



Geosyntec 
consultants

Stormwater as a Local Resource

LADWP's Stormwater Capture Master Plan

Mark Hanna, PhD, PE

May 6, 2016

- Water imports under pressure and water scarcity becoming the new normal
- Local resource development, like stormwater capture, can help offset imports
- The many municipal needs greatly outweigh funding
- Local investment in water supply can leverage other initiatives such as water quality improvements, flood management, open space development, etc.
- Need to develop technically sound defensible plans to direct our limited resources

LA's Water Supply

Water Sources and Reliability Challenges



Delta

Sierra Mountains



Los Angeles Aqueduct

State Water Project

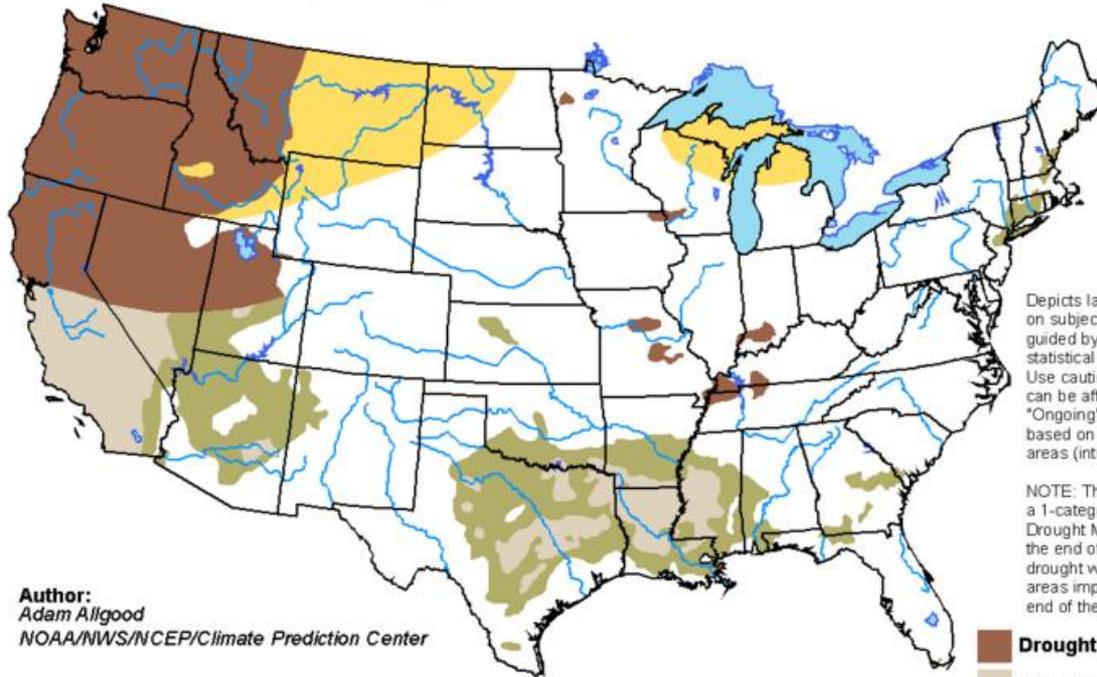


Colorado River Aqueduct

Local Groundwater, Conservation,
Recycled Water, Stormwater Capture

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for October 15 - January 31, 2016
Released October 15, 2015

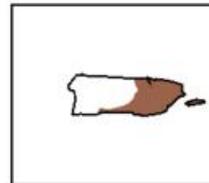
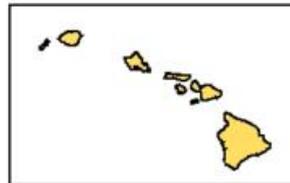


Author:
Adam Allgood
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

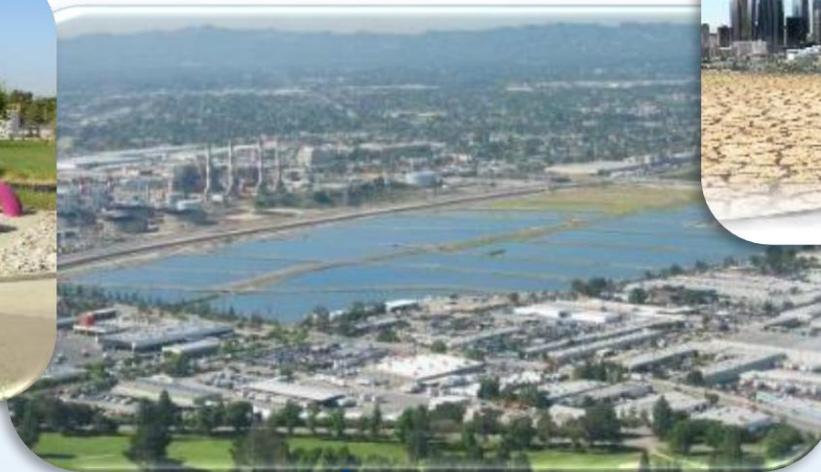
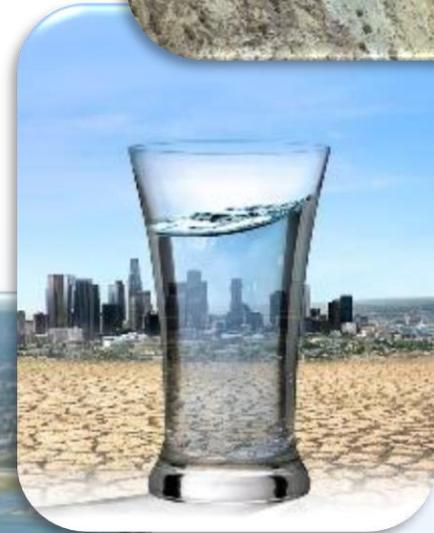
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists/intensifies
- Drought remains but improves
- Drought removal likely
- Drought development likely



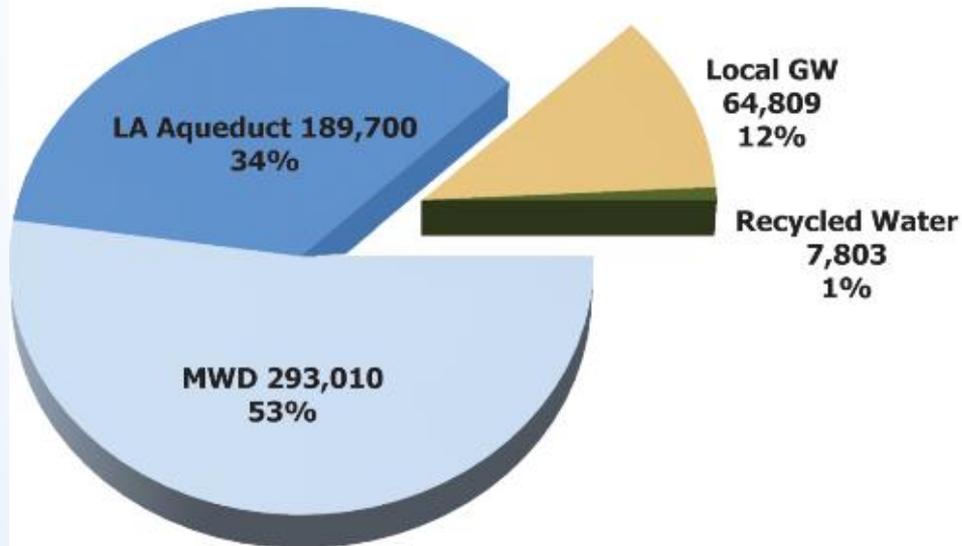
<http://go.usa.gov/3eZ73>

- Increase Water Conservation
- Increase Recycled Water Usage
- Clean-up the Local Groundwater Basins
- Increase Stormwater Capture



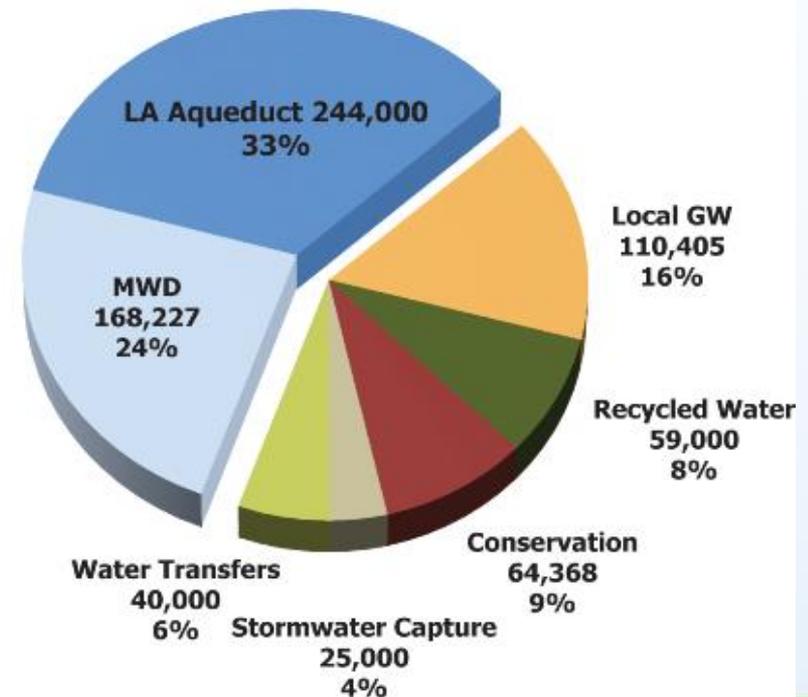
Today

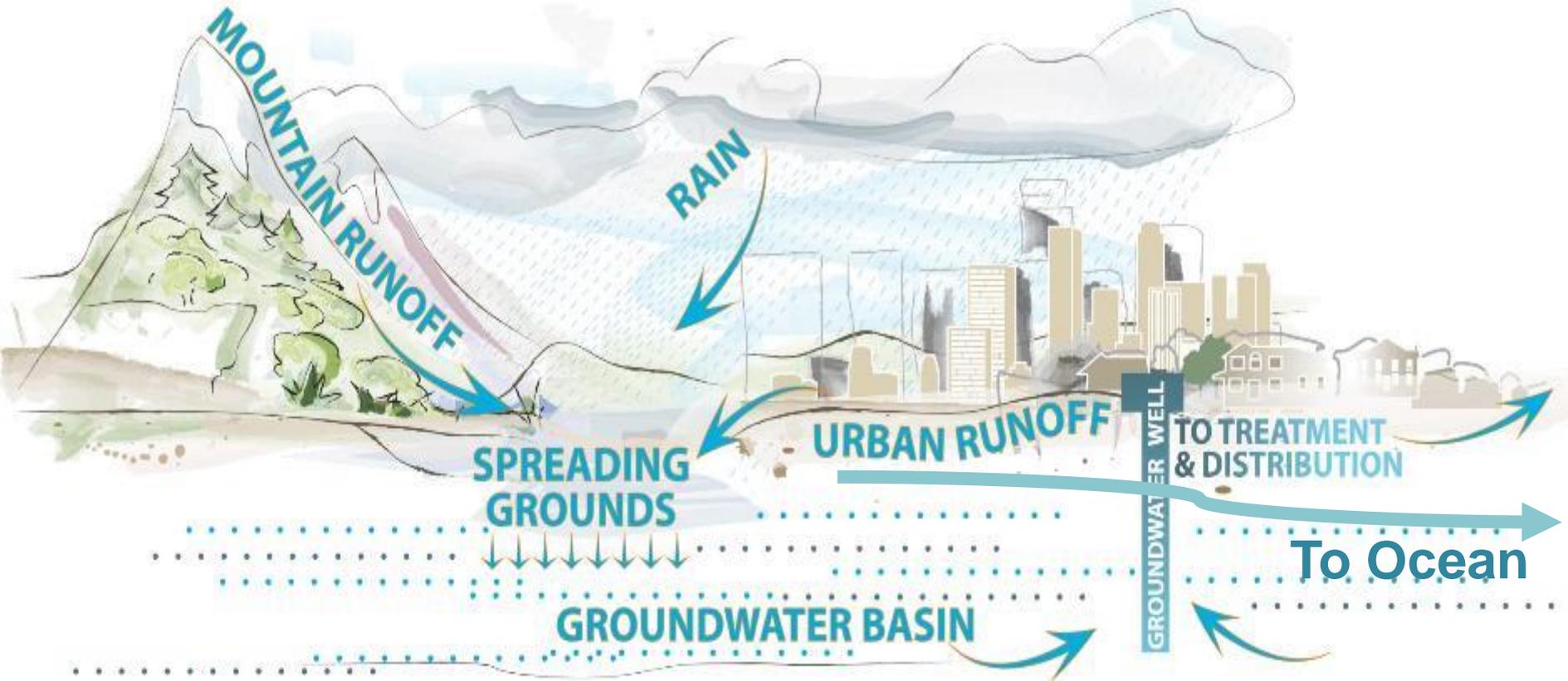
FYE 2010 - 2014 Average
Total: 553,876 AFY



Future

Fiscal Year 2034 - 35
Total: 711,000 AFY

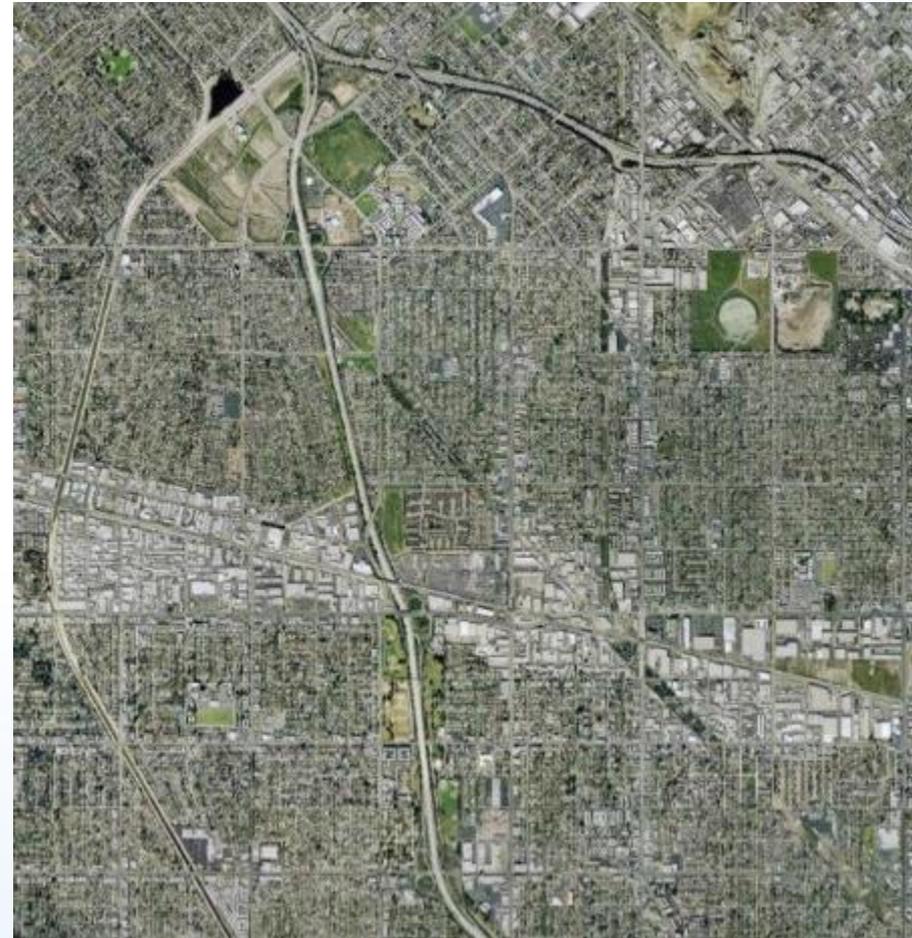




Why we need to take action



**Eastern San Fernando Valley
1949**



**Eastern San Fernando Valley
2008**

WATER & DROUGHT

OCTOBER 25, 2015

South state storms show no easy remedies for California drought



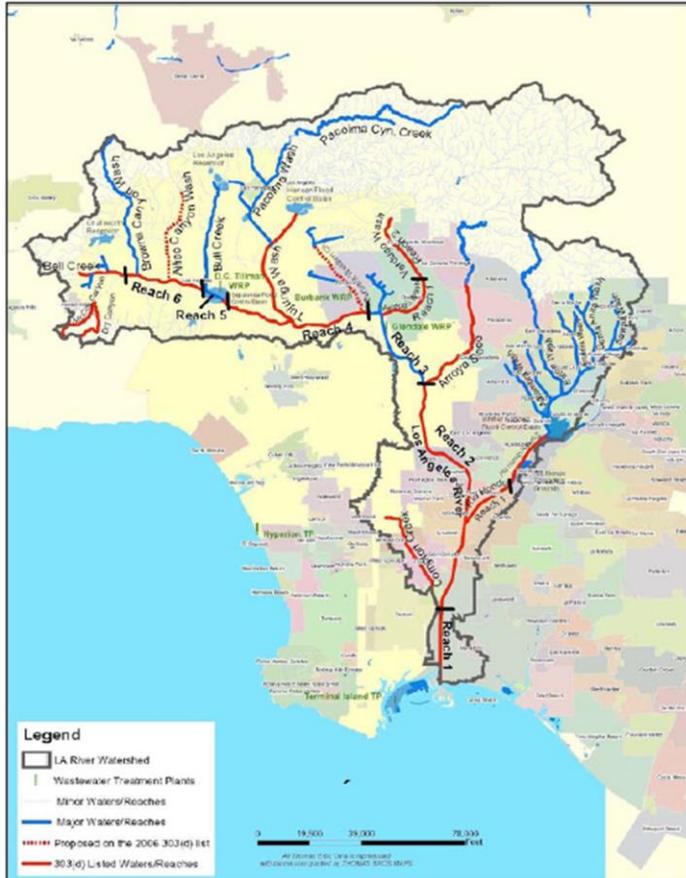
HIGHLIGHTS

Mudslides, floods but little drought relief

El Niño stays south, where water storage is lacking

Snow in Sierra Nevada needed for long-term recovery

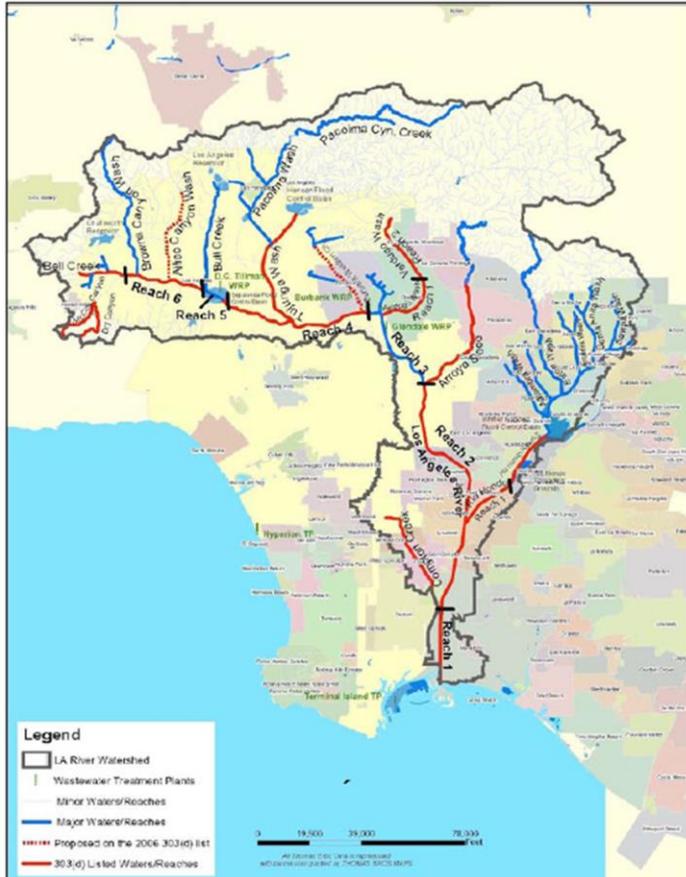
Wet Weather



Flow Volume (acre feet per year)			
Reach ID	Average Annual	Wettest Year (2005)	Driest Year (2007)
Reach 6	44,061	117,115	9,202
Reach 5	66,444	178,209	14,942
Reach 4	147,636	517,631	26,181
Reach 3	202,955	709,974	34,758
Reach 2	274,217	939,492	48,095
Reach 1	278,814	951,673	48,887

1. flows do not include point source discharges or dry weather runoff
2. water year runs from Oct 1 - Sep 30

Wet Weather



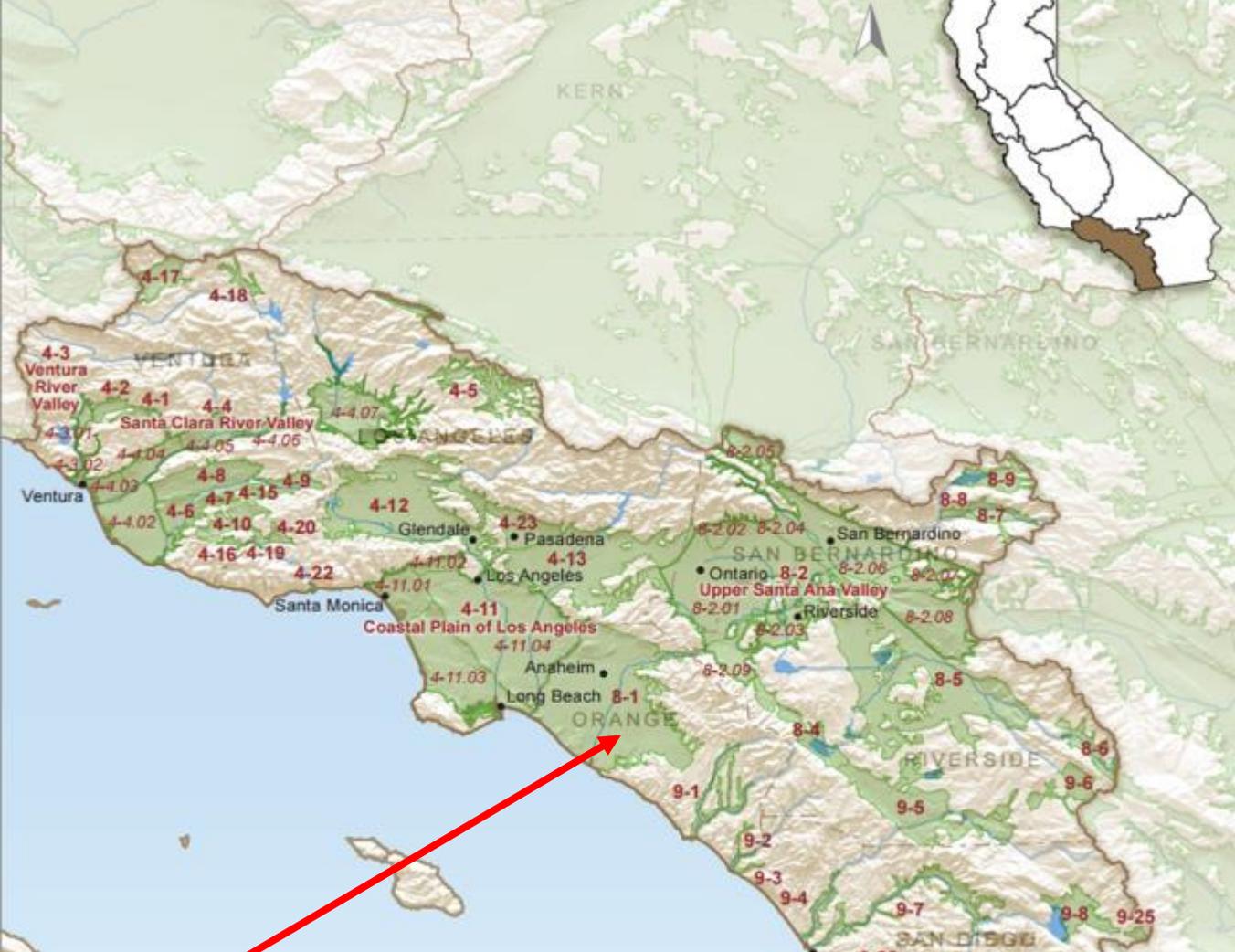
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Alluvial Groundwater Basins and Subbasins within the South Coast Hydrologic Region

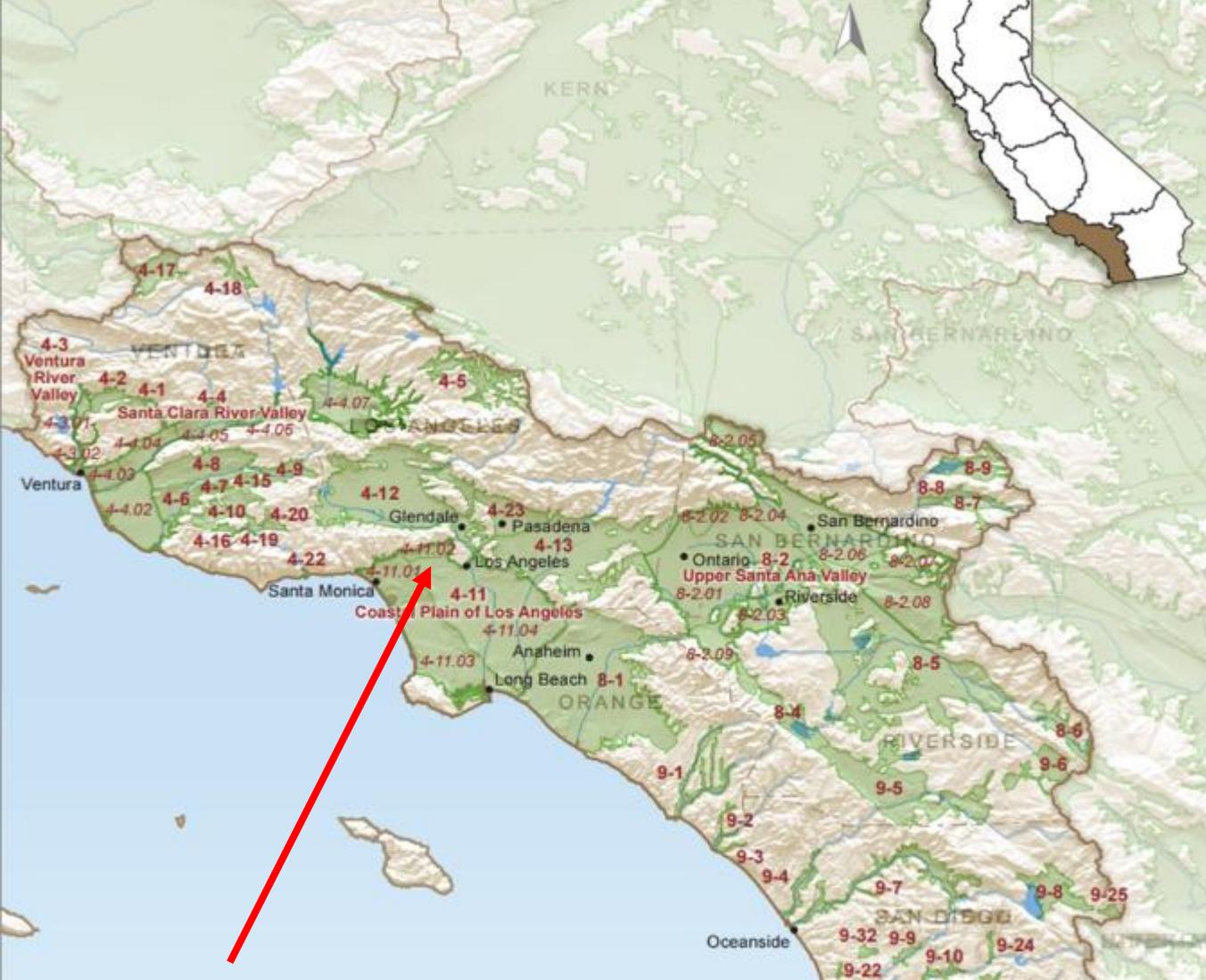


Alluvial Groundwater Basins and Subbasins within the South Coast Hydrologic Region



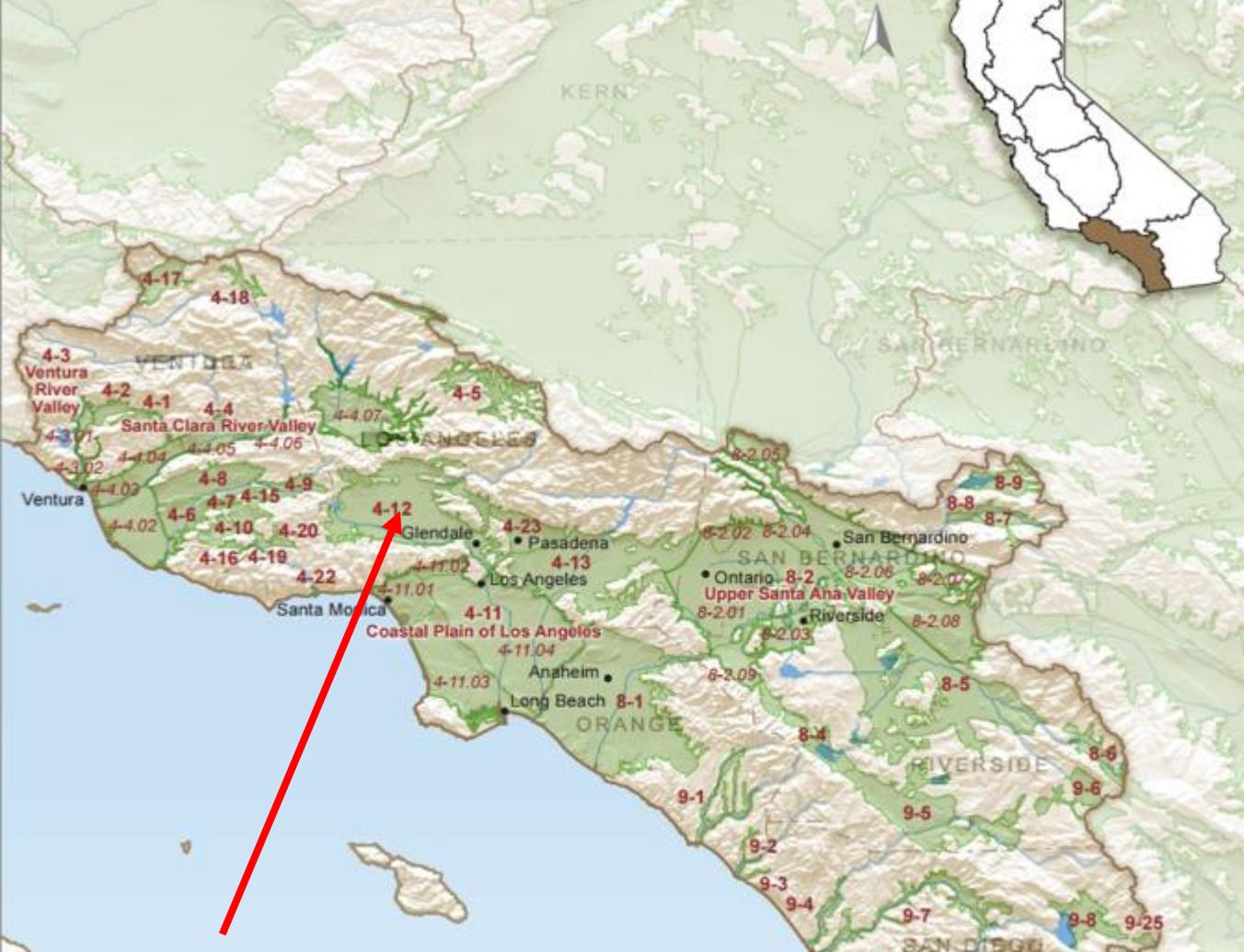
Groundwater Basin	Status	Available Storage Capacity	Recharge Routes
Coastal Orange County	Unadjudicated	>300,000 AF	Percolation, Artificial Recharge, Injection, Applied Water

Alluvial Groundwater Basins and Subbasins within the South Coast Hydrologic Region



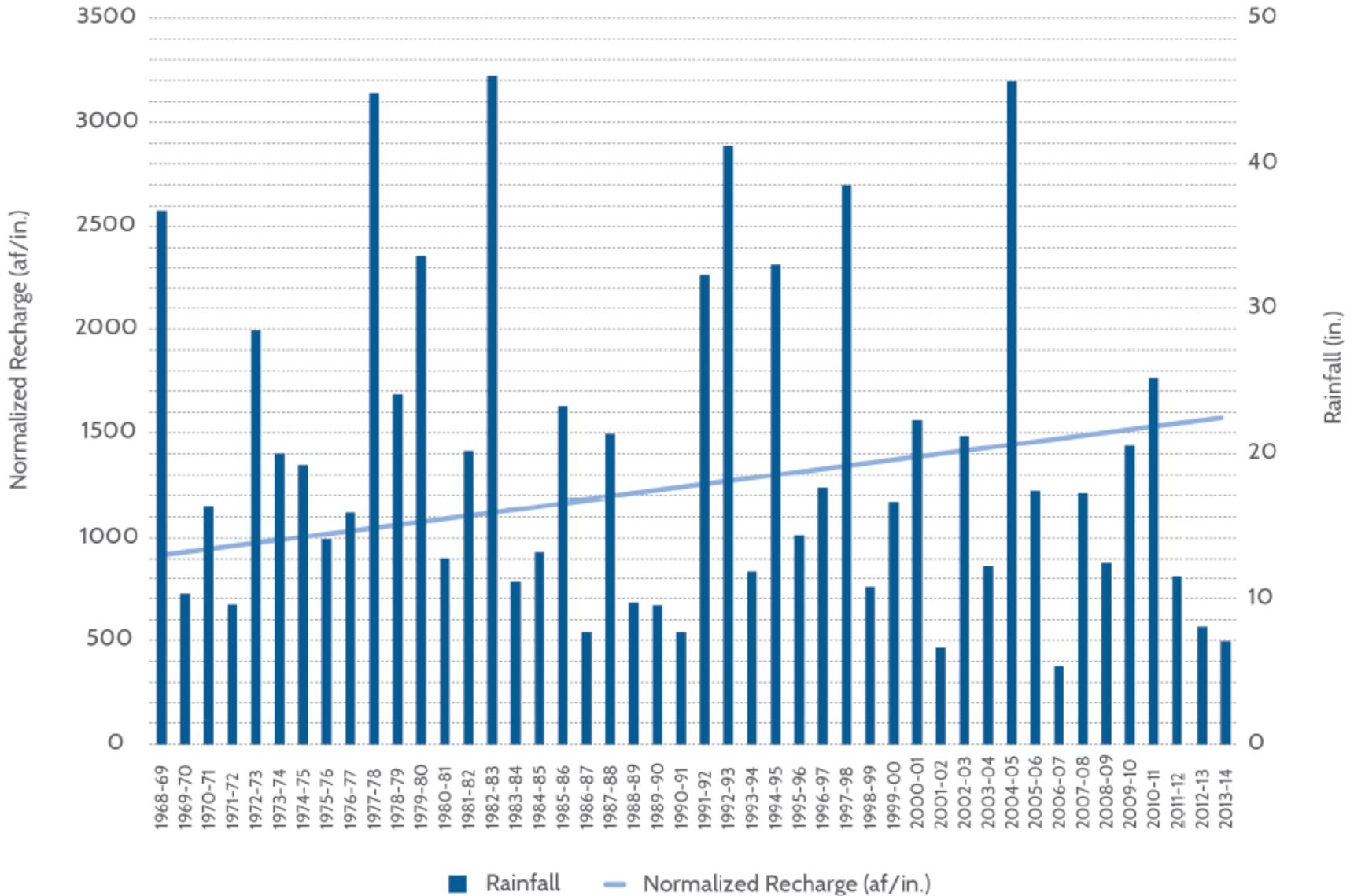
Groundwater Basin	Status	Available Storage Capacity	Recharge Routes
Hollywood Basin	Unadjudicated	~10,000 AF?	Percolation

Alluvial Groundwater Basins and Subbasins within the South Coast Hydrologic Region



Groundwater Basin	Status	Available Storage Capacity	Recharge Routes
San Fernando Basin	Adjudicated	> 500,000 AF	Percolation, Artificial Recharge, Applied Water

Increased Recharge Efficiencies



Dam Improvements



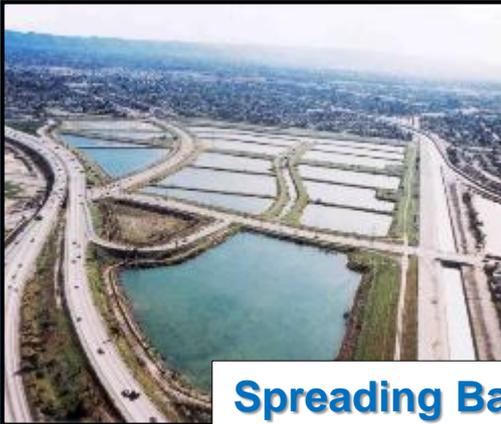
Sub-Regional



Centralized ←

CAPTURE

→ Distributed



Spreading Basins

Parkway Basins



Rain Barrels





What is the Master Plan?

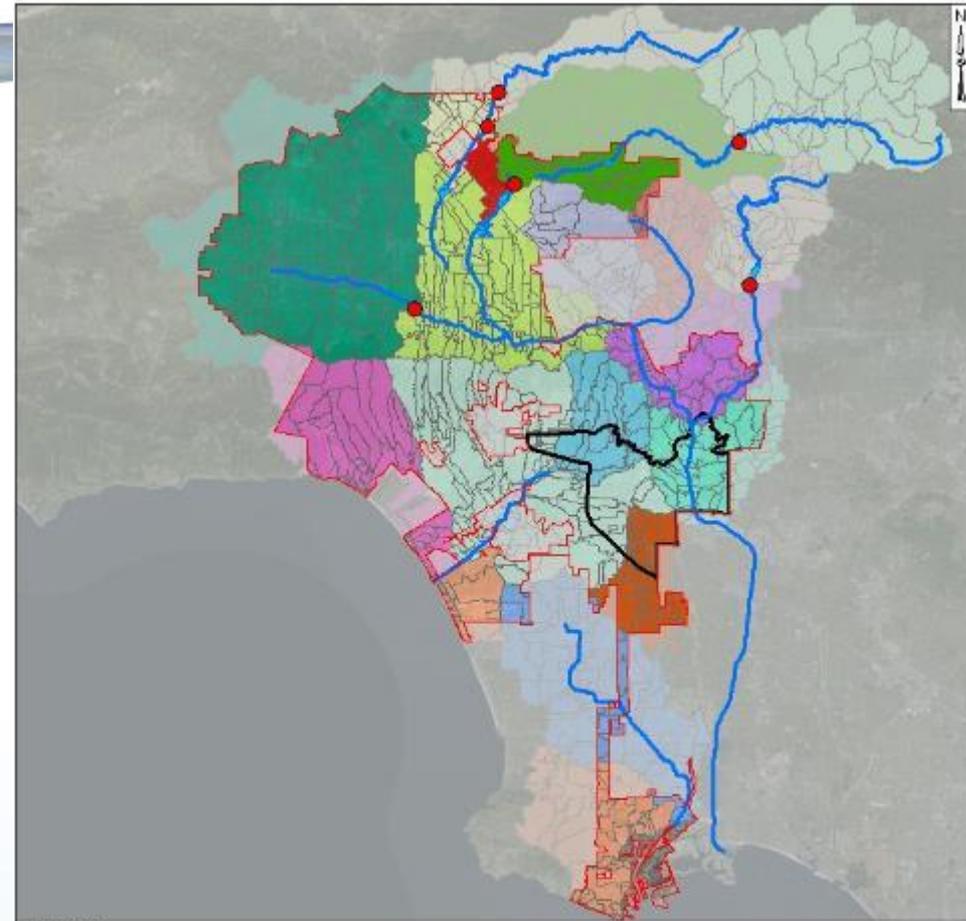
- Technically sound and defensible plan to guide LADWP's stormwater investments over the next 20 years

Goals of the Master Plan

- Quantify stormwater capture potential through a flexible scenario-based program
- Identify new projects, programs, and policies
- Prioritize based on water supply criteria
- Develop cost/benefits for proposed projects/programs/policies

Study area divided into 1001 subbasins grouped into 17 subwatersheds by:

- Major watersheds
- Centralized facilities
- River networks
- Aquifer boundaries



Legend

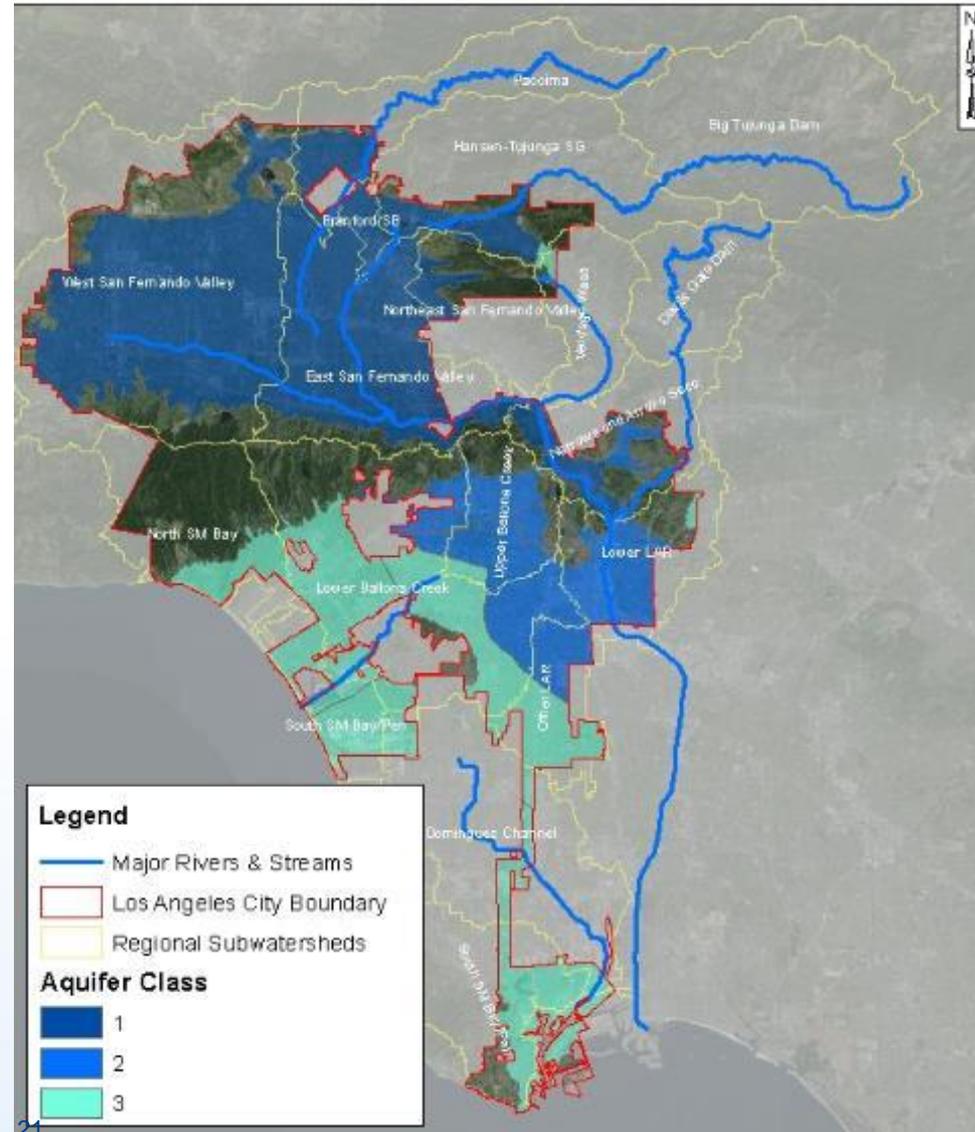
Dams	Lower LA River	Brantford SB
Major Rivers & Streams	Other LA River	Devil's Gate Dam
Spreading Grounds	Upper Ballona Creek	Big Tujunga Dam
Los Angeles City Boundary	Lower Ballona Creek	Hansen Tujunga SG
Los Angeles Forebay	Narrows and Arroyo Seco	West San Fernando Valley
North SM Bay	East San Fernando Valley	Pacoima SG
South SM Bay and Peninsula	Northeast San Fernando Valley	
Dominguez Channel	Verdugo Wash	

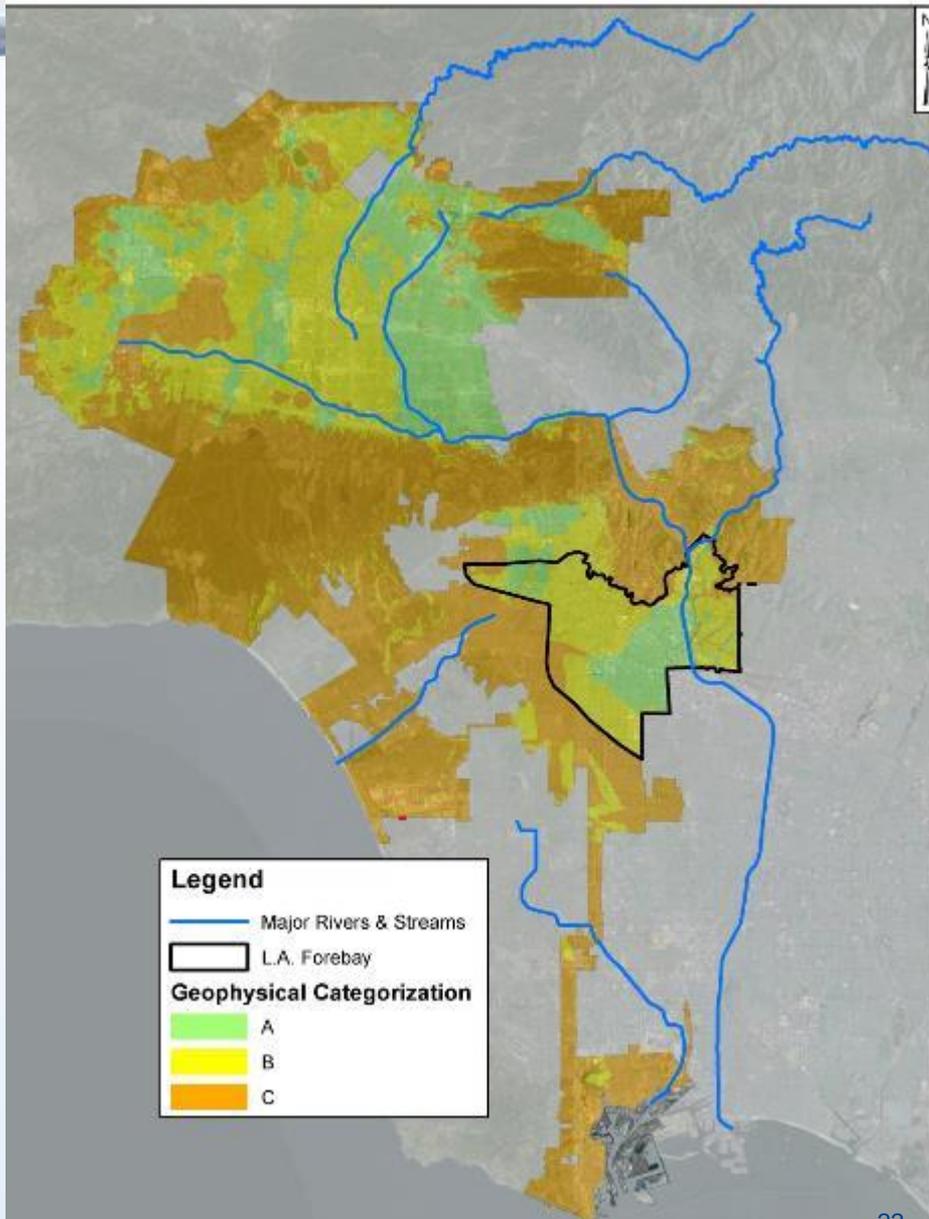
Groundwater Basins

- San Fernando Basin
- Hollywood Basin
- Santa Monica Basin
- Central Basin
- West Coast Basin

Aquifer Classes

- Class 1: City controlled
- Class 2: Regionally controlled
- Class 3: Perched





CATEGORY A

- Least hydrogeologically constrained
- Highest priority aquifers
- Conducive to infiltration BMPs

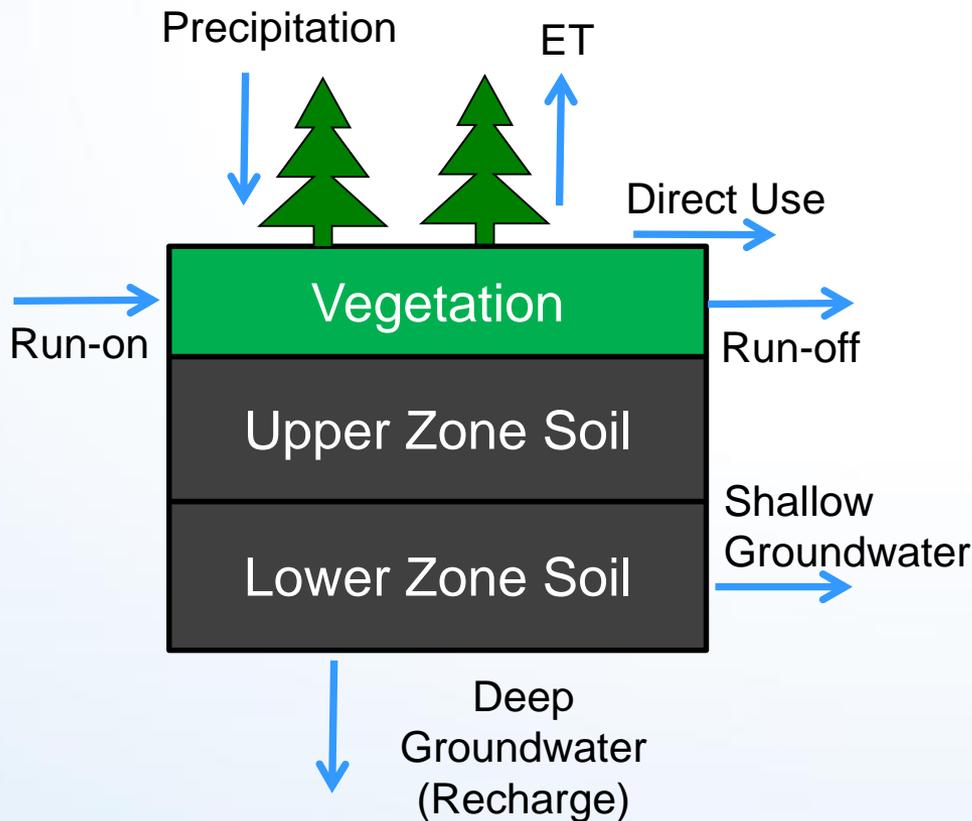
CATEGORY B

- Somewhat hydrogeologically constrained
- Mid level priority aquifers
- Conducive to infiltration BMPs

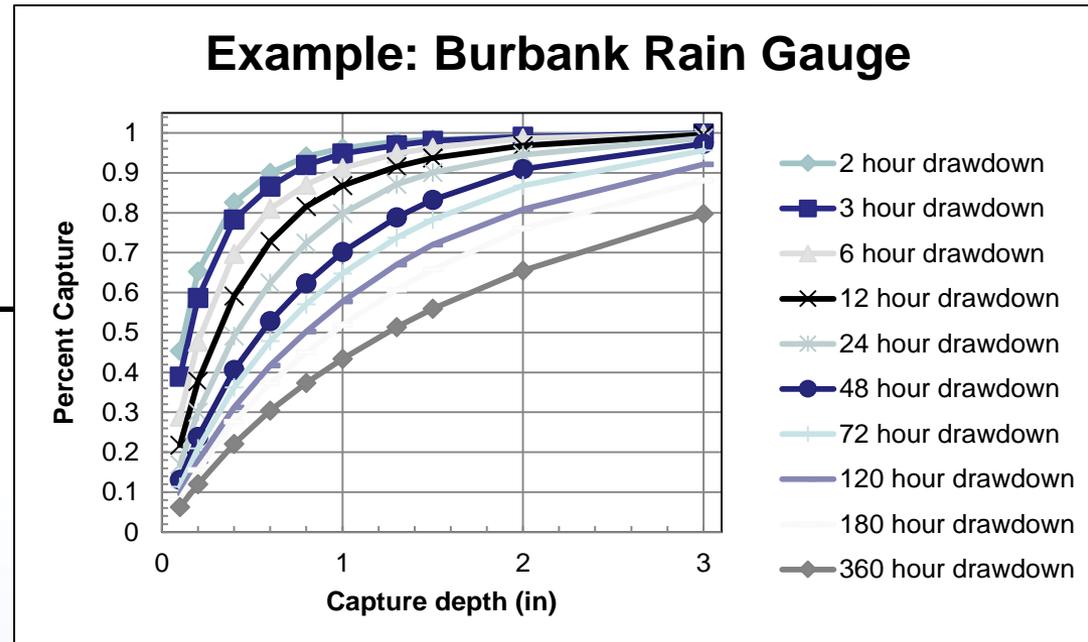
CATEGORY C

- Most hydrogeologically constrained
- Lower priority aquifers
- More advantageous for direct use BMPs

Step 1: Hydrology modeling of existing condition. (LSPC/GWAM)



Step 2: Modeling of unit BMPs to develop nomographs. (LSPC)



Precip / ET (71 gages)



Runoff



1 acre-impervious area

Generic BMP
(10 capture depths,
10 drawdown times)



Overflow

Capture (recharge / direct use)



Modeling Process

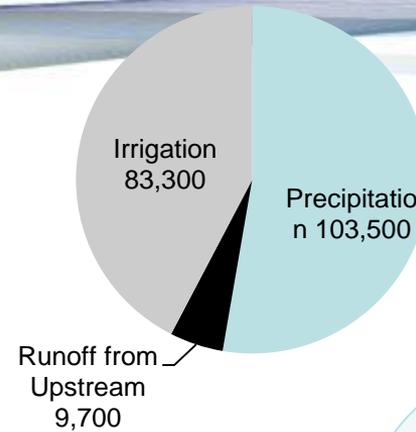
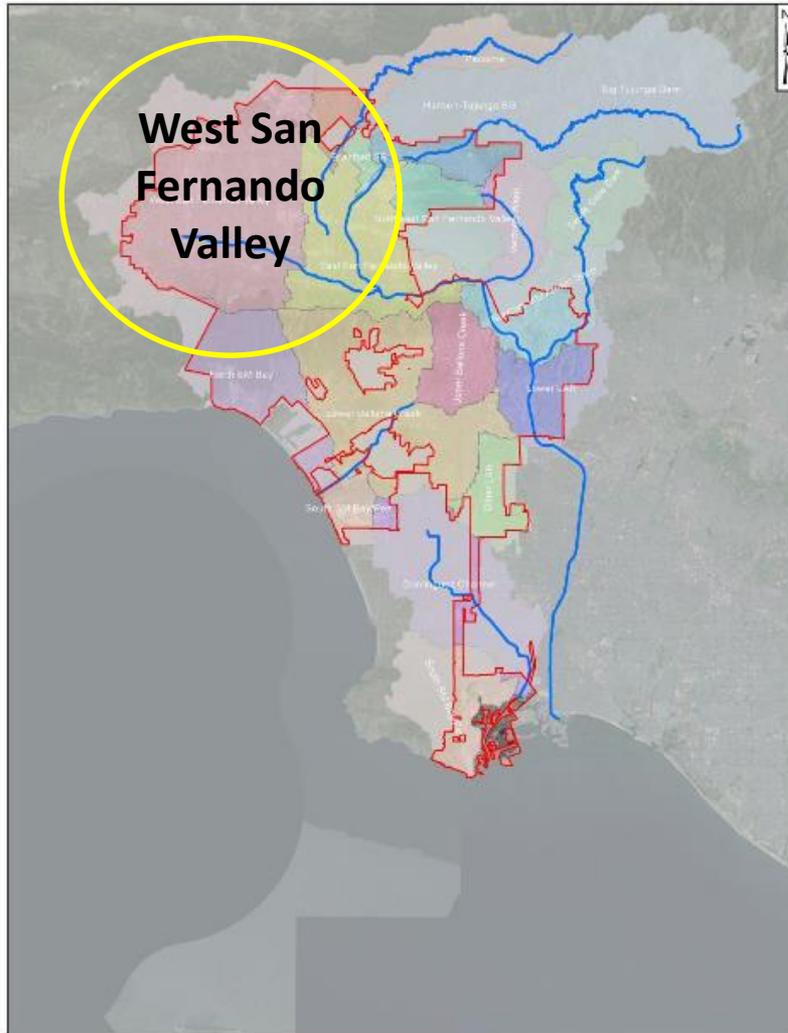
Step 3: Project and program development, application throughout City, and quantification of capture

Centralized Facilities

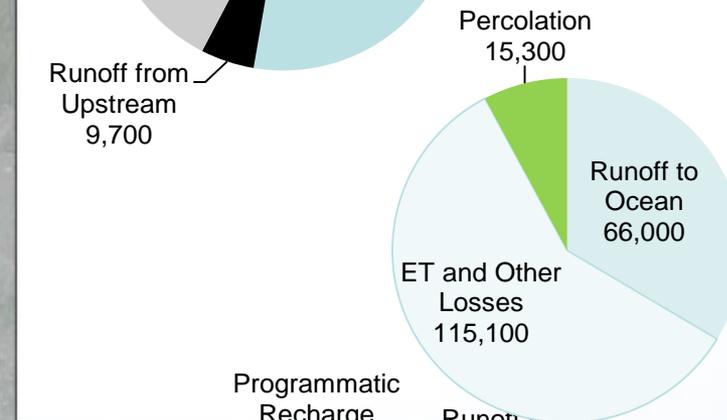


Distributed Programs

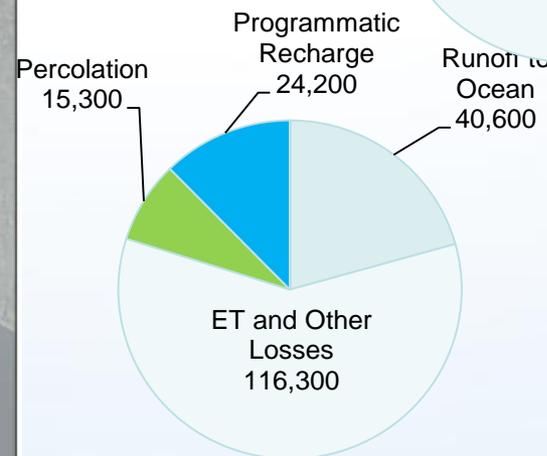
Program	Examples
On-site Infiltration	Residential Rain Garden Program
Green Streets	Commercial Green Street Program
Subregional Infiltration	Neighborhood Recharge Facility Program
On-site Direct Use	Residential or Commercial Cistern Program
Subregional Direct Use	Distributed Reservoir Program
Impervious Replacement	Impervious Surface Replacement Program



**Inputs
(af/yr)**

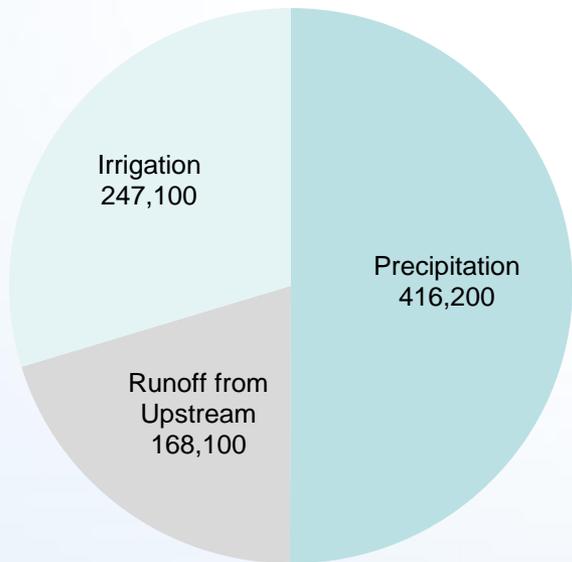


**2015
Output
(af/yr)**

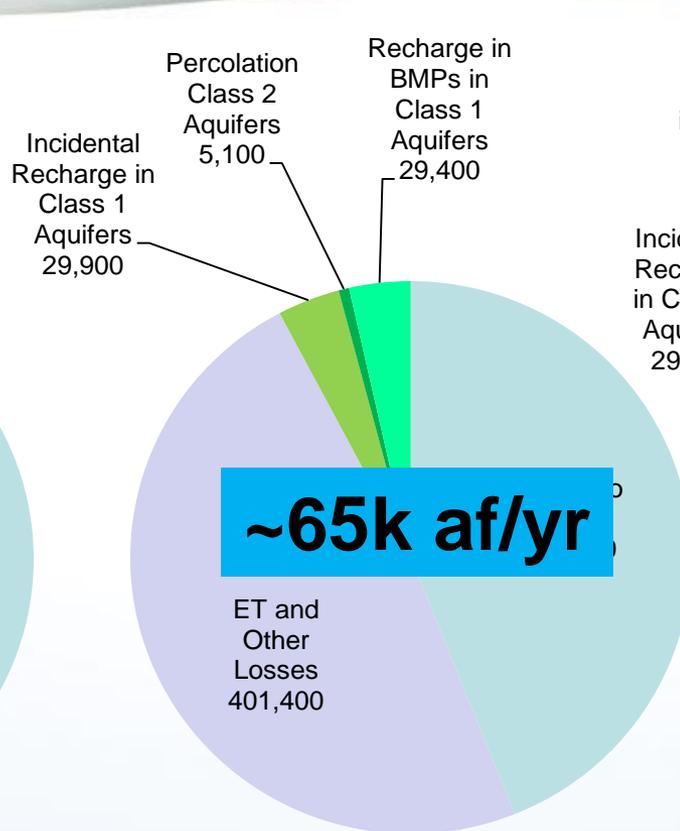


**2035
Output
(af/yr)**

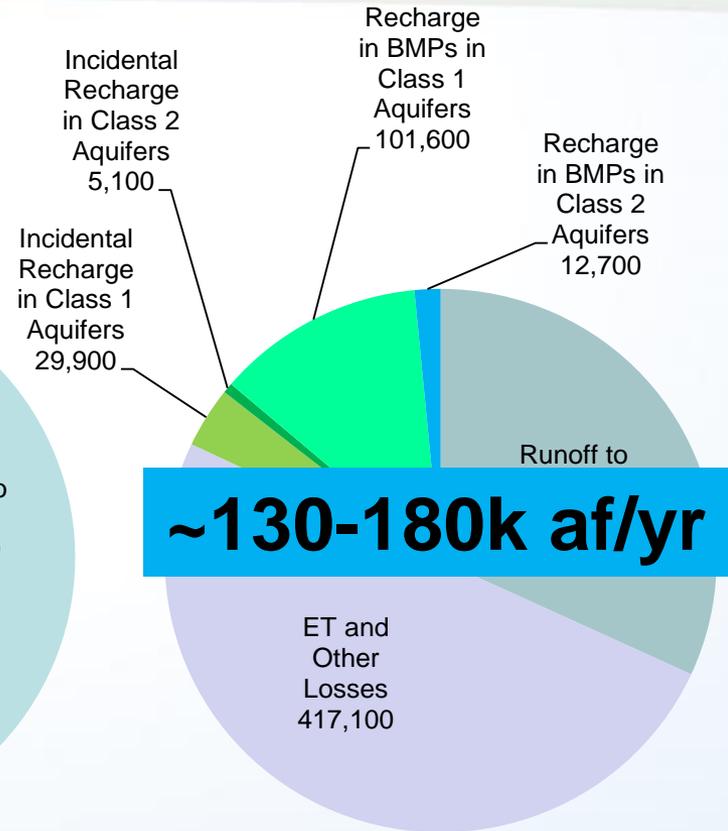
Results (City Wide)



Input
(af/yr)

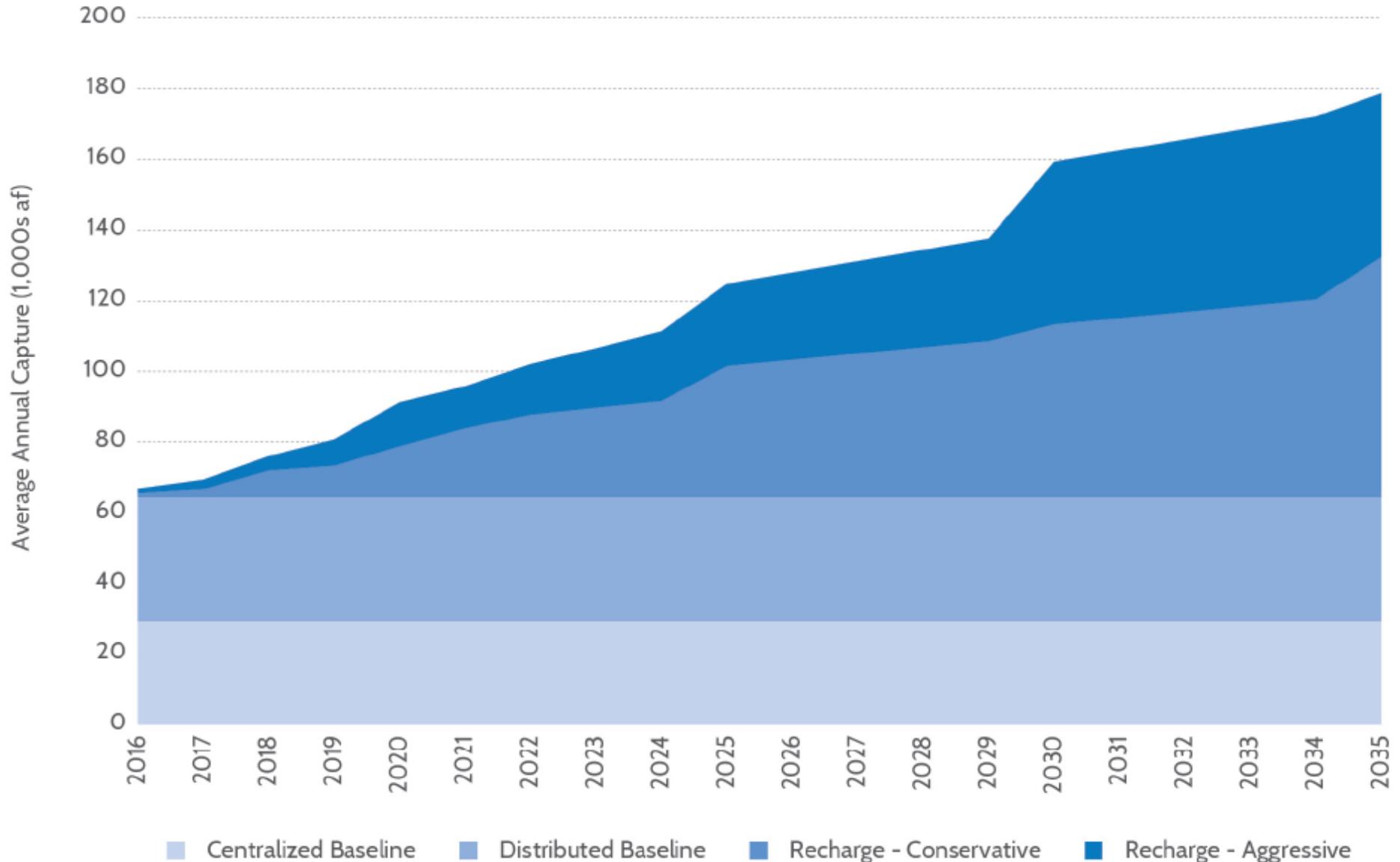


Existing Output
(af/yr)

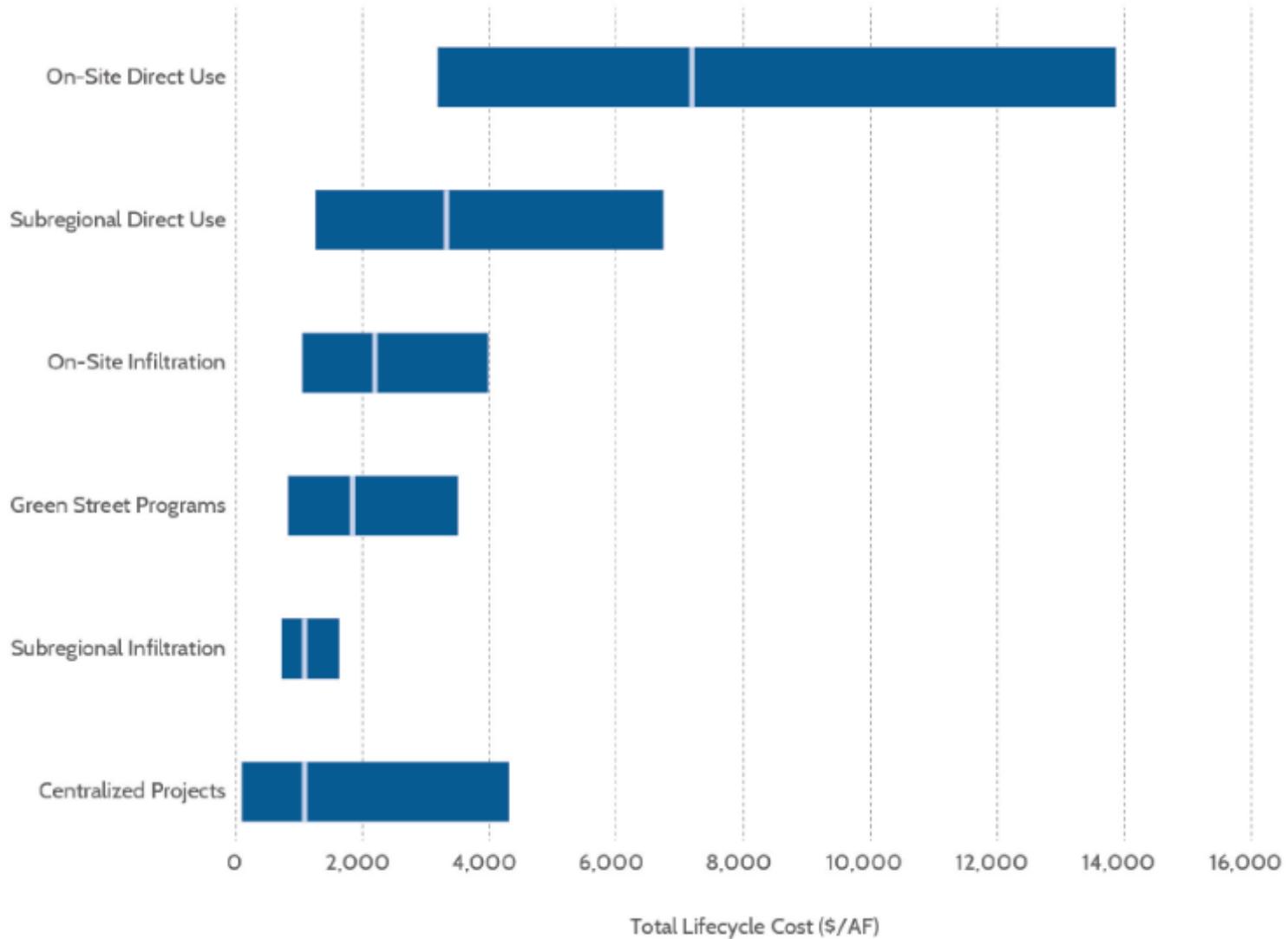


2035 Output
(af/yr)

Water Supply Benefits Over Time

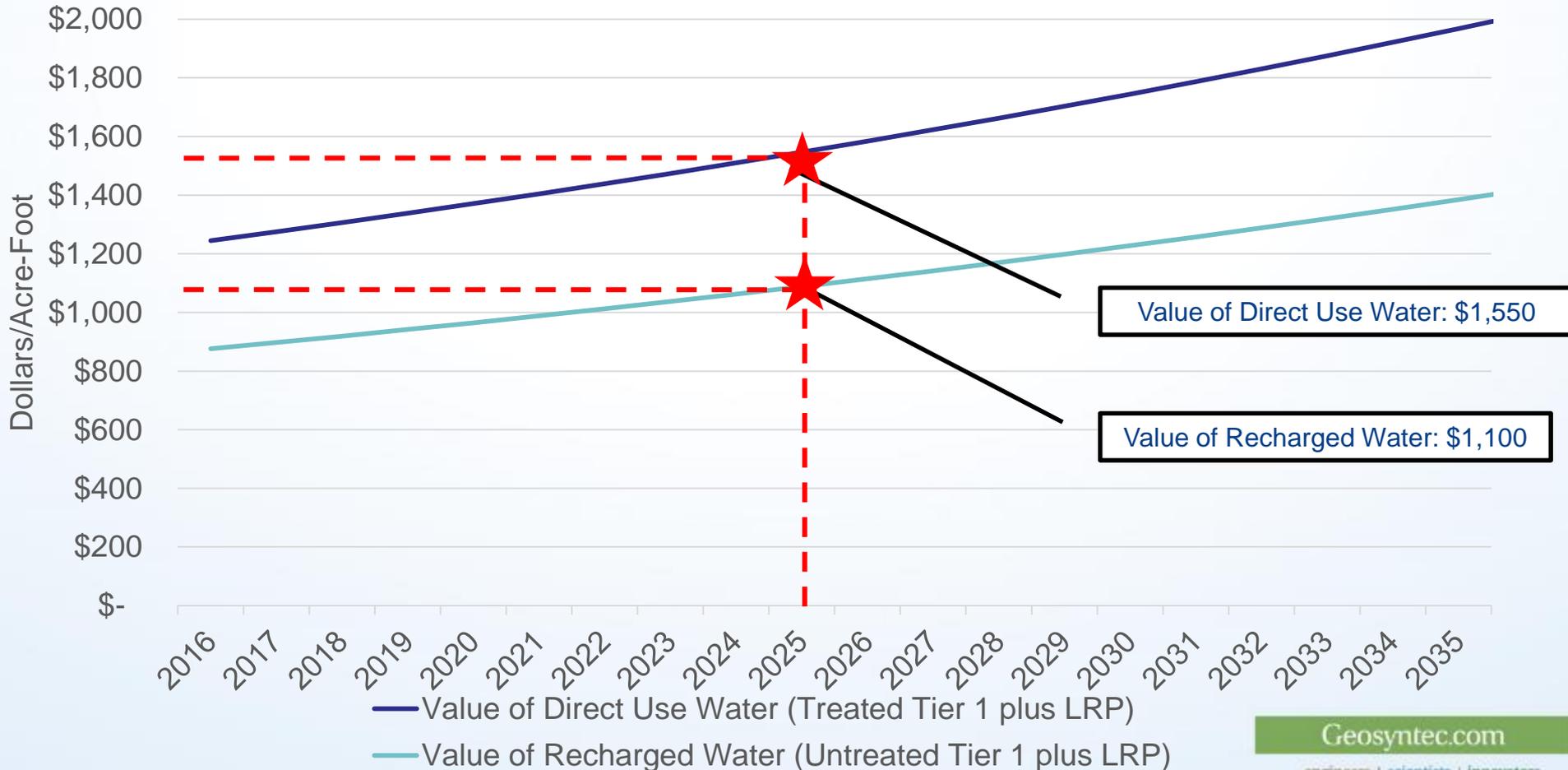


Program Cost Effectiveness

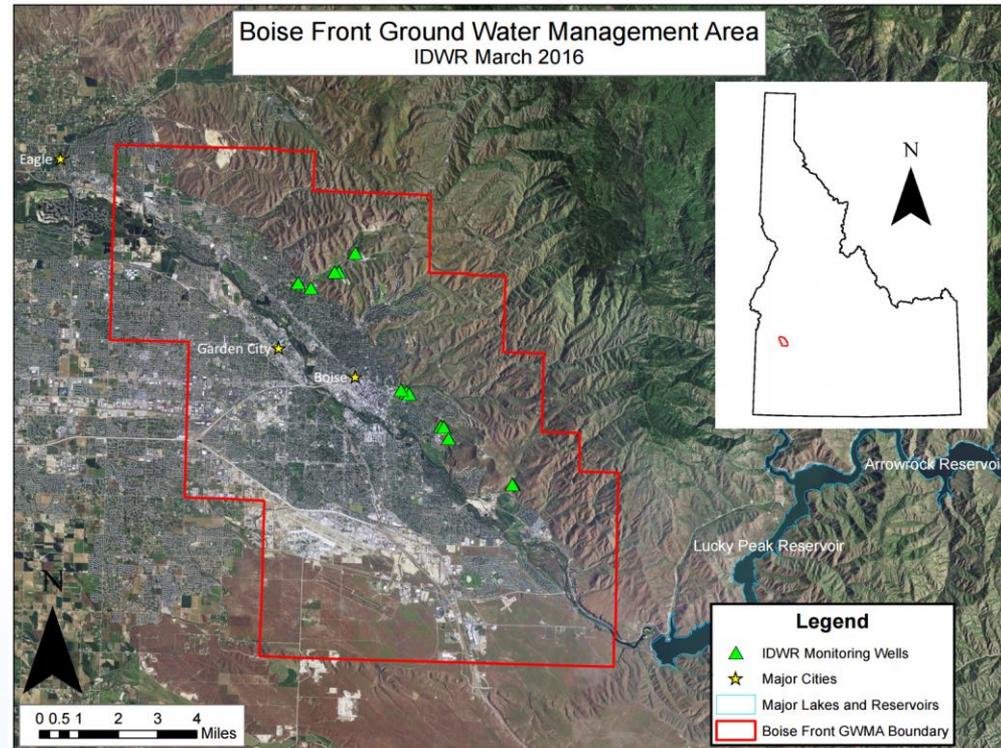


Implementation Strategies – Value of Captured Water to LADWP

Projected Cost of MWD Water

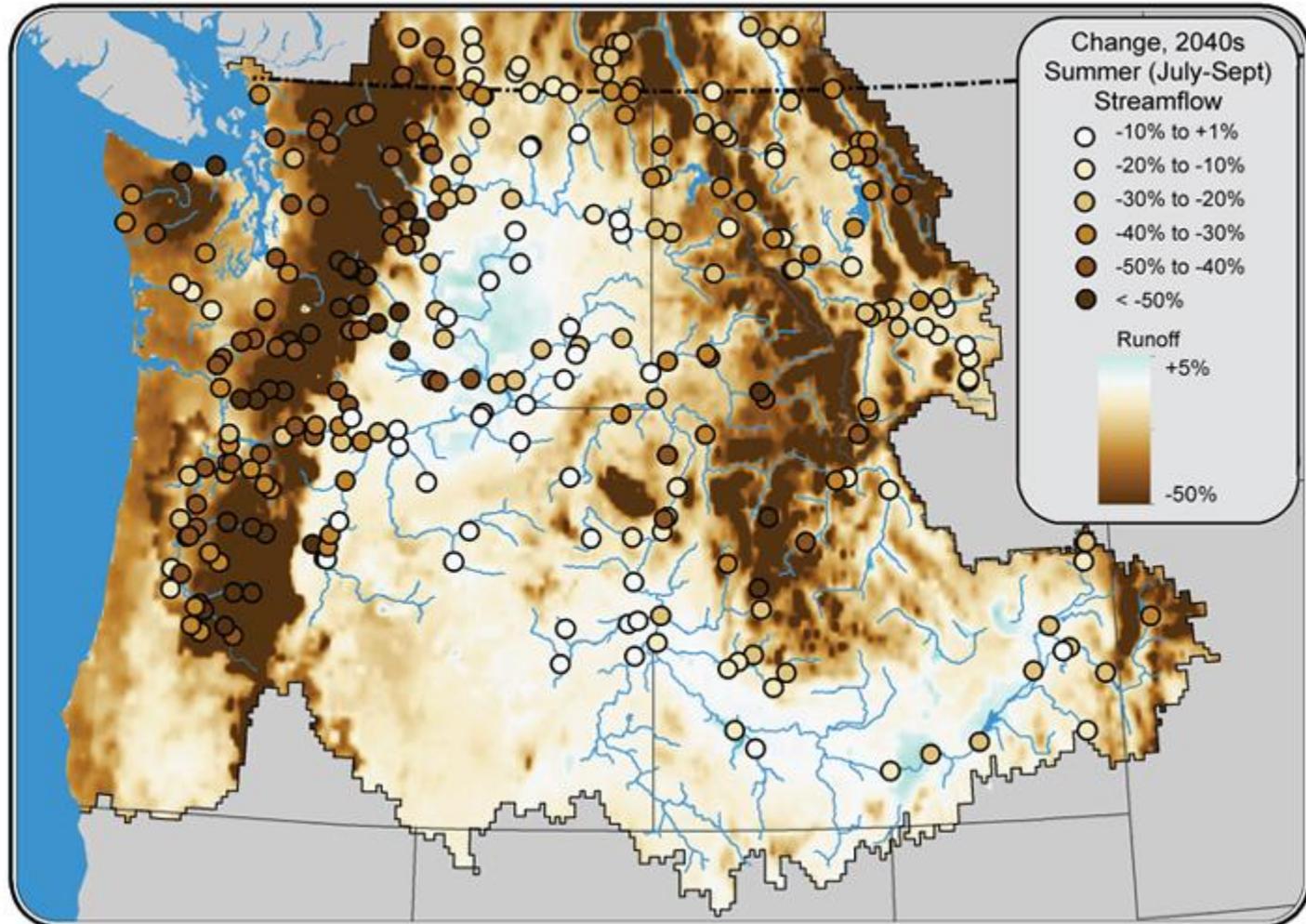


- Water supply through groundwater augmentation
- Water conservation through direct use programs
- Improved flood risk management
- Enhanced water quality
- Peak flow reductions
- Open space creation/preservation



- Purveyor-led projects and programs
 - Centralized and subregional facilities specifically for water supply
- Purveyor-coordinated (with other agencies)
 - Multi-benefit approaches to stormwater management
- Property owner implementation
 - Require LID (and incentivize voluntary actions)

Reduced Summer Flows



- Stormwater capture master planning for water supply can help guide other policies and investments being made.
- The development of technically sound and defensible plans requires surface water and groundwater modeling, and a comprehensive understanding of future conditions
- In Los Angeles, the current value of water delivered to the City is ~\$800 per acre-foot with a premium of ~\$300 for locally controlled water

- https://www.ladwp.com/ladwp/face/s/ladwp/aboutus/a-water/a-w-sourcesofsupply/a-w-sos-stormwatercapture?_adf.ctrl-state=7kadrrnkq_29&_afrLoop=119111353319321



Residential Customers

- [Pay bill](#)
- [Transfer Service](#)
- [Rebates](#)
- [Start new service](#)
- [View more](#)

Commercial Customers

- [Pay bill](#)
- [Transfer Service](#)
- [Rebates](#)
- [Start new service](#)
- [View more](#)

Partners Business to Business

- [Economic development](#)
- [Become a vendor](#)
- [New construction](#)
- [Real estate](#)
- [View more](#)

My Account

Username

Password

Remember me

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[Login/Website Issues?](#)

Current Topics

OUR NEW RATES 2016-2020

[Save the Drop](#)
[Class Action Settlement](#)
[More Current Topics](#)

Upcoming Events

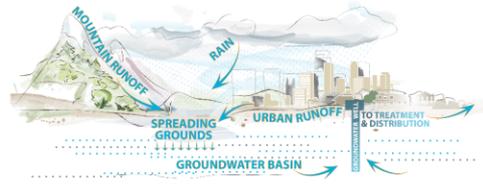
Stormwater Capture

Background
 LADWP is working to reduce our reliance on higher cost imported water. To do so, the LADWP is pursuing a multi-pronged initiative that includes stormwater capture, water conservation, recycled water, and groundwater reclamation.

Stormwater capture is an important element of the LADWP's overall plan to increase our local water supply. The principle involves capturing precious rainfall and runoff from open space and urban lands for either direct use or allowing the water to infiltrate into groundwater basins for future use.

Each year, on average, more than 27,000 acre-feet (more than 8.8 billion gallons) of stormwater is captured each year at centralized spreading grounds where it recharges the San Fernando Groundwater Basin. Stormwater runoff that cannot be contained at these facilities is discharged to the Pacific Ocean via streams, rivers, and storm drains. LADWP plans to continue implementing stormwater capture projects that decrease the amount of runoff lost to the Pacific Ocean. Projects include large scale spreading grounds enhancements and smaller scale green streets, rain gardens, and rain barrels.

To learn more about how stormwater capture fits into the LADWP's efforts to secure a sustainable water supply for Los Angeles, please view the [2010 Urban Water Management Plan](#).



Contact Us

For more information on the Stormwater Capture Program, please fill out our [Contact Us Form](#).

Stormwater Capture Master Plan

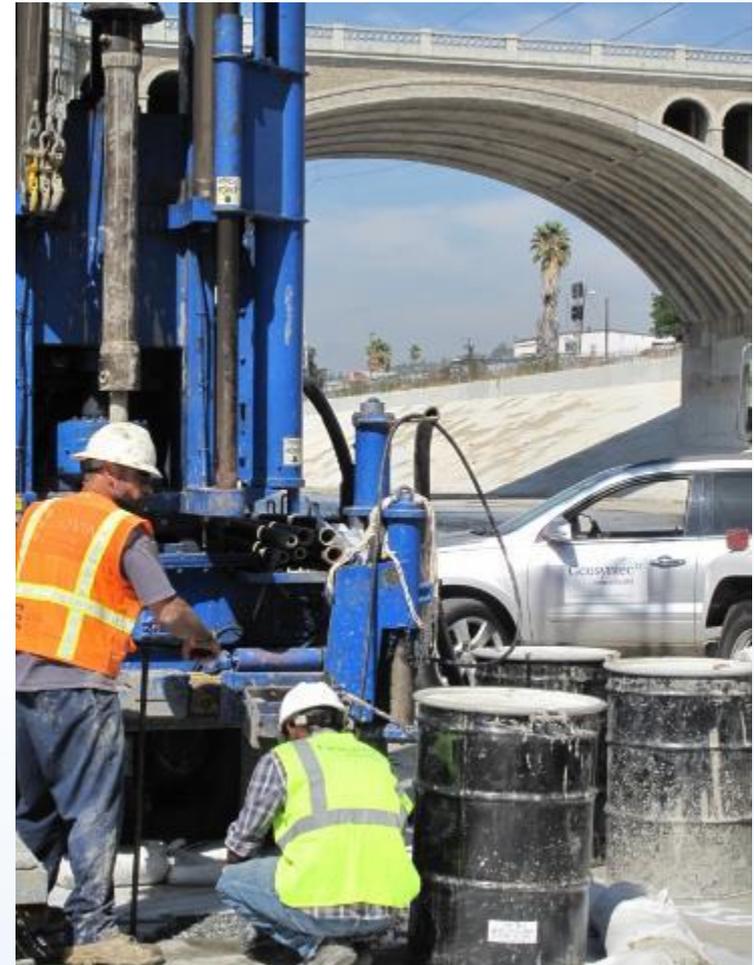
LADWP has completed its Stormwater Capture Master Plan. [Learn more about the Stormwater Capture Master Plan](#).

Final Documents

- [Stormwater Capture Master Plan Final Report](#)
- [Stormwater Capture Master Plan Appendices](#)
- [Stormwater Capture Master Plan Fact Sheet](#)

- [Groundwater Remediation](#)
- [Recycled Water](#)
- [Water Conservation](#)
- [Rates](#)

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- Yakima Basin, WA
 - In the basin, drought conditions lead to curtailed water deliveries to preserve environmental flows. Multiple stakeholders have collaborated to:
 - Evaluate recharge to surficial alluvial aquifers with excess streamflows
 - Evaluate aquifer storage and recovery (ASR) into deeper basalt aquifers
- Nisqually Watershed, WA
 - The community has been evaluating surface and subsurface storage options to retain excess streamflow
- Snohomish County, WA
 - The County has evaluated infiltration of stormwater flows for aquifer storage, including:
 - Investigation of land use effects on aquifer storage and baseflow to streams
 - Delineation of critical aquifer recharge areas
- City of Salem, OR
 - The City developed a municipal aquifer storage and recovery (ASR) well field
 - The ASR wellfield provides 10 million gallons per day capacity in a basalt aquifer.
- City of Issaquah, WA
 - The City has evaluated water quantity and quality impacts from the development of aquifer storage projects.
 - Investigated infiltrating stormwater flows.