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Eng. Abdulrahman bin Abdulmohsen Al Fadhili

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saudi water forum SWF

"Sustainable Water.. for Sustainable Development"



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Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية



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California Water Scarcity and Climate Change

Jeffrey Kightlinger, General Manager
The Metropolitan Water District of Southern California

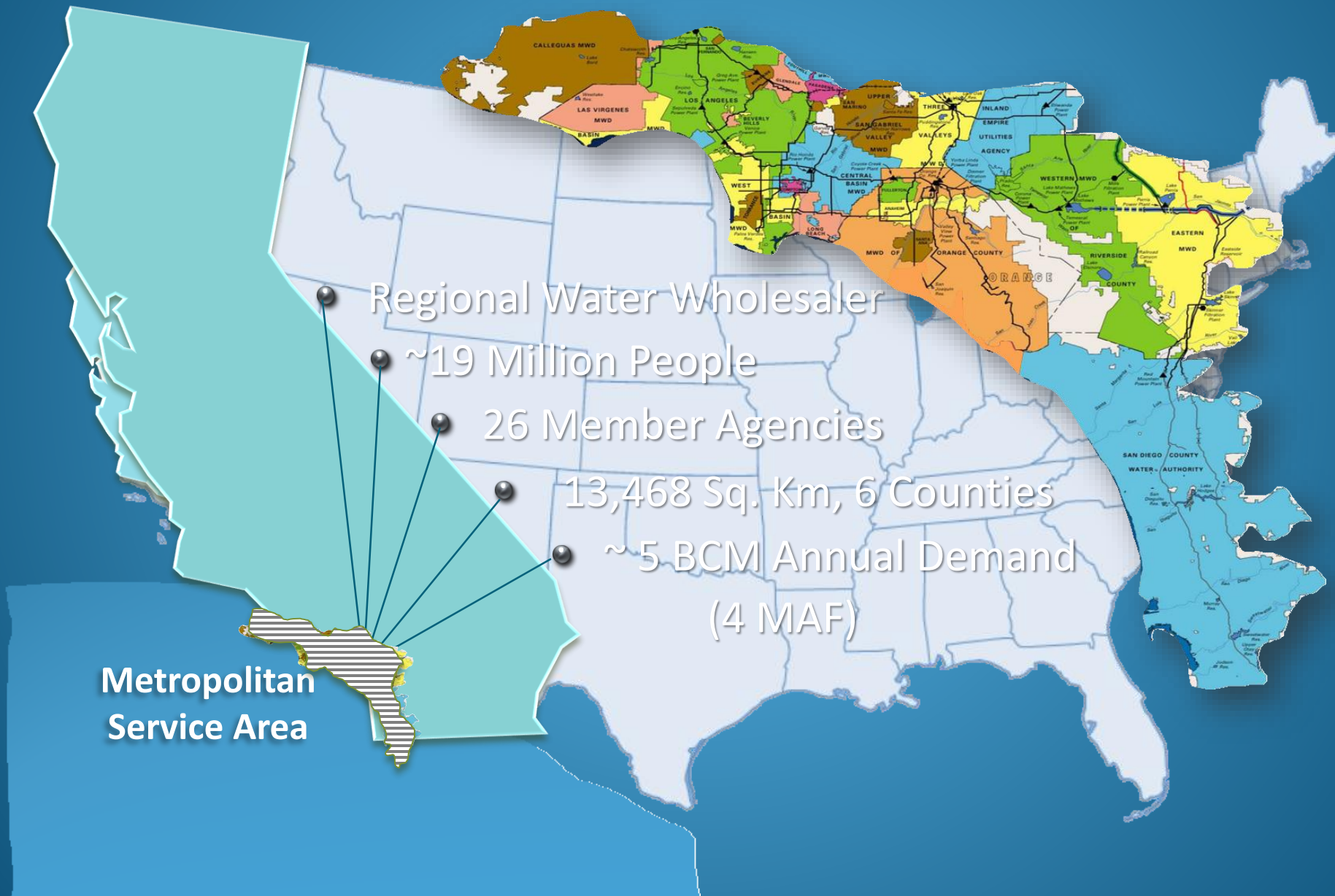
California Water Scarcity and Climate Change



Saudi Water Forum
March 19, 2019

Jeffrey Kightlinger, General Manager
The Metropolitan Water District of Southern California

Metropolitan Water District



Metropolitan's Imported Water Supply

State Water Project

- Conveys water 805 km
- 2,467 MCM (2 MAF) annual contracted amount, subject to availability

Colorado River Aqueduct

- Conveys water 389 km
- 1,542 MCM (1.25 MAF) capacity
- Owned/Operated by Metropolitan



Metropolitan's Key Infrastructure



**10 Reservoirs: 1.3 BCM
(1.07 MAF)**



5 Treatment Plants



**1,336 km of Pipelines / Tunnels
(830 miles)**

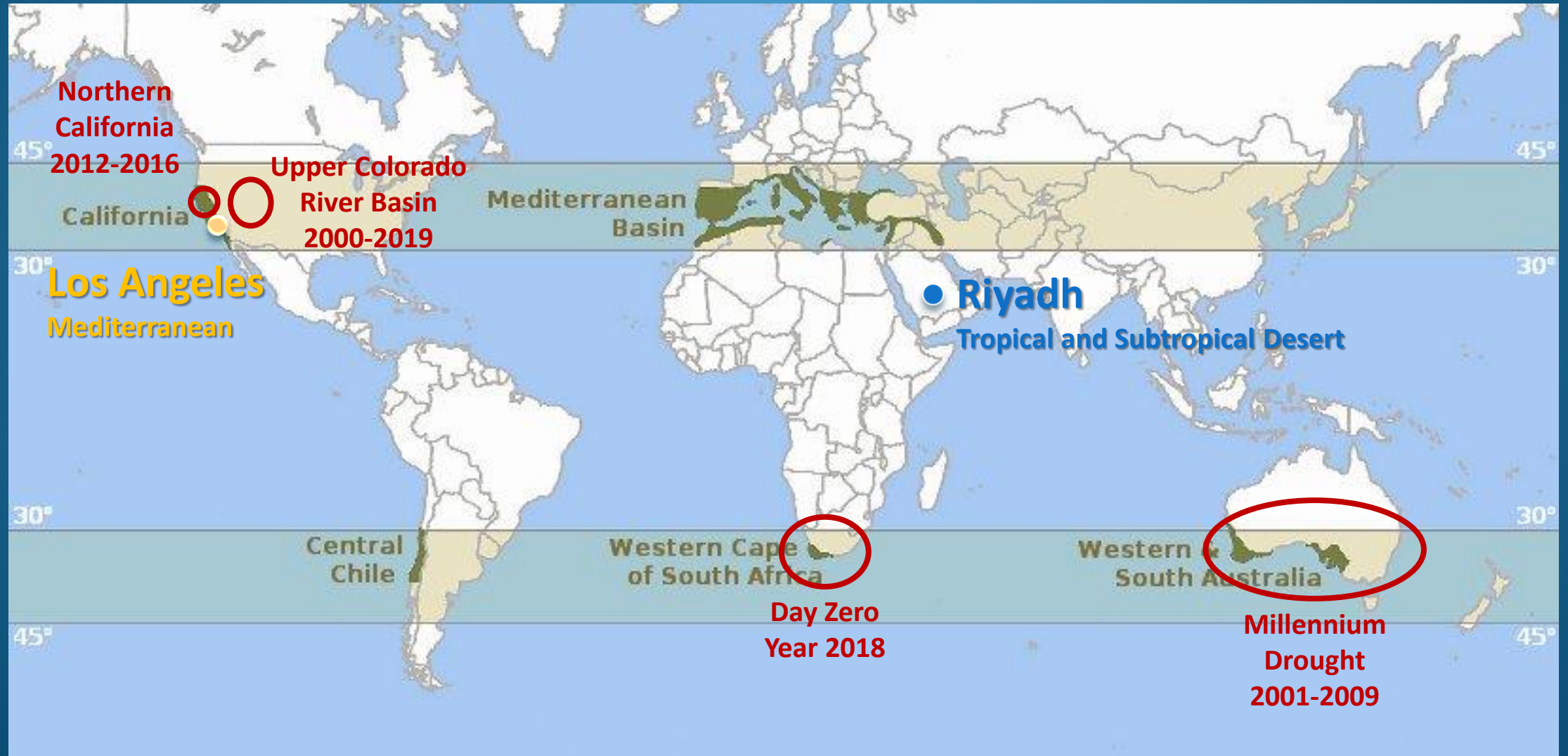


**Colorado River Aqueduct
5 Pump Stations 493 m lift (1,617 ft.)**

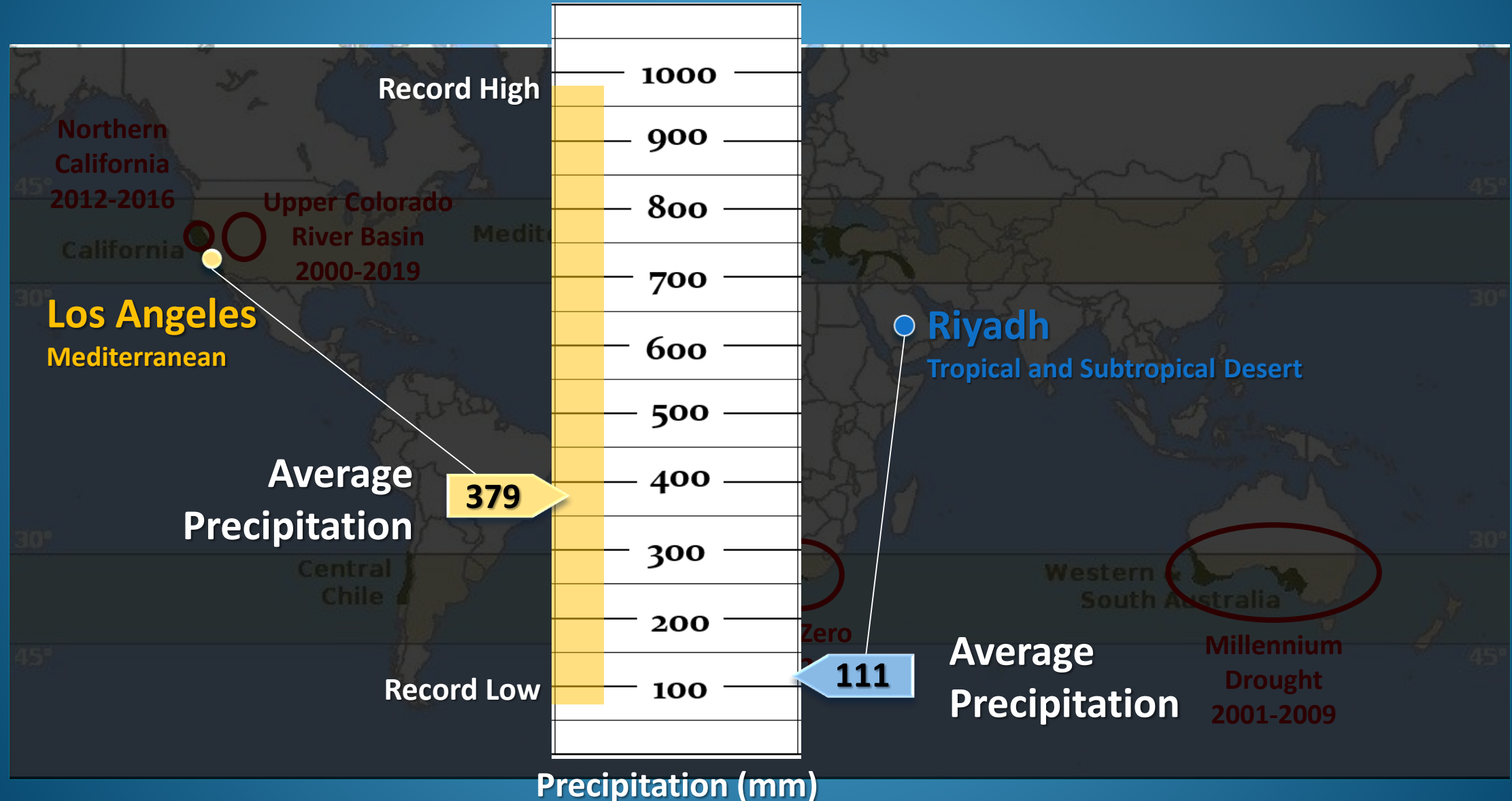


Water Quality Lab

Our Climates are Different, but the Challenges of Water Scarcity are Shared



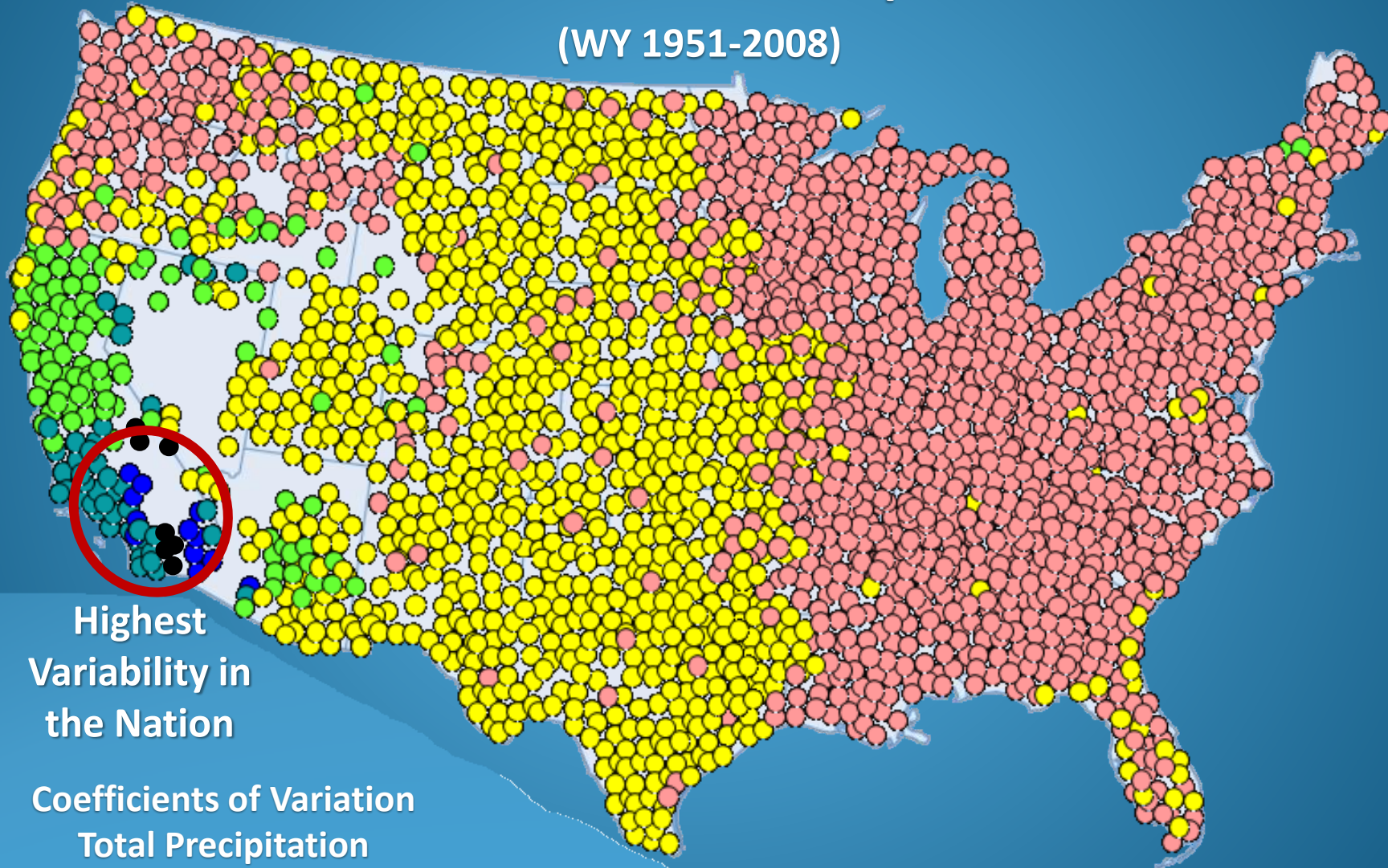
Our Climates are Different, but the Challenges of Water Scarcity are Shared



Existing Challenges: High Volatility

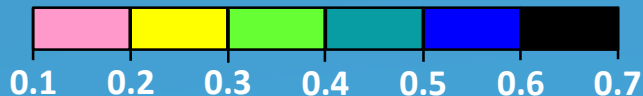
Variation of Total Precipitation

(WY 1951-2008)

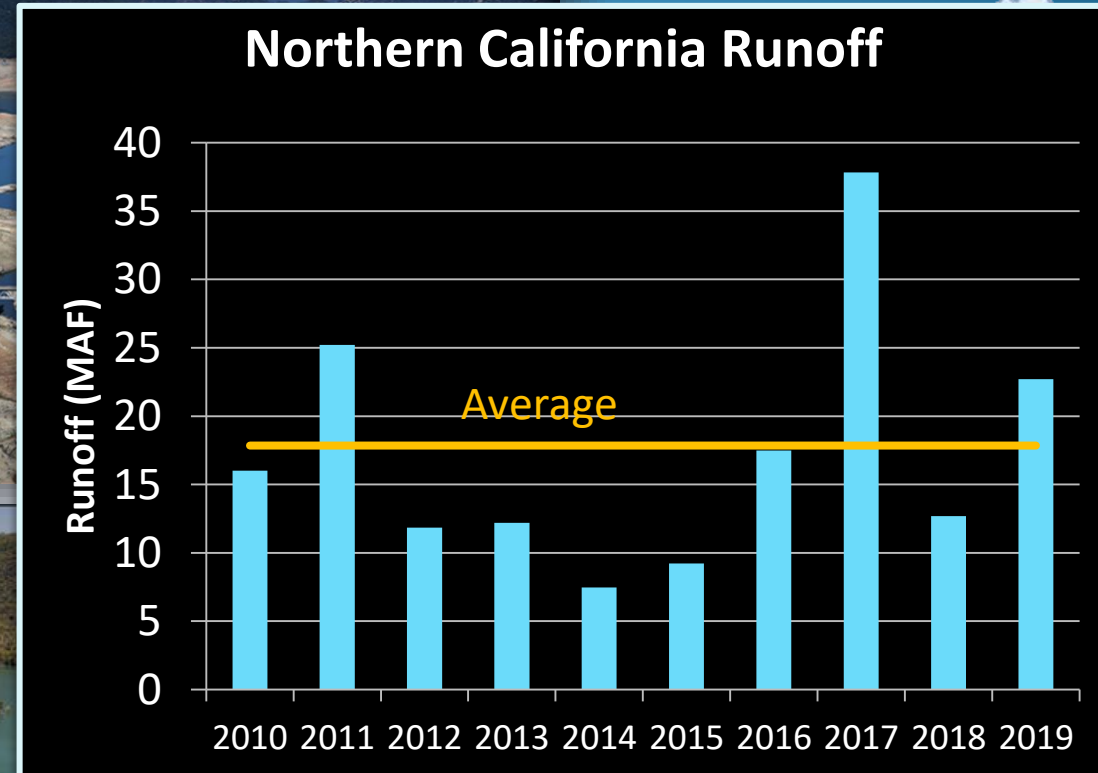
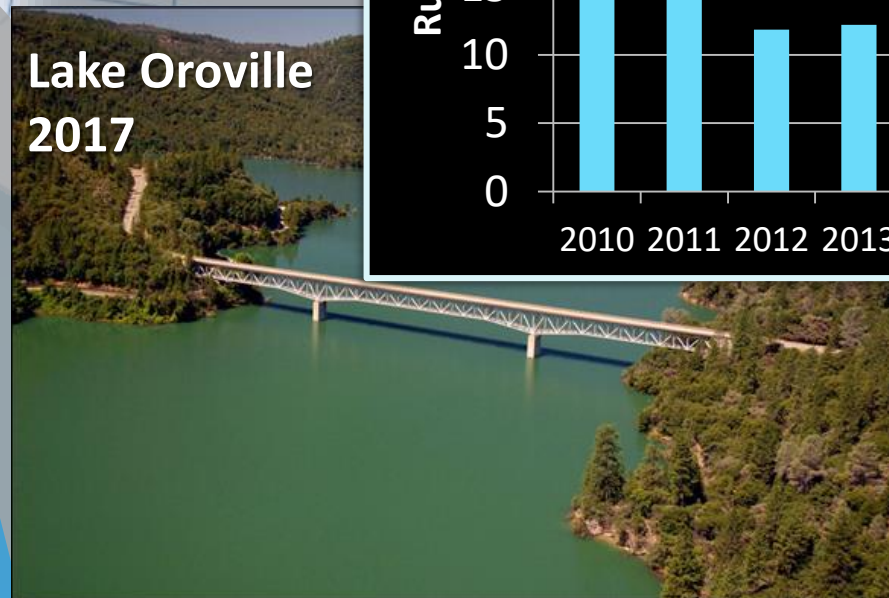
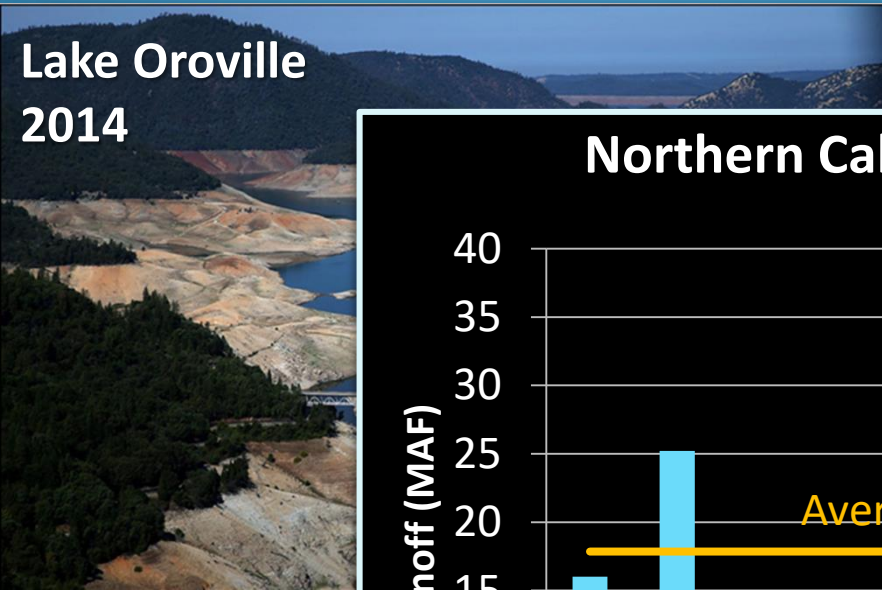
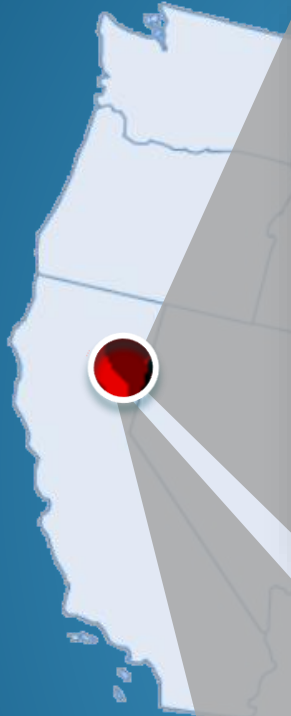


Highest
Variability in
the Nation

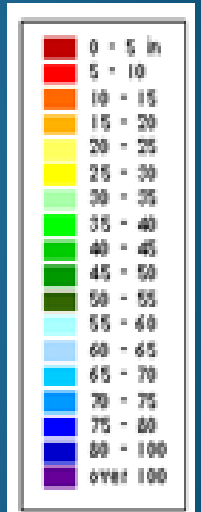
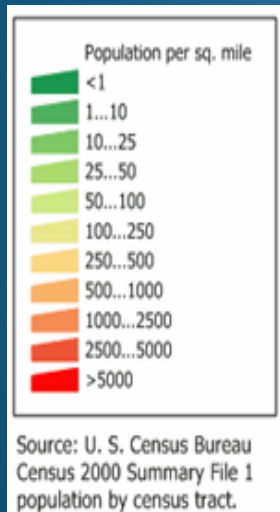
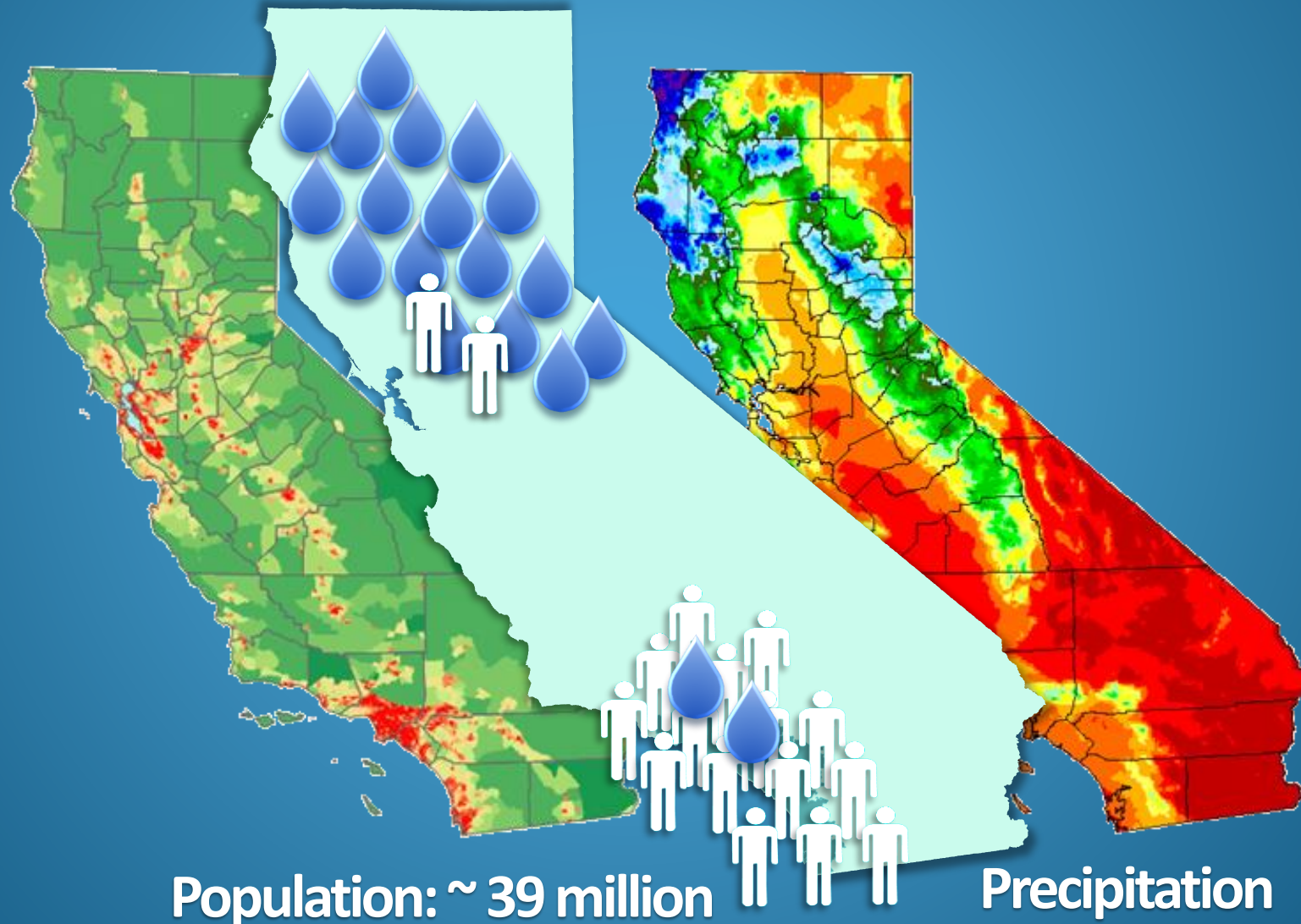
Coefficients of Variation
Total Precipitation



Existing Challenges: Extreme Conditions



Existing Challenges: Water Mismatch



Blueprint for Southern California Water Supply Reliability

Integrated Resources Plan

- Long-term strategy adapting to changing conditions
- Diversified resource portfolio

Desalination

Conservation

Recycling

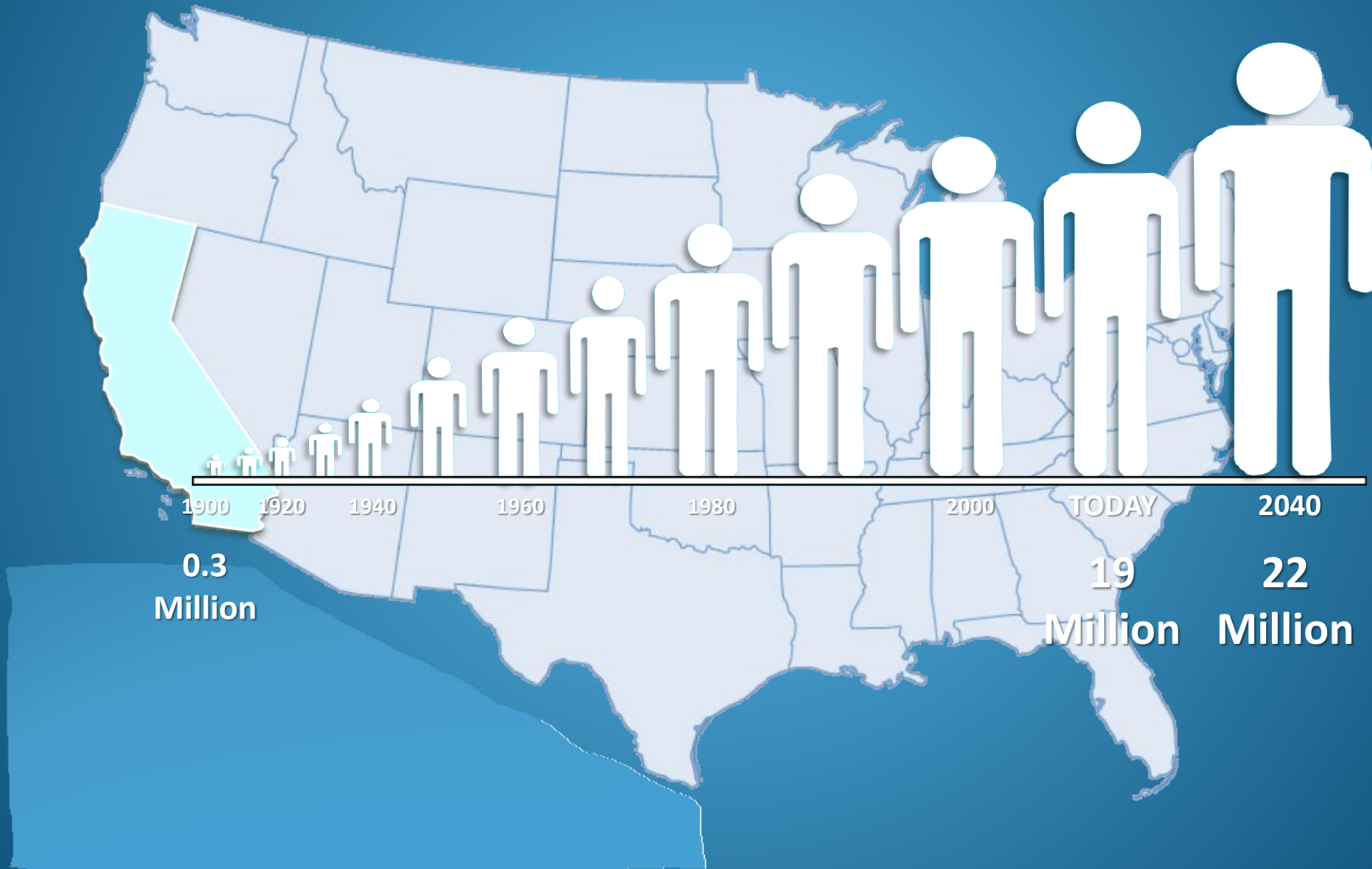
**Ground
Water
Recovery**

Storage

**Transfers/
Exchanges**

**Imported
Supplies**

New and Evolving Challenges: Population Growth



New and Evolving Challenges: Continued Growth and Water Imbalances on the Colorado River System

Lake Mead



Annual
Runoff: 15.0 MAF

Allocated
Supply: 16.5 MAF

- 1.5 MAF

New and Evolving Challenges: Environmental and Regulatory Demands

California water supplies are highly regulated in order to protect the environment and other beneficial uses, resulting in decreased water supply reliability

Los Angeles
Aqueduct
Supply cut
by 50%

State
Water
Project
Supply cut
by 30%



New and Evolving Challenges: Agricultural Demand

Leader in Agricultural Production and Global Exports

California's Top 10 Agricultural Export Markets, 2017			
Rank	Country	Export Value \$1 Million	Leading Exports
1	European Union	3,408	Almonds, Wine, Walnuts
2	Canada	3,287	Wine, Strawberries, Lettuce
3	China/Hong Kong	2,270	Pistachios, Almonds, Wine
4	Japan	1,452	Almonds, Rice, Walnuts
5	Mexico	1,057	Dairy and Products, Table Grapes, Tomatoes
6	Korea	996	Processed
7	India	880	Oranges and Products, Almonds, Beef and
8	United Arab Emirates	371	Products
9	Turkey	346	Almonds, Cotton, Walnuts
10	Vietnam	331	Almonds, Walnuts, Hay



Exports (2017): \$20.56 billion

#1 Almonds: \$4.57 billion
#2 Dairy: \$1.60 billion
#3 Pistachios: \$1.57 billion

\$50 Billion in Crop Cash Receipts (13.4% of total USA)

New and Evolving Challenge: Climate Change

State Water Project

TODAY



FUTURE



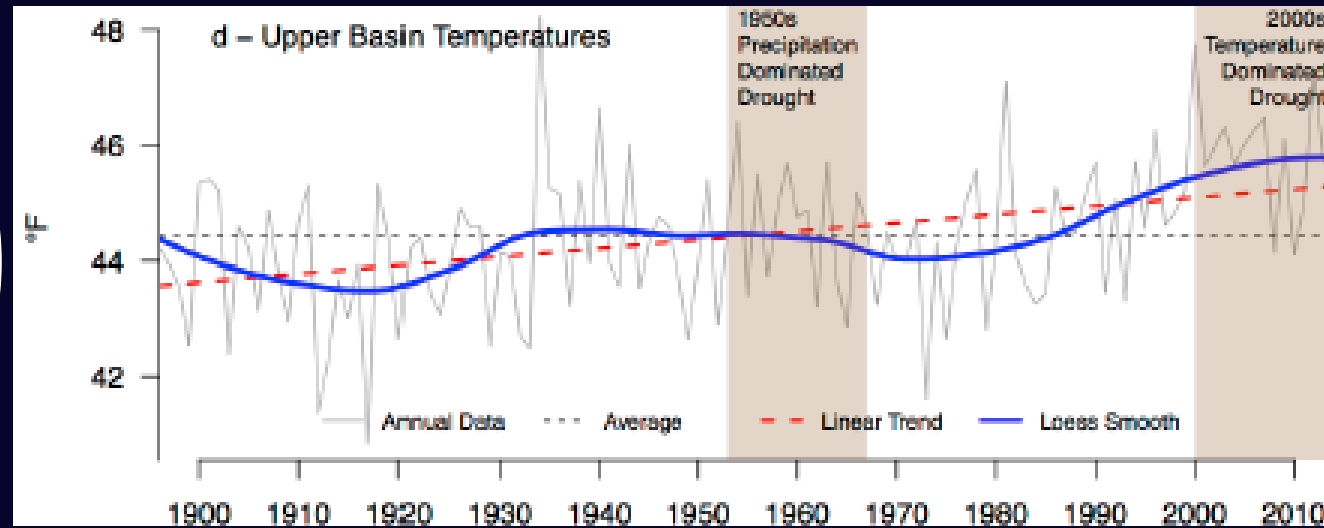
A temperature increase of 1°C moves snow level elevation 152 meters higher

- More than 33% Reduction in Snowpack by 2050
- Changing Precipitation Patterns
- Changing Runoff Timing and Intensity
- 0.4 m to 2.4 m Sea Level Rise by 2100

New and Evolving Challenge: Climate Change Colorado River

Temperatures Key to 2000's Decline

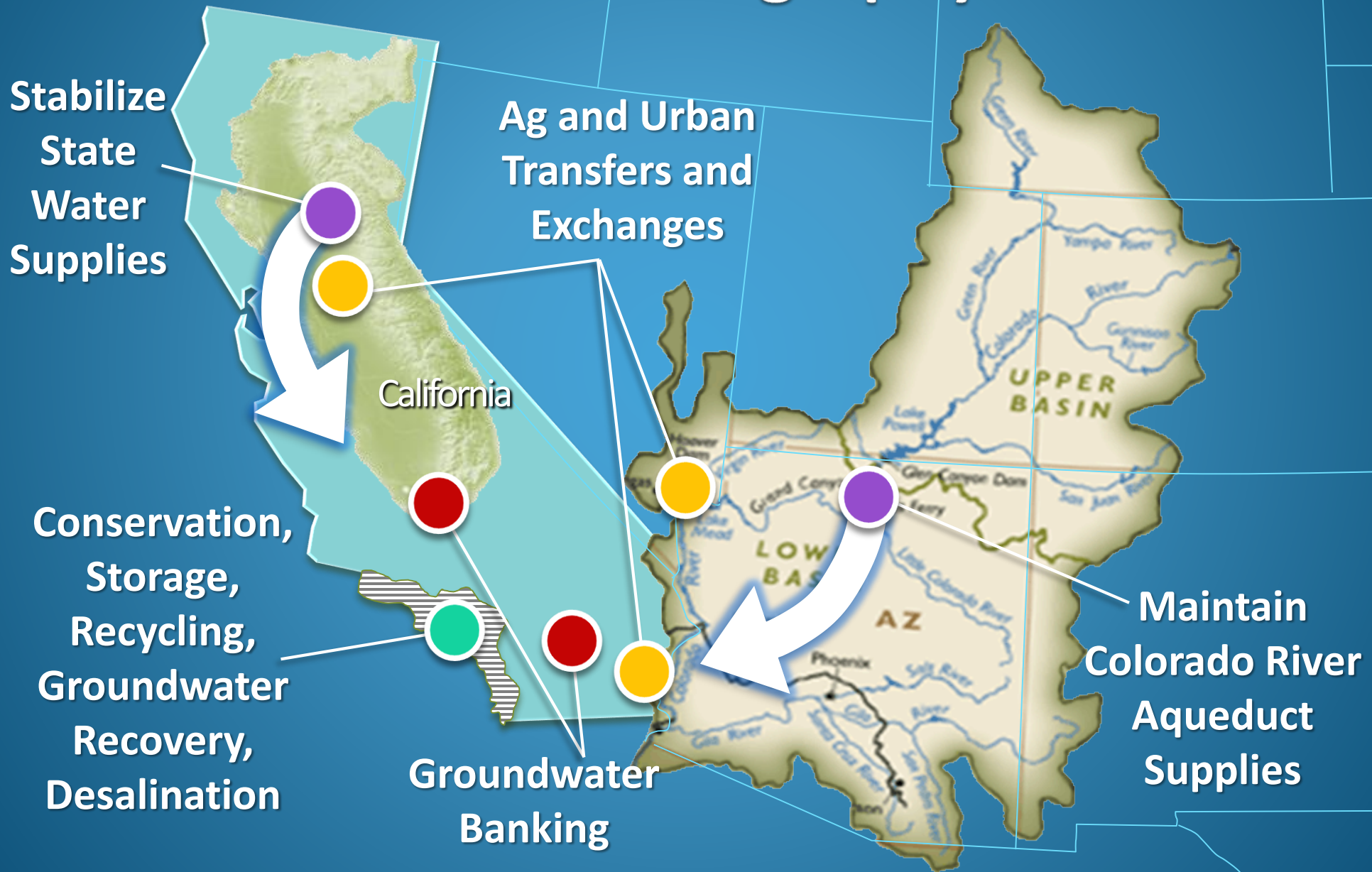
Record Colorado
River flow
reductions
averaged 19.3%
per year during
2000-2014



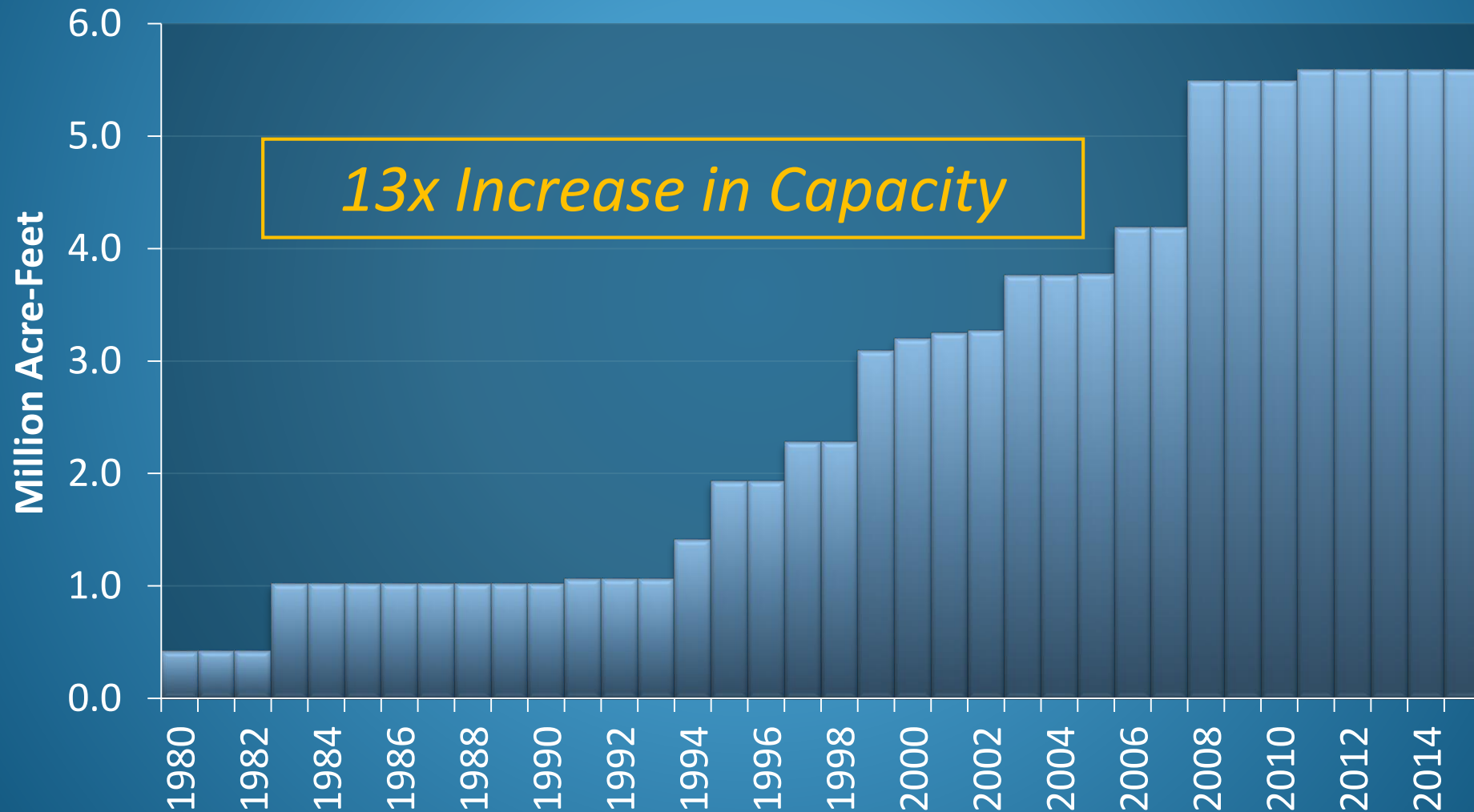
Warming alone will drive Colorado River flow declines of -6.5% +/- 3.5% per °C

- Longer Growing Season
- More Warmth on any Given Day
- More Evaporation from Soils
- More Opportunity for Sublimation

Adaptation and Continued Diversification in Geography and Tools



Metropolitan Has Made Significant Investments in Regional Storage Capacity



Lower and Flatten Urban Demand

\$772 M Conservation Investment

Turf Removal



Largest Program in
the Nation



Device Rebates



Outreach

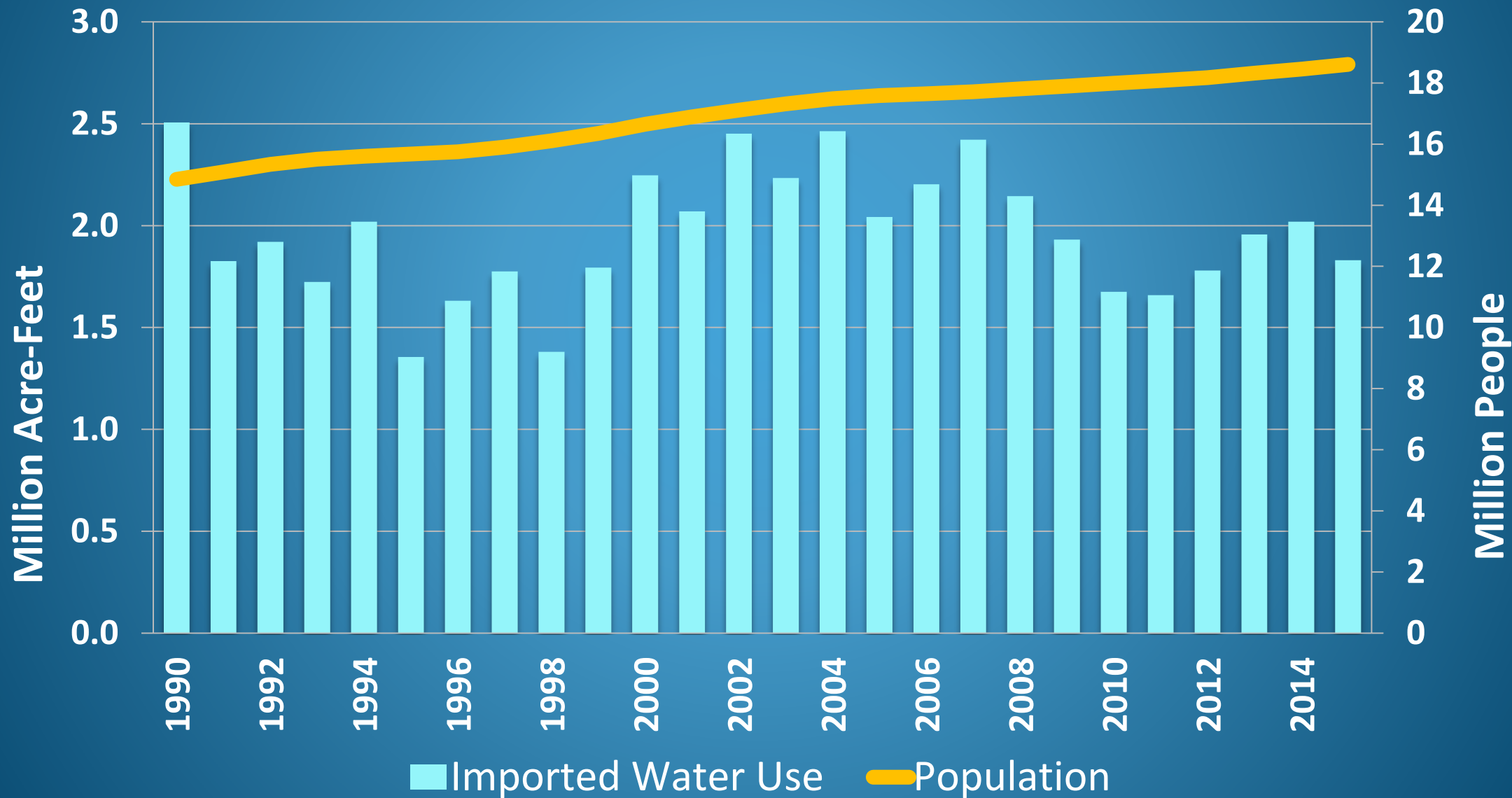
Education



Over 4,440 MCM savings since 1990

Lower and Flatten Urban Demand

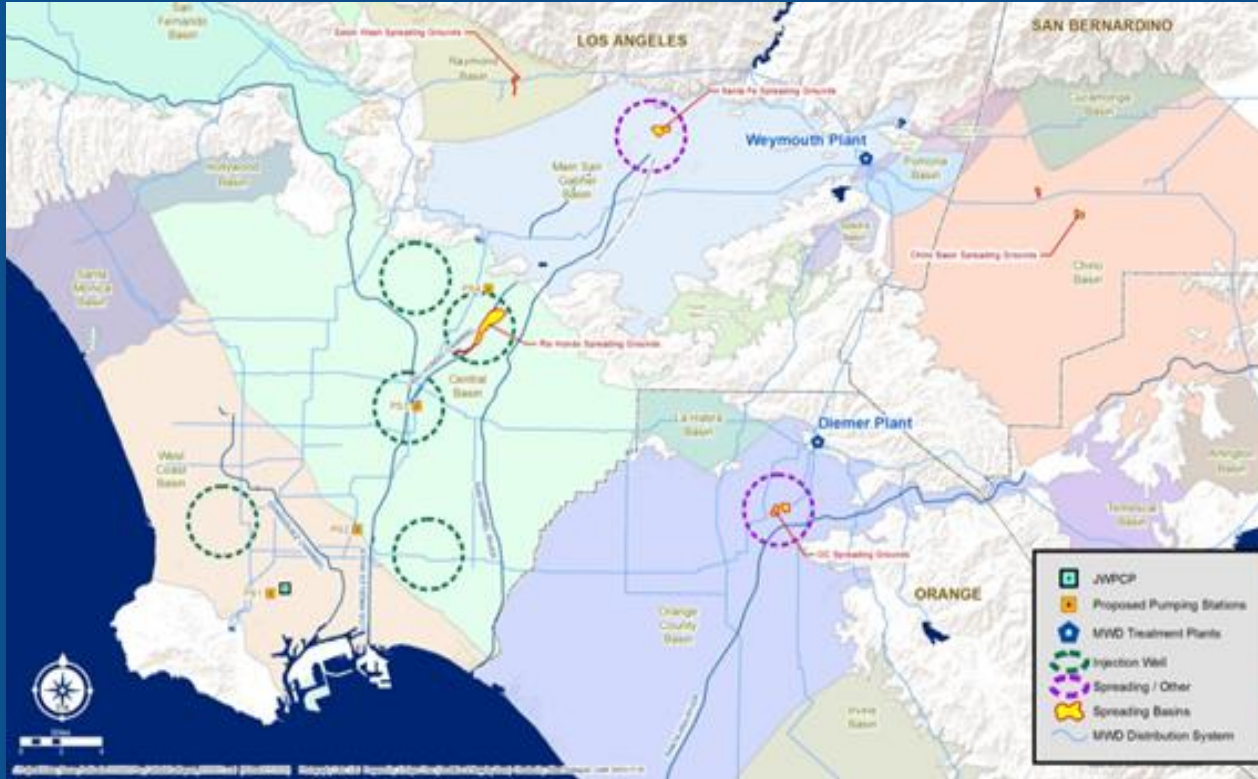
Demands Remain Flat as the Region Grows



Advance Local Supply Development

Capital Cost: \$3.4 Billion

Initiate Regional Recycled Water Project



**7.9 m³/s (150 mgd) at an
estimated \$2.7B**

**Increase
Subsidies**



Drought-Proofed!

This site is irrigated with
Recycled Water to protect
Burbank's drinking water supply.



Largest Program in the Nation

Invest in Agricultural Efficiency on Colorado River

Best Management Practices

Imperial Irrigation District Conservation



Canal Lining



Seasonal Fallowing

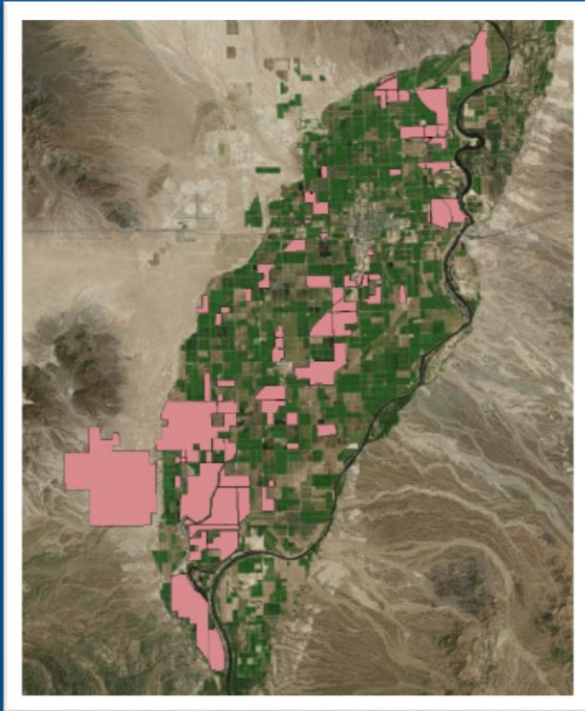


Lowers Agricultural Demand

Strategic Land Purchases

\$415 M Land Acquisitions

Palo Verde Valley Lands



Keep farmers farming
through conservation lease
incentives

Delta Islands



Kick-start science, environmental
mitigation, address multiple
stressors impacting species

Increases Flexibility and Resilience

Modernize State Infrastructure

Billions Invested

Diamond Valley Lake and Inland Feeder



Cal Water Fix



\$10.8 / \$17.1 B



Seismic



Subsidence



Climate Change



Fish Protection



Flow Patterns



Water Quality

~ \$5 month/
household

For Climate Change Volatility

Summary

- Water scarcity can come in many forms
- Metropolitan's Integrated Resource Plan allows us to adapt to changing conditions
- Long-term challenges remain
- Regional and global partnerships are the cornerstone of water supply reliability

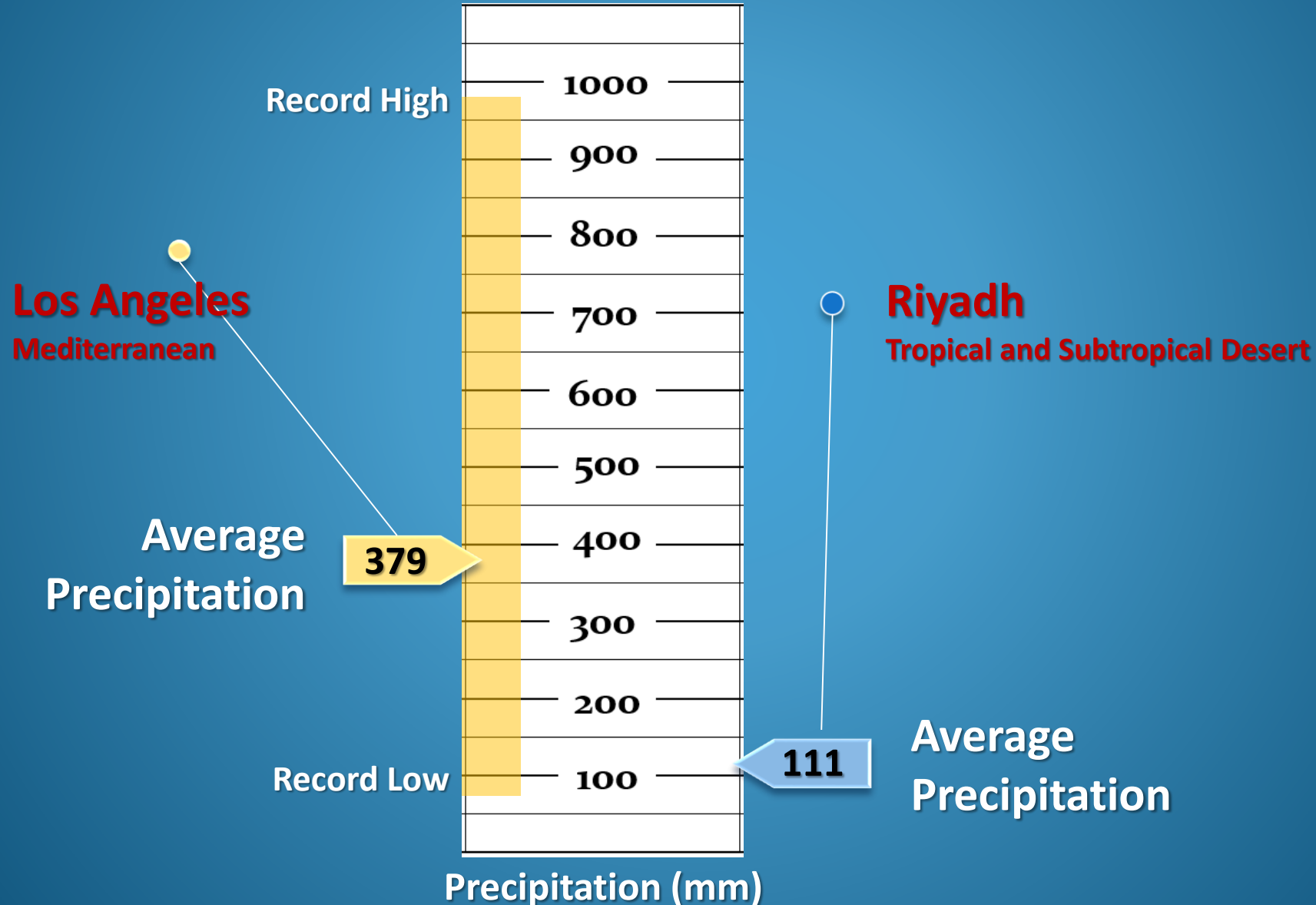


Jeffrey Kightlinger, General Manager

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Desalination

New and Evolving Challenges: Agricultural Demand

CA exports >99% of many high-value produce:



Exports (2017): \$20.5

- #1 Almonds: \$4.5 billion
- #2 Dairy: \$1.60 billion
- #3 Pistachios: \$1.57 billion

**\$50 billion in crop cash receipts
(13.4% of total USA)**

**California Leads the U.S.A. in Agricultural
Production and Global Exports**