-benefits of recharge and flood control

Combining recharge and flood control efforts may increase funding options, reduce peak flows and flooding hazards, increase potential for community engagement, and improve ecosystem health. For example:

- *Habitat health* can be improved with recharged floodwaters through increasing baseflow into perennial streams and expanding urban tree canopy, among other benefits.
- Recharging floodwaters can lead to *water quality improvements* by reducing sediment and contaminant transport in waterways, providing erosion control, and mitigating post-fire impacts.
- *Potential partnerships with communities that manage significant agricultural lands* and/or are concerned about groundwater depletion could lead to significant benefits for all. Further, recharging flood waters could reduce agricultural maintenance issues by redirecting water that otherwise may disrupt cropland irrigation.
- *Exploring innovative interagency partnerships* with Arizona Department of Transportation (ADOT), water/wastewater utilities, Arizona Department of Water Resources Dam Safety Program, Arizona Watershed Protection Fund, and others may enhance opportunities to embed recharge into projects.
- *Best management practices can be learned from existing recharge/flood control projects*, such as those implemented by the Cochise Conservation and Recharge Network and the Pima County Regional FCD (e.g. Rita Ranch detention basin in Tucson, Arizona).

Figure 4. A retention/detention basin with drywells used as a flood control strategy to capture and direct stormwater for recharge in Chandler, AZ. Photo: Dr. Tianfang Xu, ATUR Urban and Recharge teams, ASU.

Figure 3. Palominas Flood Control and Recharge Project.
https://www.cochise.az.gov/356/Cochise-Conservation-Recharge-Network

Research opportunities

Additional research, such as (1) modeling changes in the water balance due to climate change and future development scenarios for urban, natural, and agricultural areas, and (2) compiling hydrogeologic geospatial data into a tool for siting favorable recharge locations could equip FCDs with the knowledge needed to plan future projects. Specific opportunities discussed include:

- Refining current estimates and projections of urban runoff generated as a result of development could inform potential stormwater capture and improvements in detention basin requirements for new subdivisions.
- Compiling geospatial data to map areas of increased wildfire risk and post-fire flooding would assist with recharge in areas where wildfire is a key management concern.
- Insights on how recharge of floodwaters may support dam safety could encourage project managers to consider the co-benefits of recharge, as well as facilitate potential interagency partnerships.
- An assessment of diversion or inflatable dams could determine their viability in supporting groundwater recharge in the floodplain.

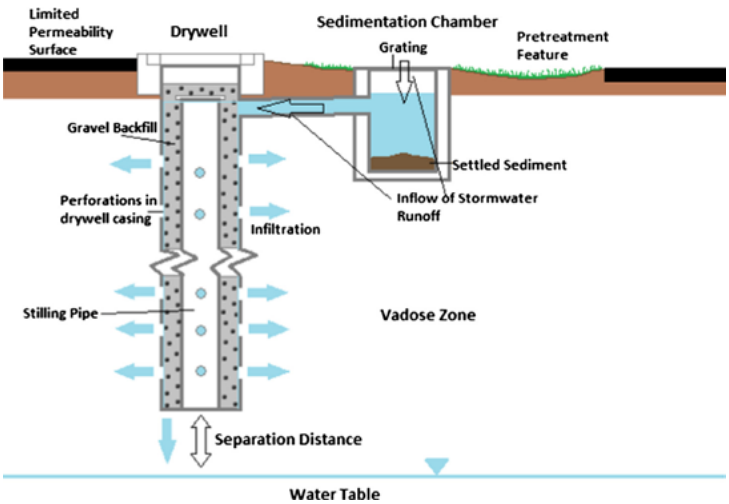

Figure 5. "The design of a typical drywell, including a grass swale and sedimentation chamber pretreatment" (Edwards et al., 2016). Drywells help direct stormwater into the subsurface rapidly and reduce losses to evaporation.

KEY TAKEAWAYS

Enthusiasm at the intersection of flood control and recharge

Flood Control Districts participants from across the state are enthusiastic about integrating recharge objectives with flood control efforts. Although there are some districts that are already engaged in integrating recharge benefits in stormwater management efforts, there is still a lot to be gained from sharing experience across districts and explicitly integrating recharge into policy and practice where opportunities to do so are identified.

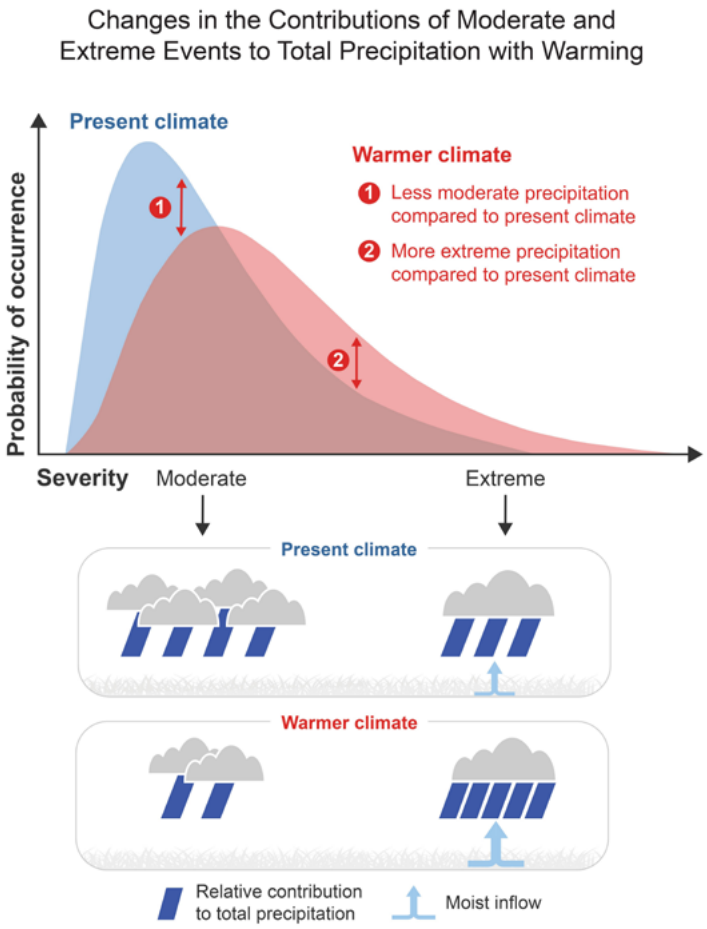

Figure 6. Projected changes to extreme precipitation events as a result of climate change. Source: NCA5, Ch. 3 Earth Systems Processes

Climate change uncertainty

Projected changes to precipitation patterns and intensities due to climate change present challenges for Flood Control Districts in planning for future stormwater management and recharge efforts.

Through combining analyses of precipitation, evapotranspiration, land use/urban runoff, ground and surface water modeling, and geologic mapping, the ATUR team is conducting a high-level assessment of locations and methods for enhanced capture and recharge given future climate change projections and development scenarios. Flood control practitioners will be able to use these data to inform and assess the suitability of combined flood control and recharge projects in their districts.

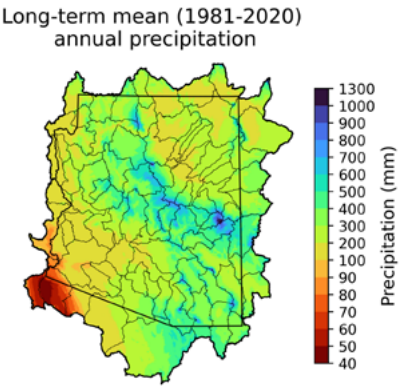

Figure 7. National Water Model output for average annual precipitation from 1981–2020 in Arizona's HUC8 basins. Similar models are being developed to reflect projected impacts of future climate change scenarios on precipitation, evapotranspiration, runoff, and recharge across the state. Figure generated by Dr. Abdul Moiz, ATUR Hydroclimate team, ASU.

Exercising existing authorities

A significant opportunity exists for FCDs to exercise their ARS-granted authority to engage in embedding recharge benefits into stormwater management projects and to collaborate with multi-stakeholder coalitions working on groundwater resilience efforts. Prioritizing recharge outcomes in the context of flood control has the potential to support new, unconventional partnerships, improve both habitat and community health, and transform flood waters from a liability into an asset.

For more information on integrating recharge and flood control objectives, please contact Holly Richter (hollyrichter@resilientrivers.com) or Nicholas Balik (nicholas.balik@maricopa.gov). Additional information on the ATUR project can be found at: https://ccass.arizona.edu/arizona-tri-university-recharge-and-water-reliability-project.

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NOAA National Water Model CONUS Retrospective Dataset was accessed on 11/19/2024 from https://registry.opendata.aws/nwm-archive.