

## [Groundwater exchange pools in Los Angeles: An innovative example of adaptive management](#)

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Major groundwater basins in metropolitan Los Angeles. Most of the groundwater basins are adjudicated.

Across California, Groundwater Sustainability Agencies (GSAs) are devising plans to reduce long-term overdraft. As part of the 2014 Sustainable Groundwater Management Act, GSAs will submit plans in 2020-2022, which detail strategies to bring groundwater use into balance by 2040. Planning processes must assemble stakeholders and estimate sustainable yields of groundwater, quantify existing pumping, describe future options to limit overdraft, and identify funding. GSAs are actively searching for ways to stretch limited supplies and sustainably use the underground storage space created by decades of overdraft, drawing on [lessons of previous regional agreements](#).

In one part of Los Angeles County (a region whose groundwater basins are mostly [adjudicated](#), in contrast with most other parts of the state), an innovative approach has established a [community exchange pool](#) where parties can store and purchase water. The arrangement, which allows pumpers such as water districts and municipal utilities to newly store water in the emptied aquifers, was incorporated into a 2013 re-adjudication of the groundwater management agreement, now managed by the [Water Replenishment District of Southern California](#). The new arrangement presents intriguing questions. For instance, what is the potential for groundwater storage and exchange pools to help meet regional goals of water supply planning in L.A.?



The Central and West Coast Basin territories managed by WRD, where an exchange pool was instituted by the 2013 re-adjudication (Source: [WRD](#))

In a recently-published [study](#), we modeled potential operations of groundwater exchange pools across the L.A. County metro area and its adjudicated basins and sub-basins. Results indicated that, if used, storage and exchange pools have significant potential to promote long-term water supply reliability, including mitigating potential effects of water scarcity from reduced imports. Combined with water conservation, exchanging groundwater among retailers could reduce water shortages by as much as 80%. To accomplish this, pumpers with excess water store it for later use, or transfer it to other parties with supply shortfalls. Storage pool operations were seasonal, with more groundwater banking taking place during winter months and more extractions occurring in late summer.

The rules that organize such arrangements are critical. Accessibility to exchange pools is an important driver of their success. L.A.'s regional groundwater adjudications specify pumping rights among parties. These allocations occurred decades ago, and not all communities and agencies have pumping rights. This inhibits capacity to deal with water scarcity and reduces

economic incentives for building enhanced [stormwater capture infrastructure](#) that augments groundwater supplies, which is a useful economic benefit to quantify in paying for new infrastructure. Opening up access to groundwater basins, and exchange pool arrangements, by adjusting pumping rights and/or making storage and transfers more widely available could enhance reliability across retailers.

Additionally, a [distinction exists](#) between rights to pump groundwater vs rights to store groundwater. Groundwater is one type of Common Pool Resource (CPR) and [L.A. basins were seminal examples](#) in the development of contemporary theories of CPR [management](#). In California today, groundwater management agreements might treat the Common Pool Resources of groundwater supply and groundwater storage as either separate or joint. For instance, if only existing pumpers in a basin can access the storage capacity, storage and supply are managed jointly. Alternatively, if other parties without pumping rights in a basin could access its storage capacity, the CPRs would be managed separately.

Modeling results showed that this distinction is important. Managing access pumping and storage to exchange pools separately allows for greater reductions in regional shortages as compared to allotting rights for pumping and storage in exchange pools to only existing pumpers. This occurs because communities and agencies without current access to groundwater rights are more vulnerable to imported water cutbacks. Broadening access to storage facilitates broader reliability.

The modeling included a few assumptions for the storage pool operations. For instance, it assumed water retailers would meet demand reduction targets before offering water to exchanges, and also allowed pumpers to extract more than their regular allocations. We also did not account for how water would be recharged into the groundwater basins, or the economic costs of implementing the exchange pools. Clearly all of those issues would have to be addressed for exchange pools to be established broadly across a groundwater management area, but the modeling results were sufficient to suggest that such institutional reforms are worth taking seriously.

The organization of exchange pools also involves both philosophical and policy debates. Generally, exchanges of groundwater can occur as bilateral transfers between two parties, regulated contributions to storage pools based on allotted rights, market-driven exchanges where parties buy and sell water, or other schemes. Market-driven exchanges can effectively move water from areas of excess to areas of economic demand. But, markets do not necessarily address issues of equity and access. For instance, small, undercapitalized retailers in L.A. that would benefit from additional sources of water supply may not actually have funds or authority to participate in exchange pools, let alone fix their existing systems. Moreover, bilateral transfers may not adequately protect other important groundwater basin interests and values – where and how water is stored, and when and how it is withdrawn, can impact other basin users and the overlying lands and structures. As a critical resource supporting health and safety needs, groundwater basins must also be managed to incorporate state policies for water as a human right. These should all be complimentary goals in organizing flexible groundwater management agreements. For these and other reasons, relying on just one design for exchange pools will likely fail to achieve regional water supply reliability and equity goals. What can be said with

confidence is that for groundwater exchange pools to realize their potential, “storage management” will have to become an essential element in groundwater management.

As California groundwater users develop groundwater sustainability plans, flexible and adaptive agreements will be critical. Regional agencies are poised to be innovators. The groundwater basin adjudications of L.A. are unique historic, but evolving, examples of court-approved pacts that lay out the conditions for adaptive management, both between years and over time. Exchange pools can be a useful contribution in promoting management flexibility.

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