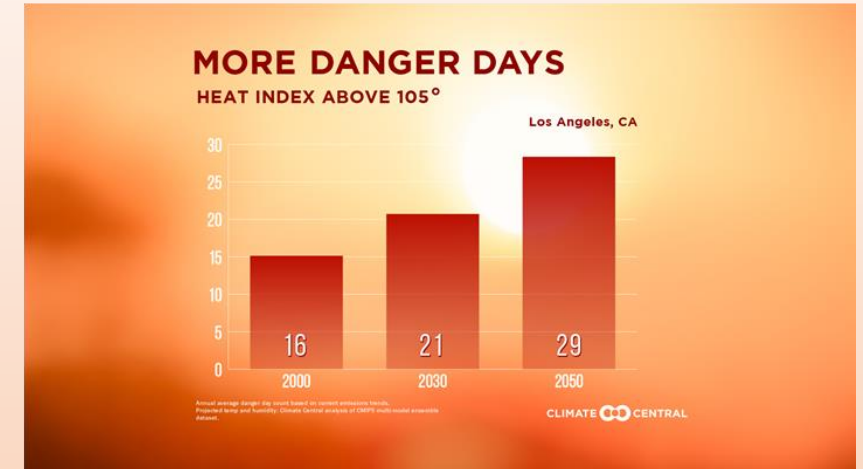


# State of the Climate and Impacts on Metropolitan Water District Supplies and Operations



Liz Crosson, Sustainability, Resilience and Innovation  
Bill Hasencamp, Colorado River Resources  
Nina Hawk, Bay-Delta Initiatives  
Mickey Chaudhuri, Water System Operations  
Brad Coffey, Water Resources Management

# Impacts Beyond Drought

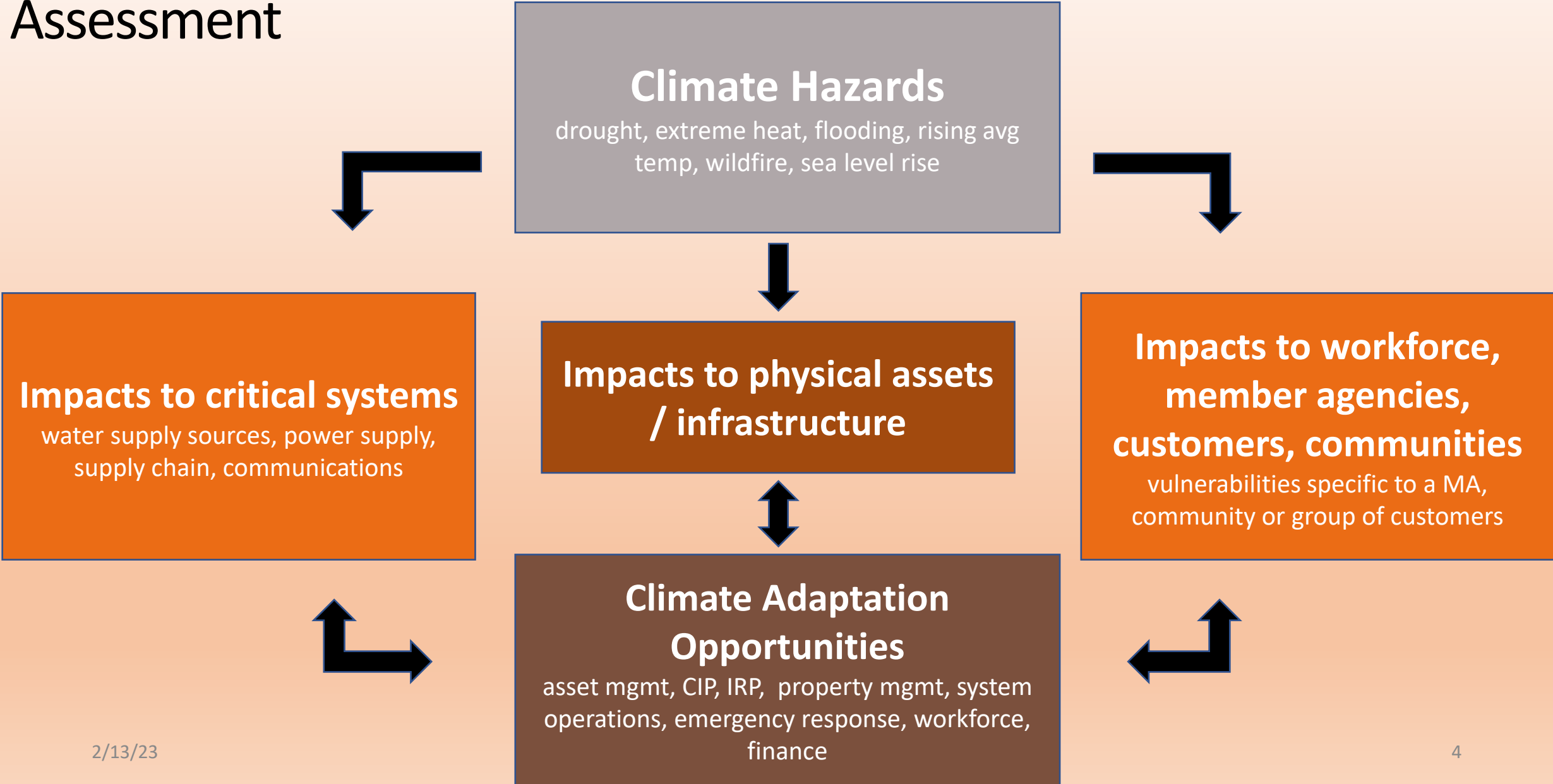


# Cascading Impacts Expose Vulnerabilities



Drought + Drought  
Drought + Drought + Drought  
Drought + Extreme Heat  
Drought + Flooding  
Drought + Fire

# Climate Vulnerability and Risk Assessment

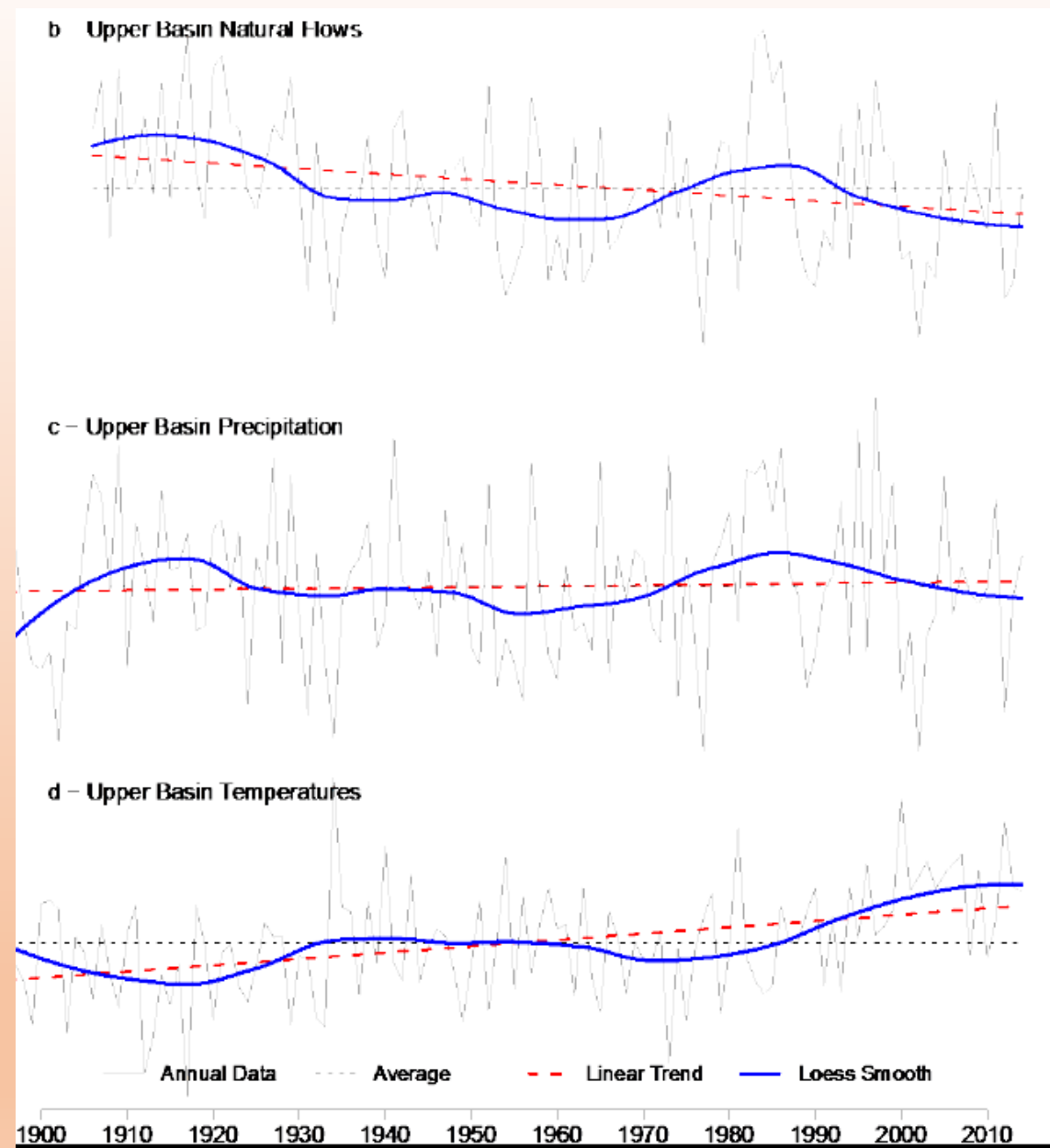




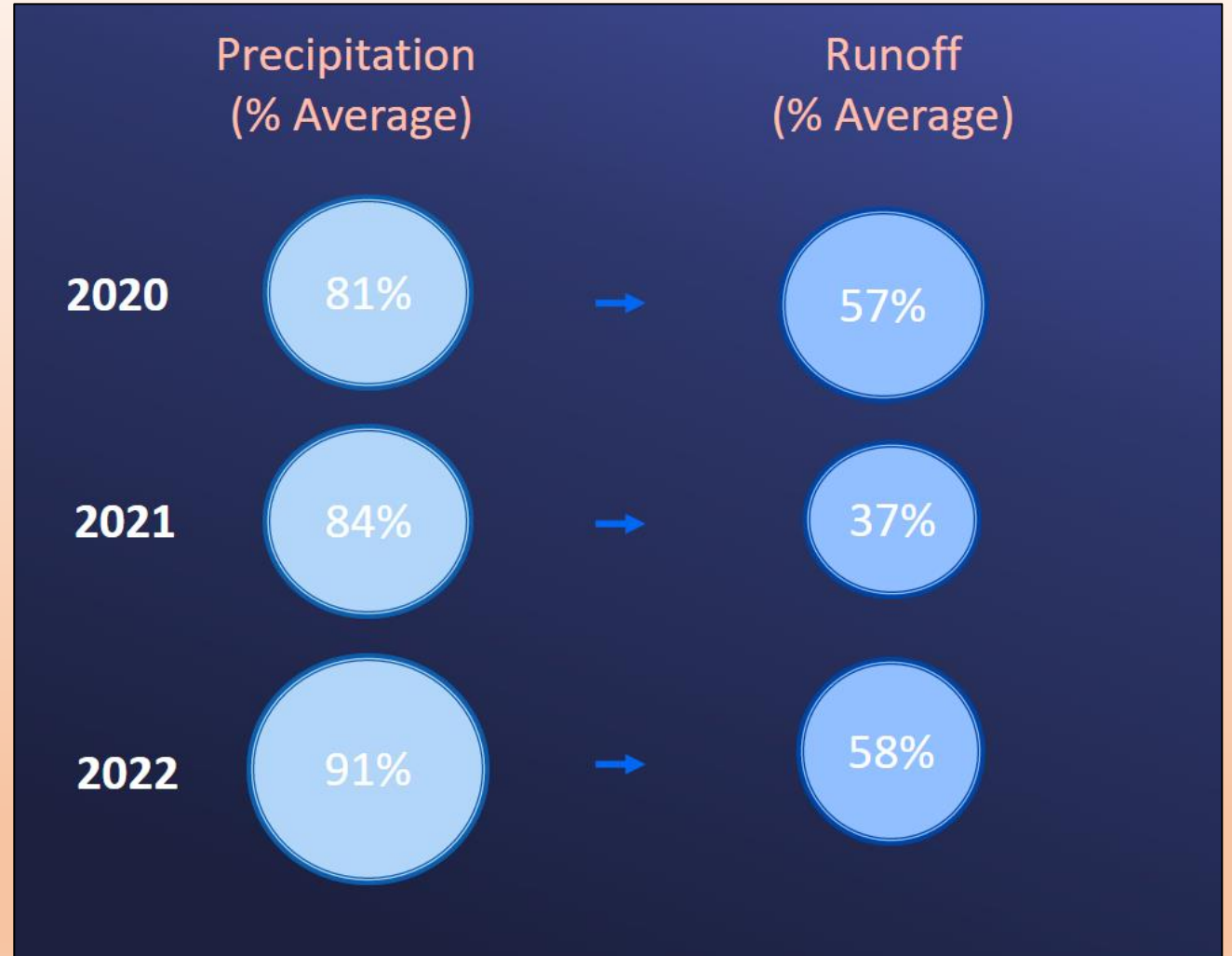
# The Colorado River Basin



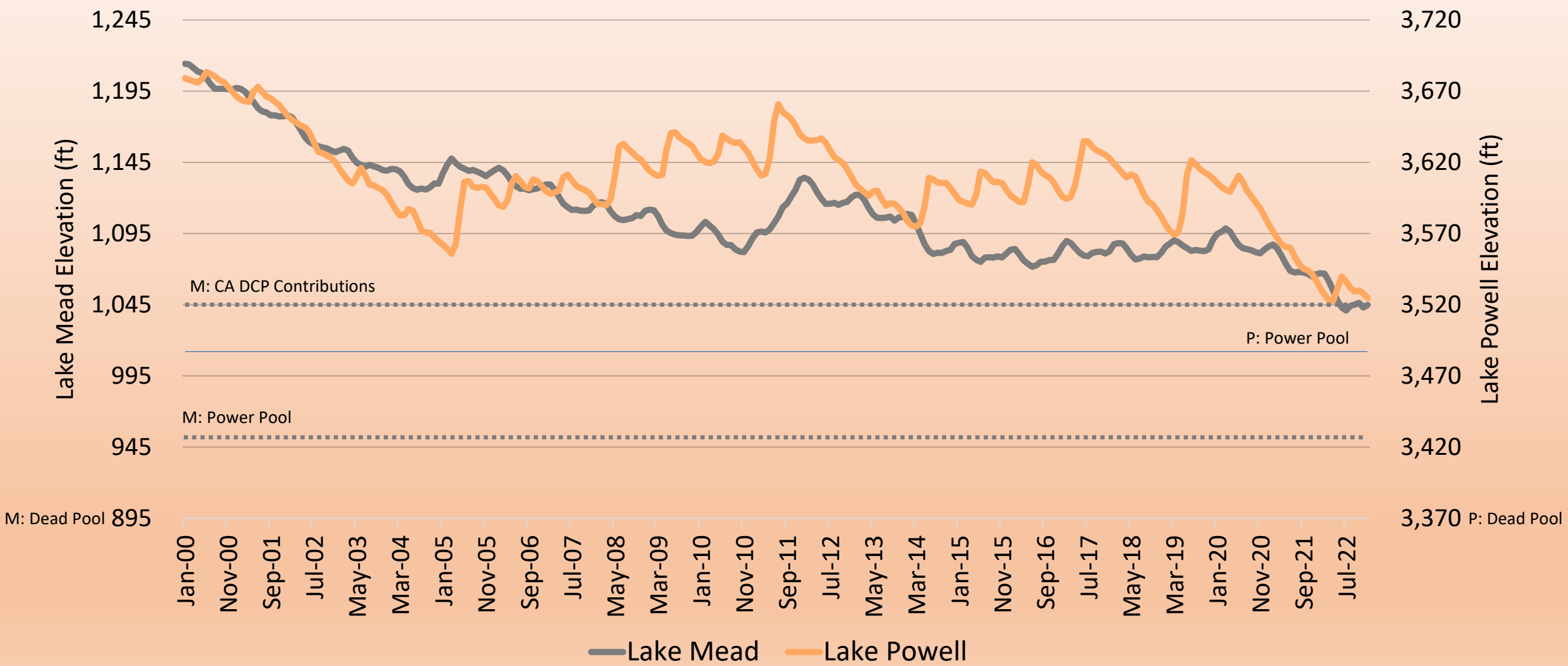
# A “Heat Drought”



# Decreased Runoff Efficiency

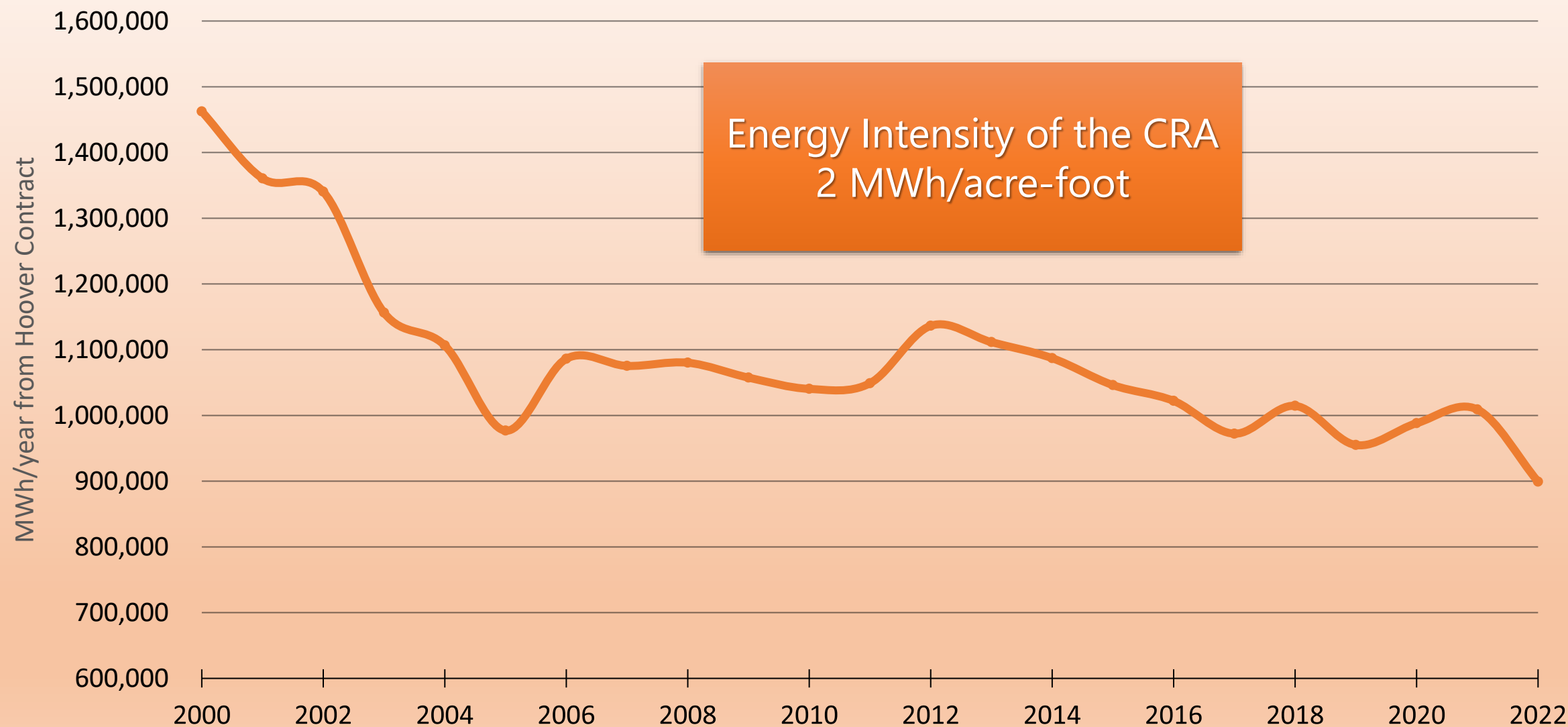


# Lake Powell and Lake Mead Decline Since 2000

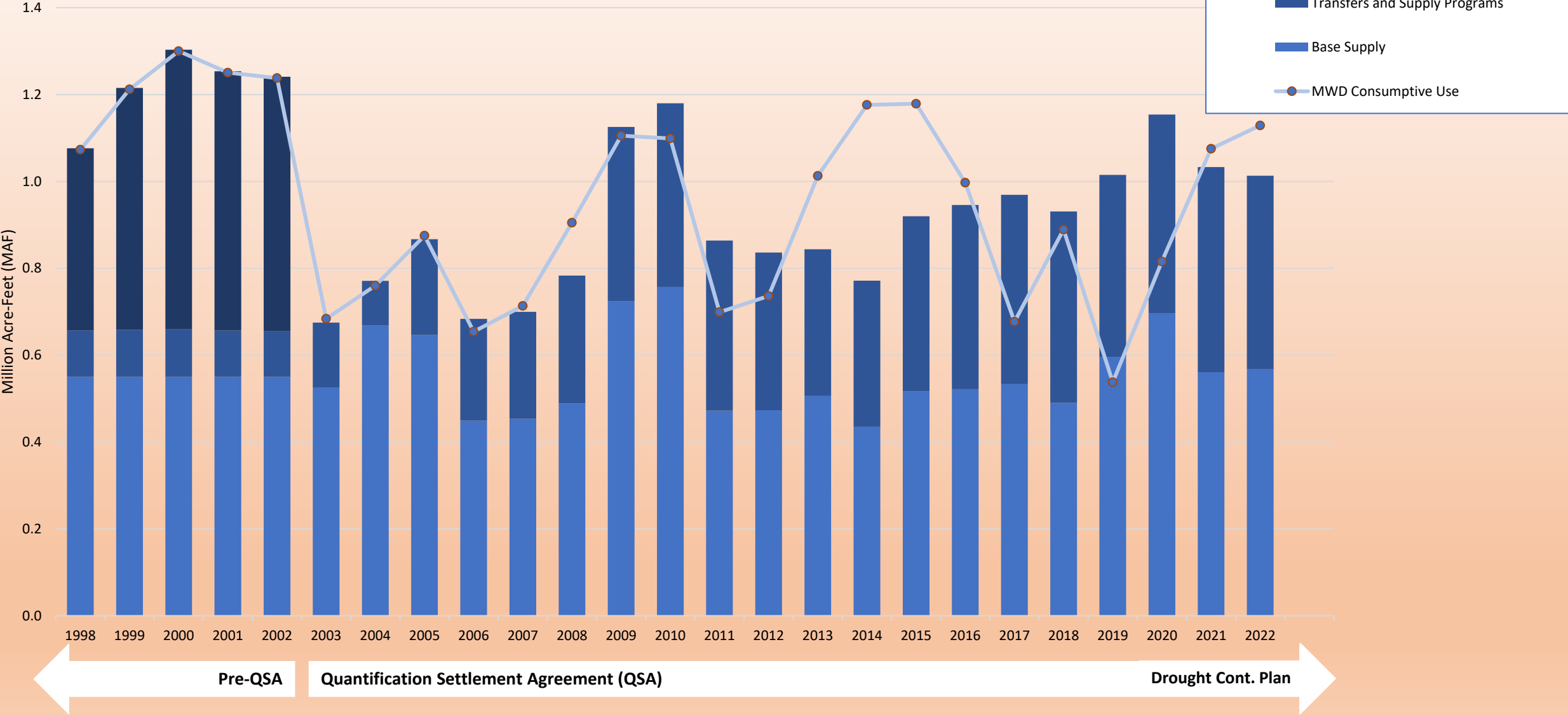




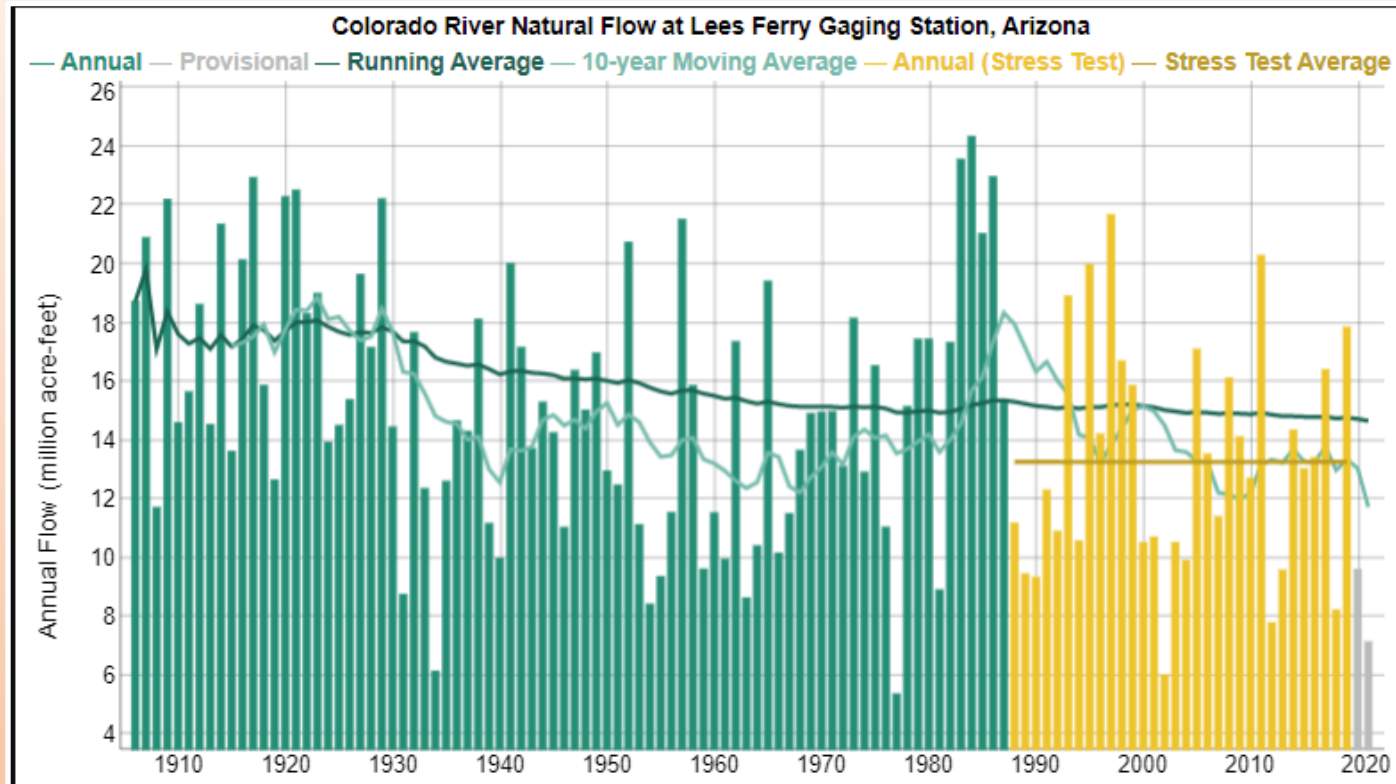
# Metropolitan's Hoover Power Resource has Declined



# Metropolitan Colorado River Supply

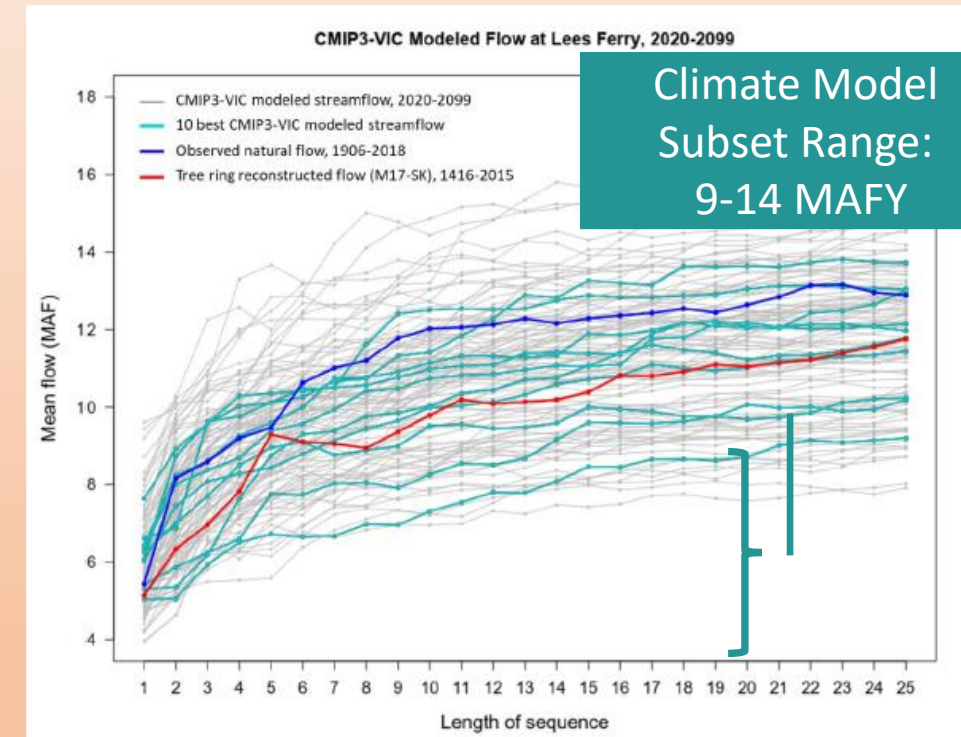


# Historical and Future Colorado River Flows

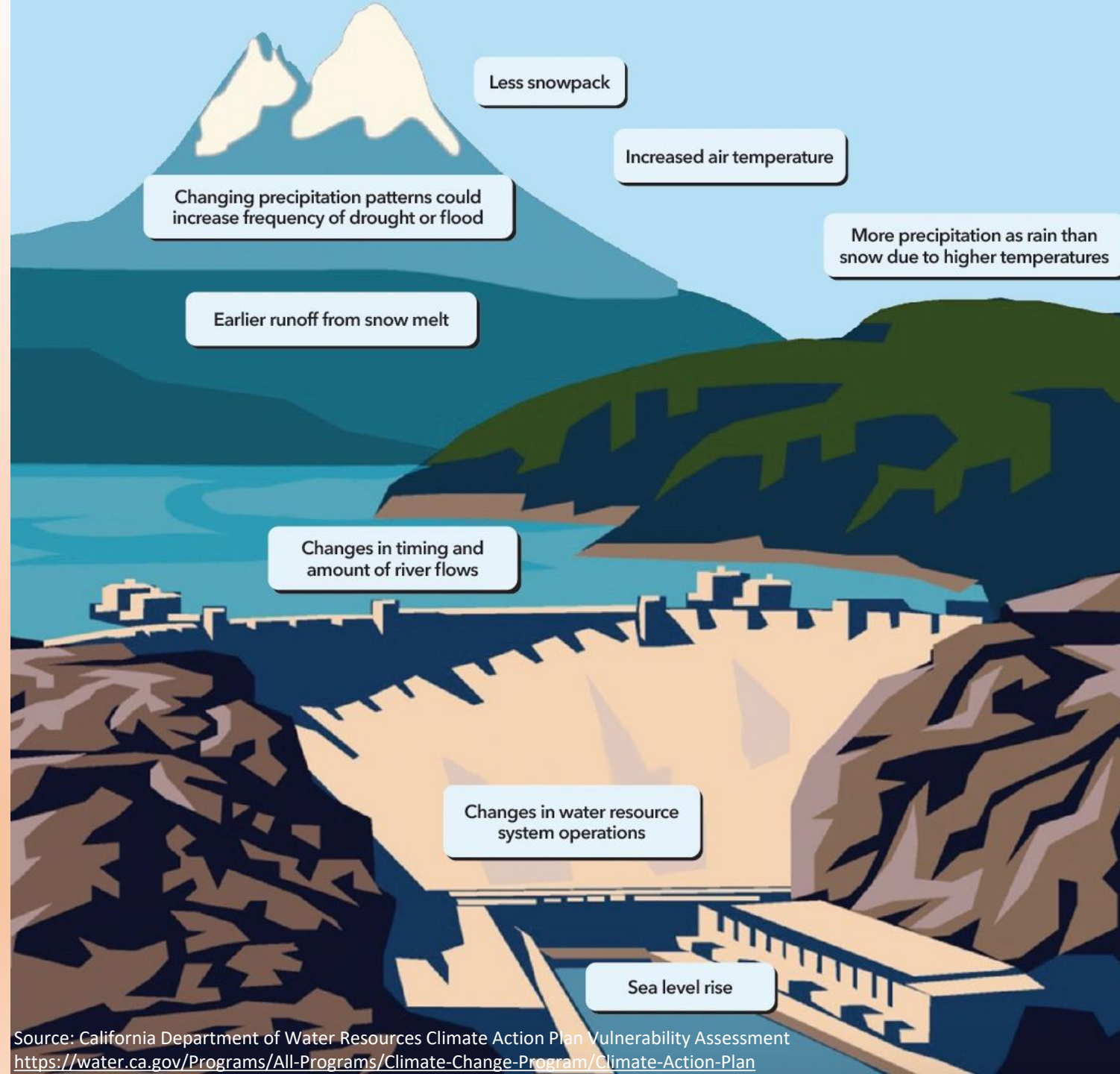


Historical Natural Flow  
at Lees Ferry

## Global Climate Model Future Projections

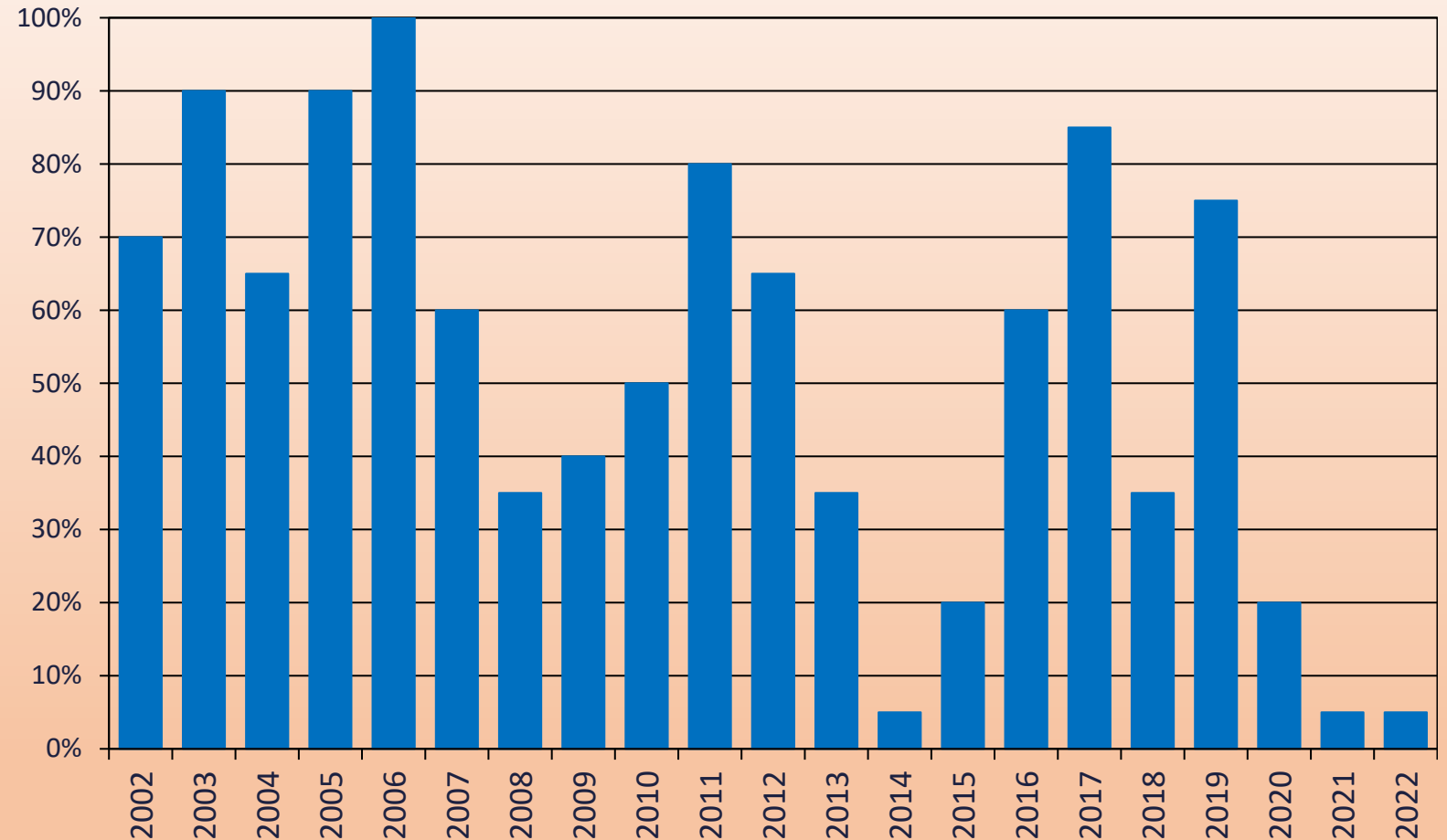


# State Water Project Reliability and Climate Vulnerabilities



# Historic State Water Project Allocations

Reliability  
of supplies  
is decreasing



Source: Department of Water Resources Historical State Water Project Allocation Summaries <https://water.ca.gov/programs/state-water-project/management/swp-water-contractors>  
California Ocean Protection Council [https://www.opc.ca.gov/webmaster/ftp/pdf/agenda\\_items/20180314/Item3\\_Exhibit-A\\_OPC\\_SLR\\_Guidance-rd3.pdf](https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf)

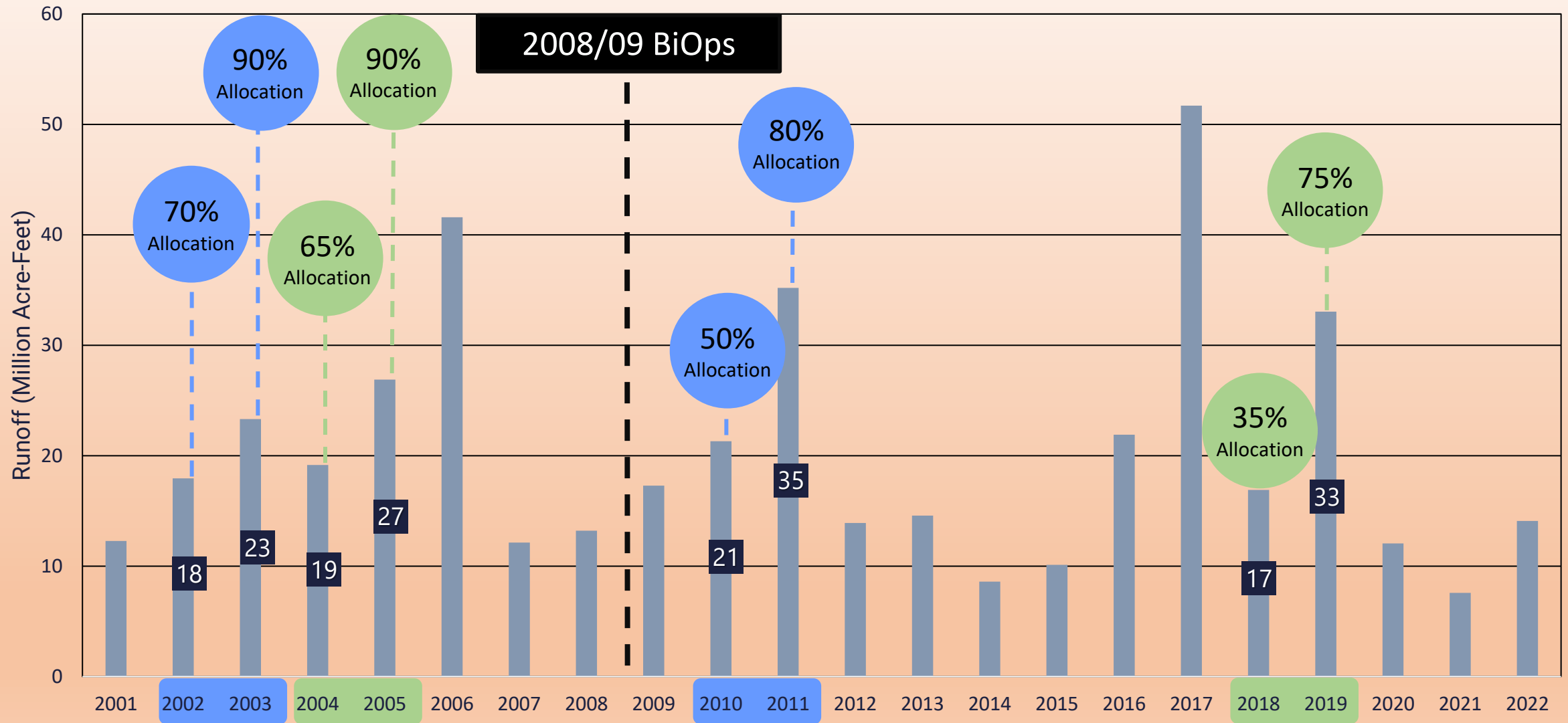


# State Water Project Headwaters Vulnerable to Climate Change



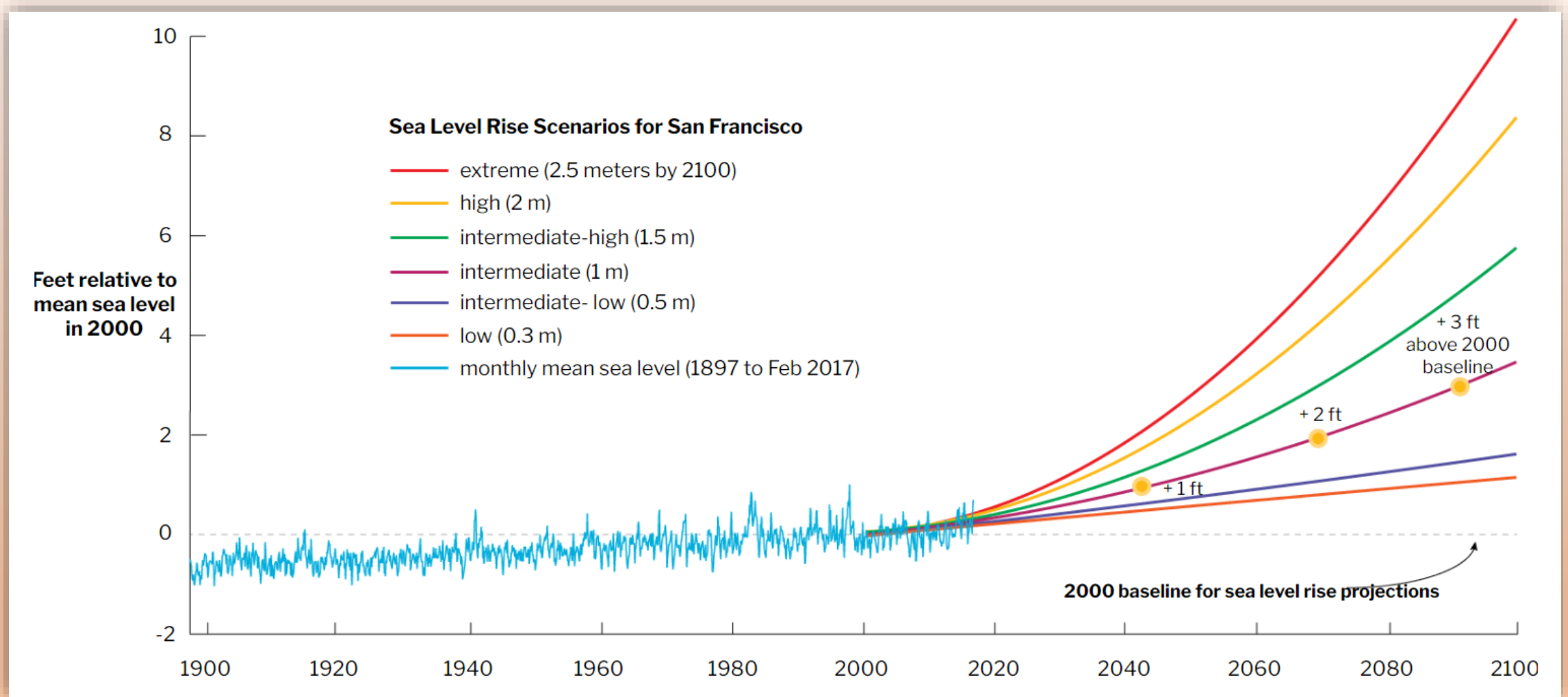
Wildfire frequency and severity are increasing

# Balancing Water Supply with the Environment



Source: Department of Water Resources Water Supply Index History, Combined Eight River Index Runoff <https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>

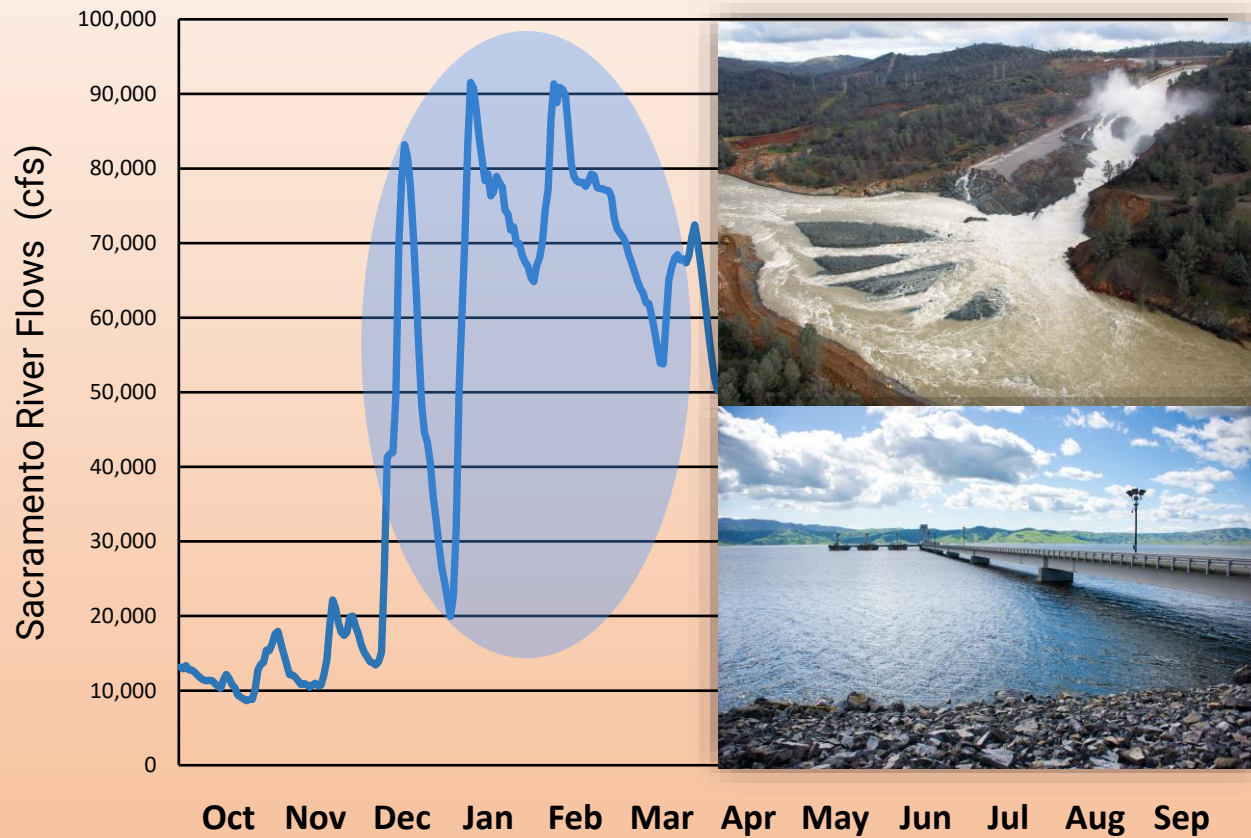
# Sea Level Rise at Golden Gate Bridge



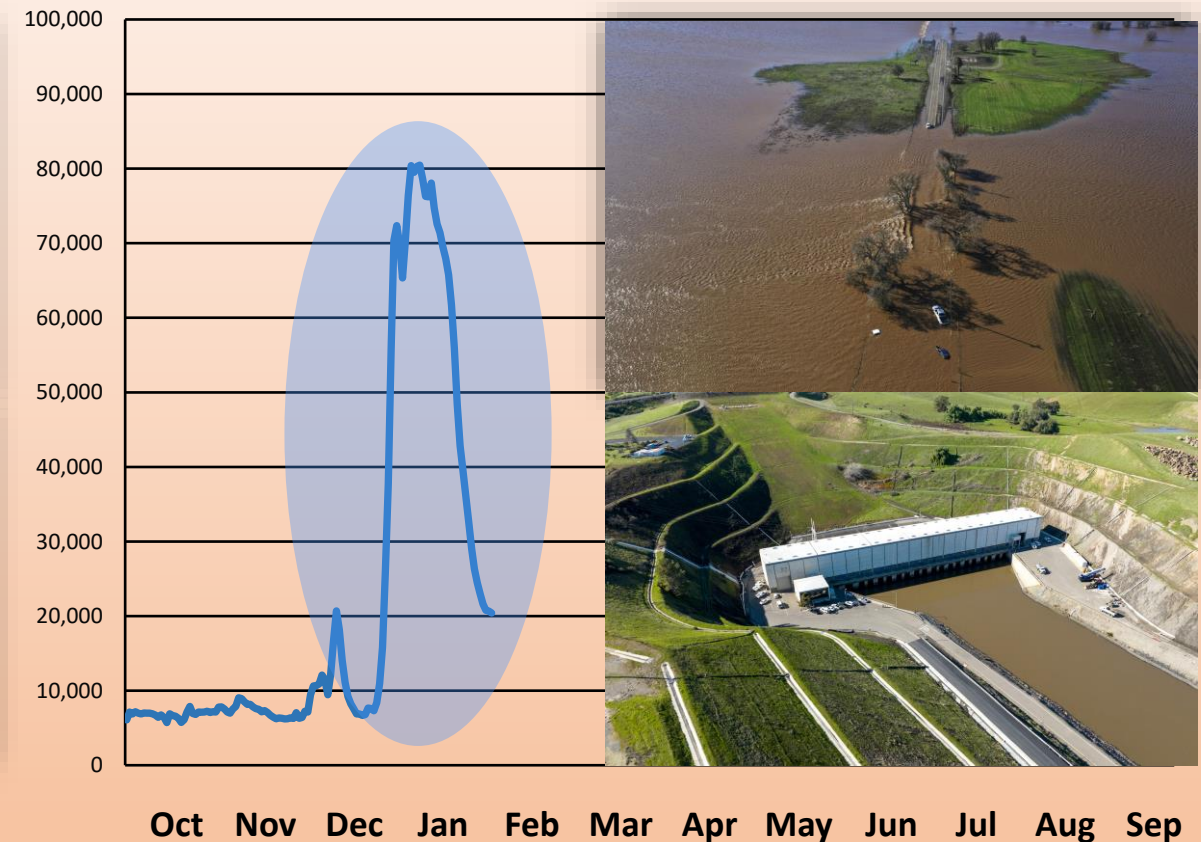
Source: San Francisco Baykeeper: <https://baykeeper.org/shoreview/california-slr.html>

California Ocean Protection Council [https://www.opc.ca.gov/webmaster/ftp/pdf/agenda\\_items/20180314/Item3\\_Exhibit-A\\_OPC\\_SLR\\_Guidance-rd3.pdf](https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf)

# Atmospheric Rivers Present Risks and Opportunities



**2017 Water Year**  
(Wet)

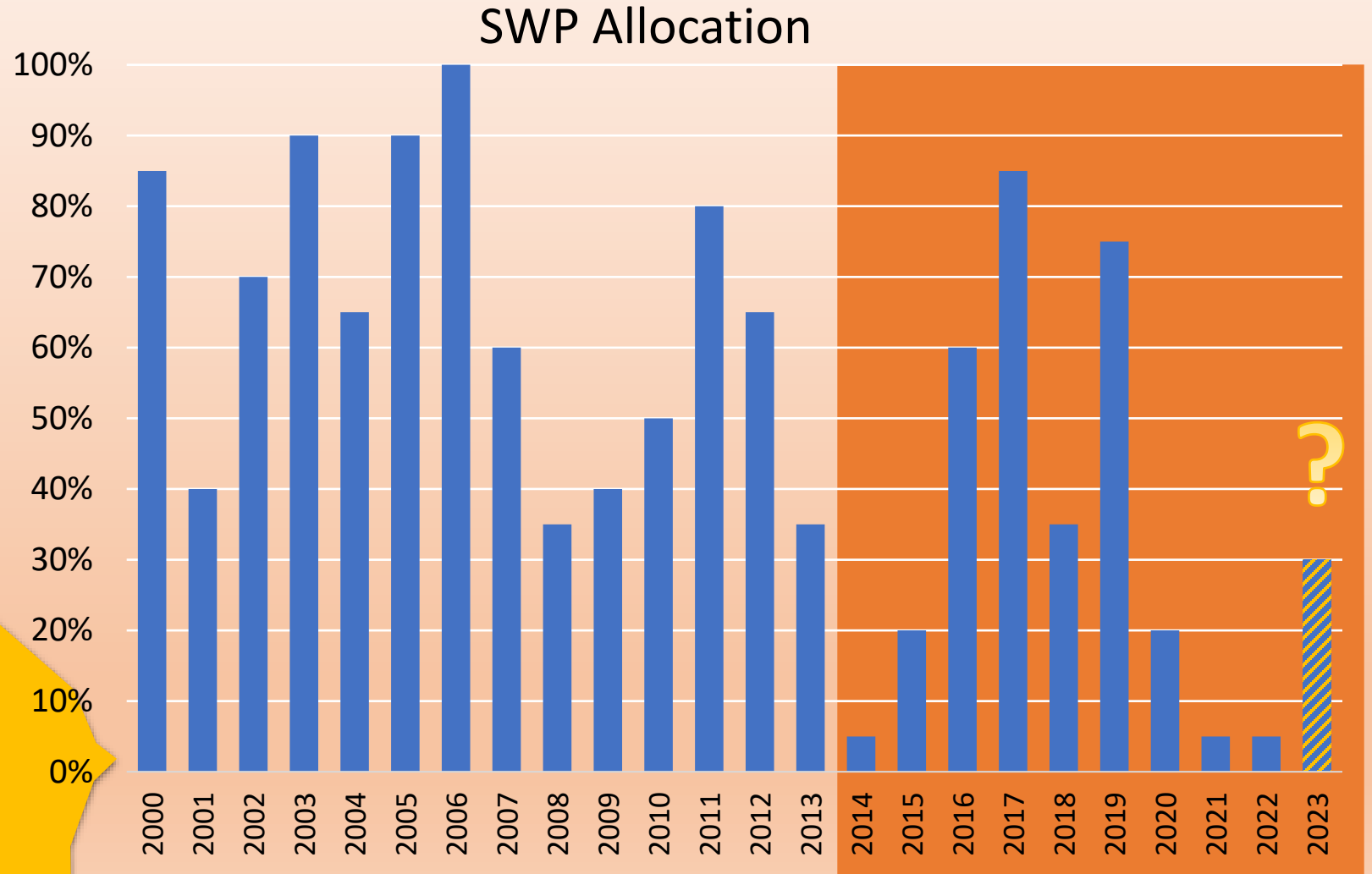


**2023 Water Year**  
(Above Normal)

Sources: Sacramento River Flows at Freeport via California Data Exchange Center <https://cdec.water.ca.gov/>  
DWR 2023 Water Supply Index <https://cdec.water.ca.gov/reportapp/javareports?name=WSI>



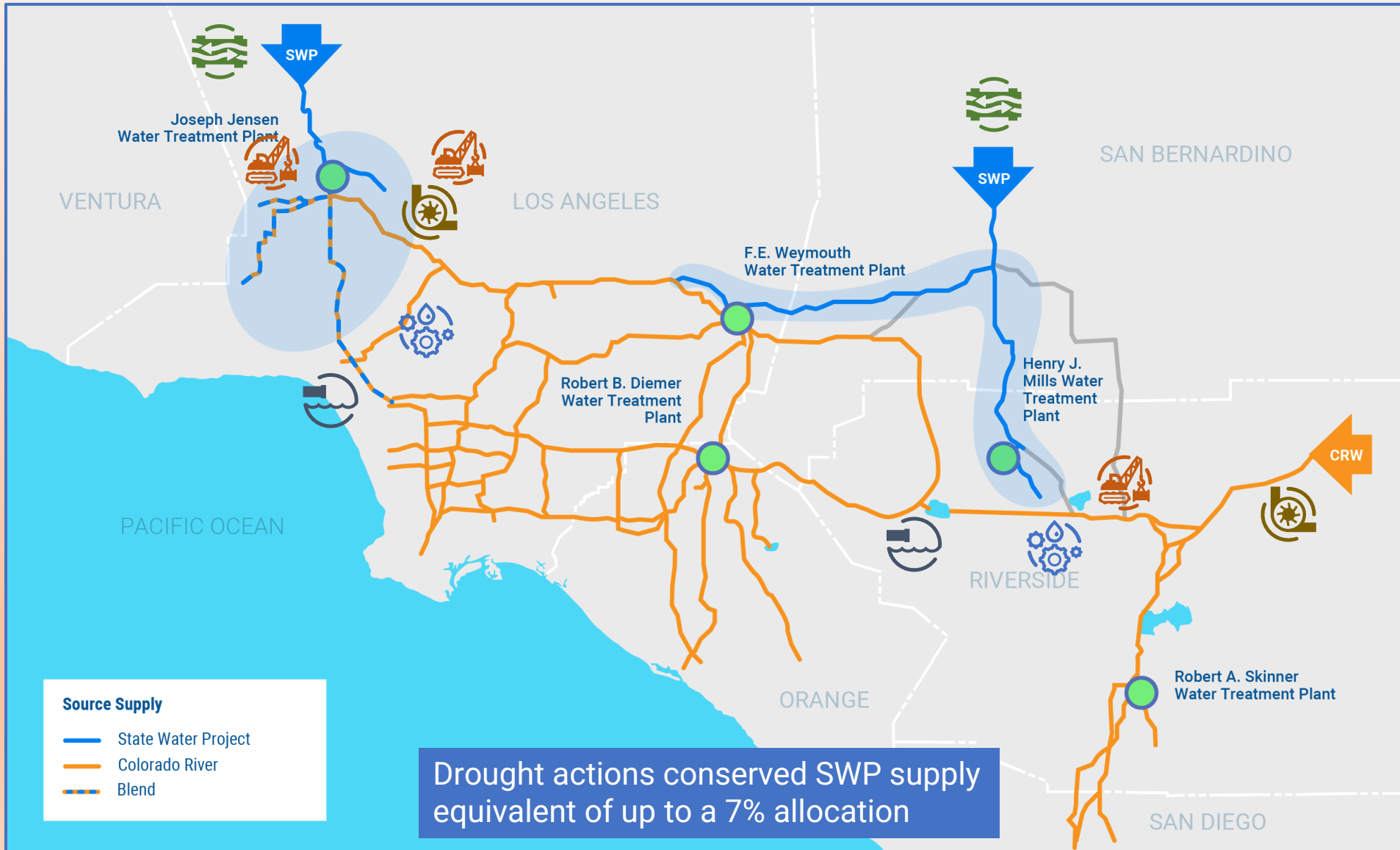
# Adapting Operations to Longer and More Intense Dry Periods with Flashes of Abundance





# Operating under Extremes

Last Drought (2014-15) – Began implementing innovative drought actions



PROGRAMS



PUMPING



INFRASTRUCTURE



SPECIAL  
OPERATIONS



EXCHANGES

# Operating under Extremes

Record Wet (2017 & 2019) – Adapted to surplus conditions with new actions



PROGRAMS



PUMPING



INFRASTRUCTURE



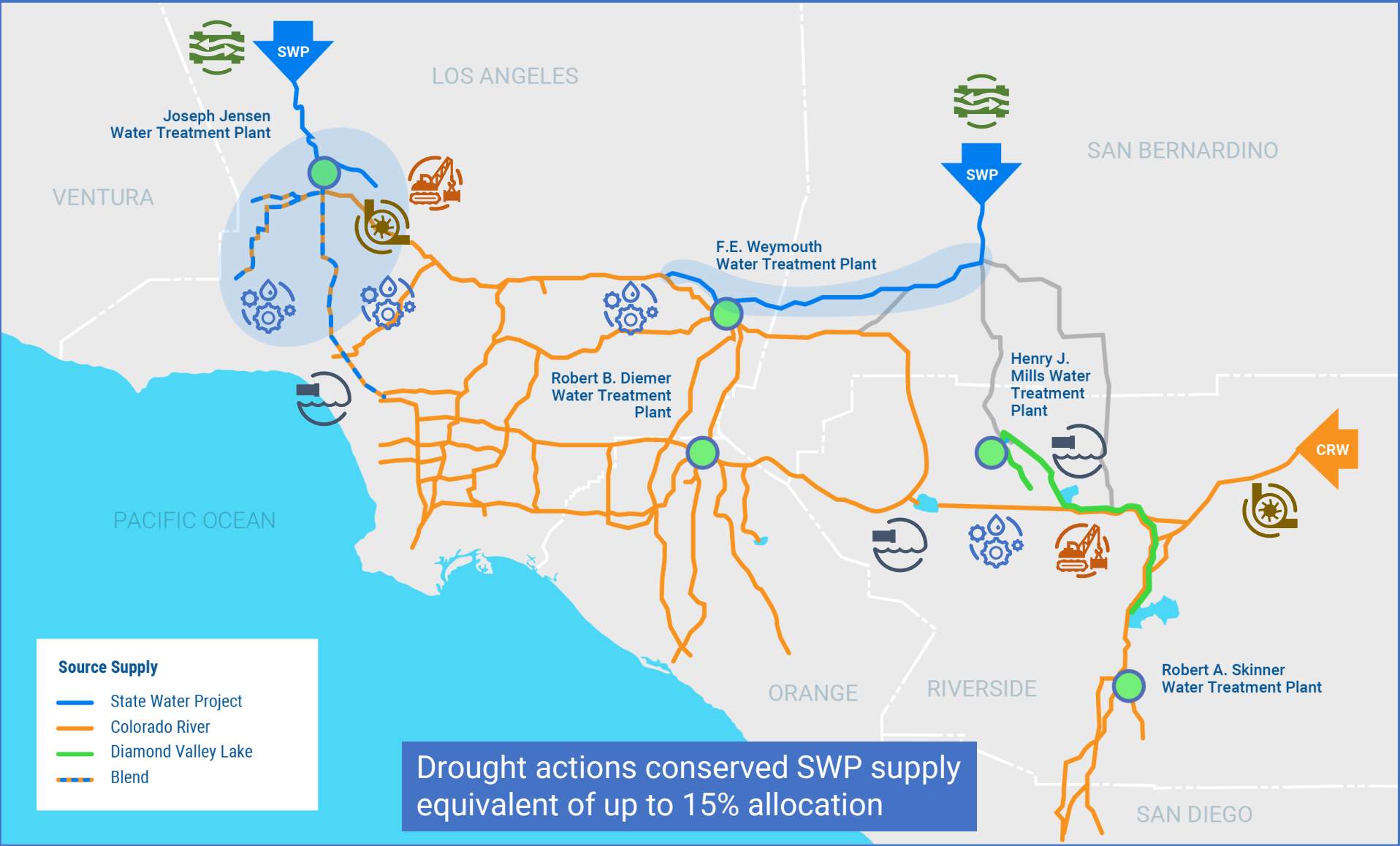
SPECIAL  
OPERATIONS



EXCHANGES

# Operating under Extremes

Record Drought (2020-22) – Added new drought actions to portfolio



PROGRAMS



PUMPING



INFRASTRUCTURE



SPECIAL  
OPERATIONS



EXCHANGES

# Challenges when Operating in a Changing Climate



System Stress



Energy Costs



Emergency Events



Supply Chain Impacts



Water Quality  
Changes



Low and High Flow  
Operations



Complex Shutdown  
Planning



New and Emerging  
Regulations



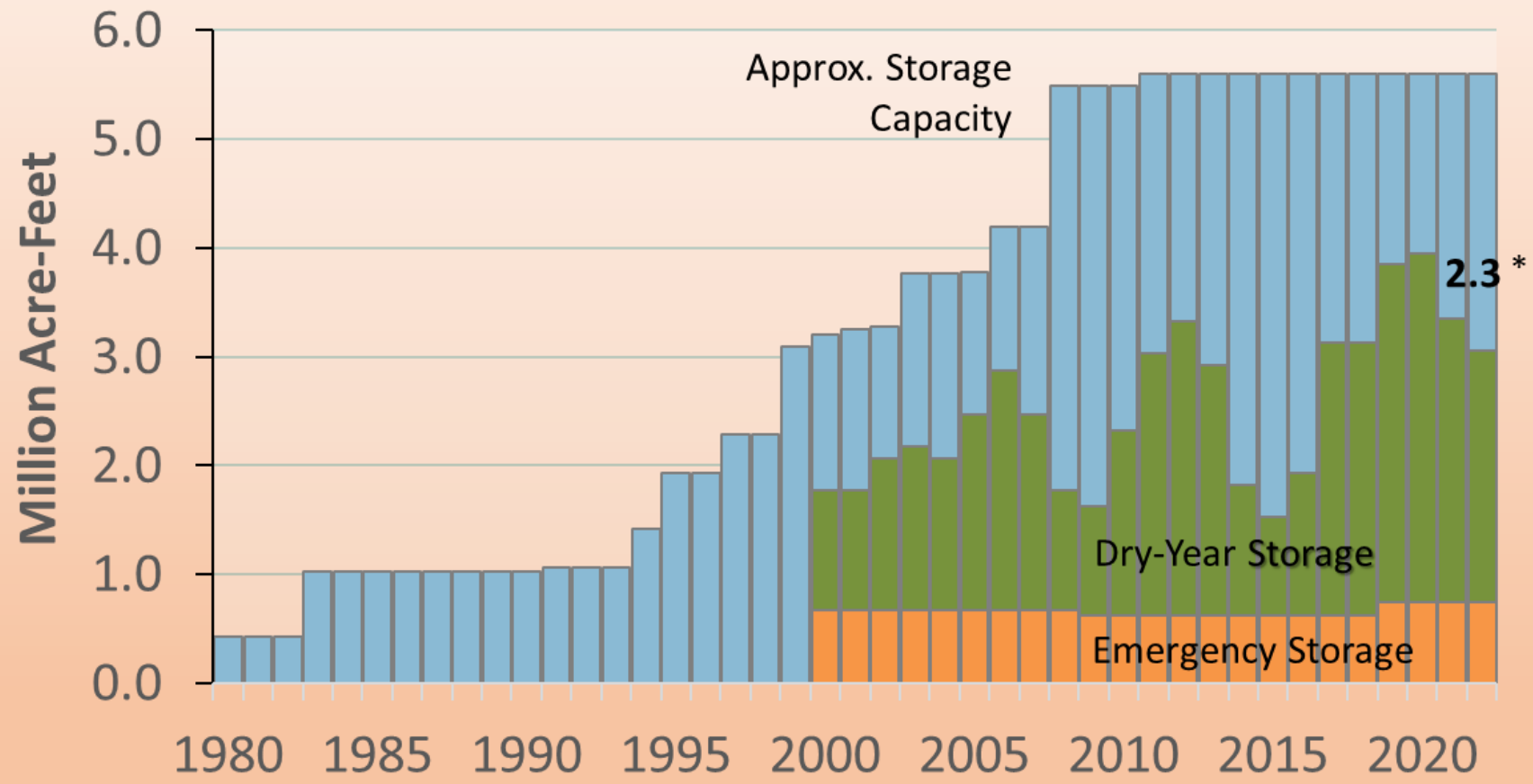
# Exposing a Vulnerability to Regional Reliability

New actions are tackling SWP Dependent Area reliability, but more must be done



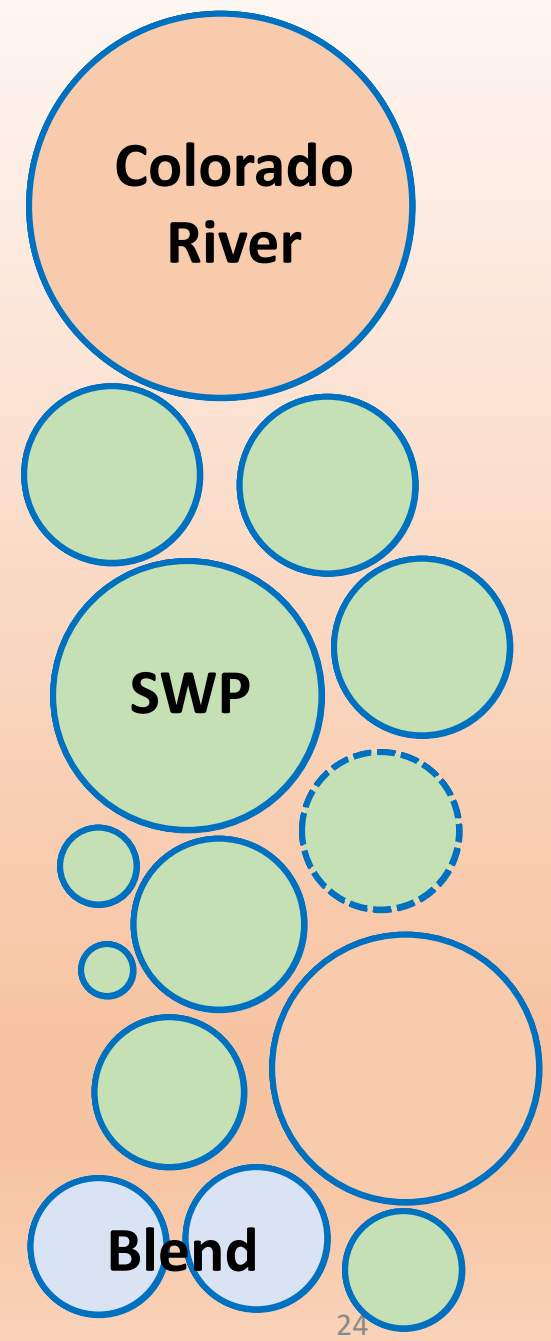


# Storage provides great benefit, but is not immune to changing conditions

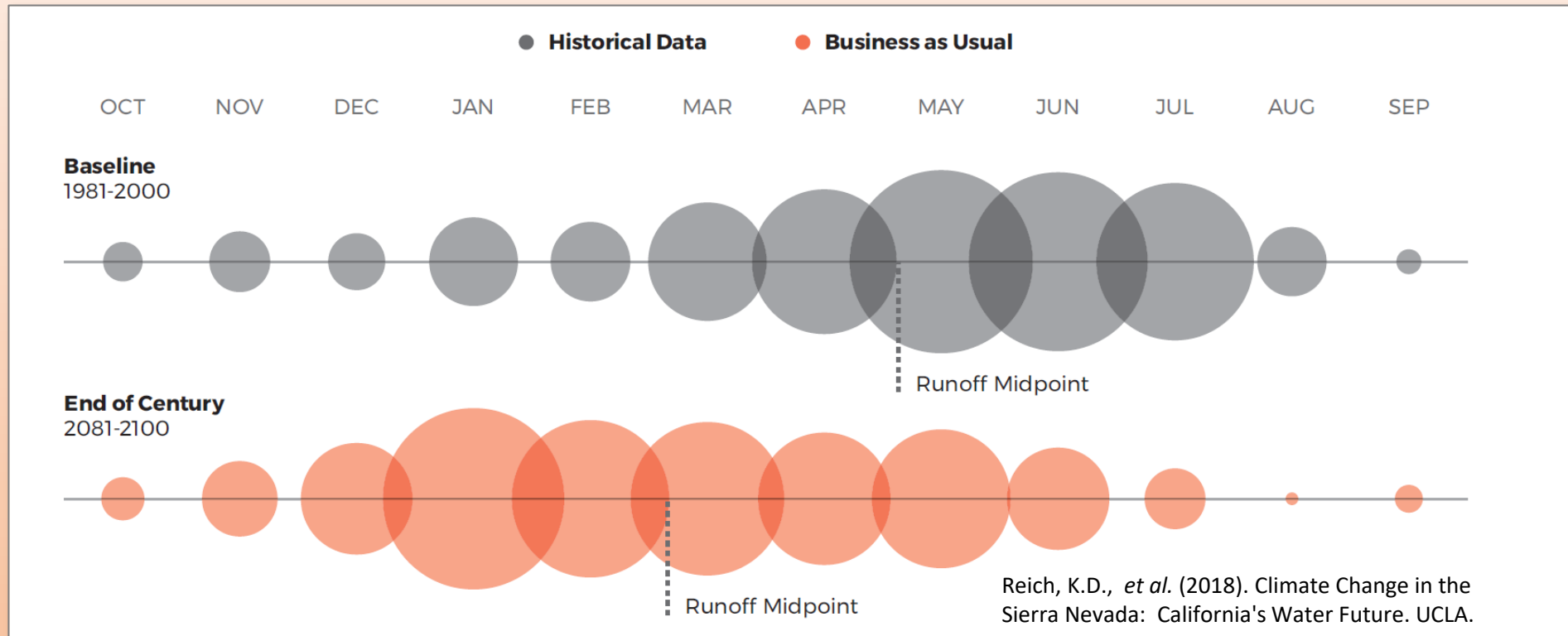


IRP Needs Assessment Identified Challenges and Opportunities

\* 2022 EOY Estimate

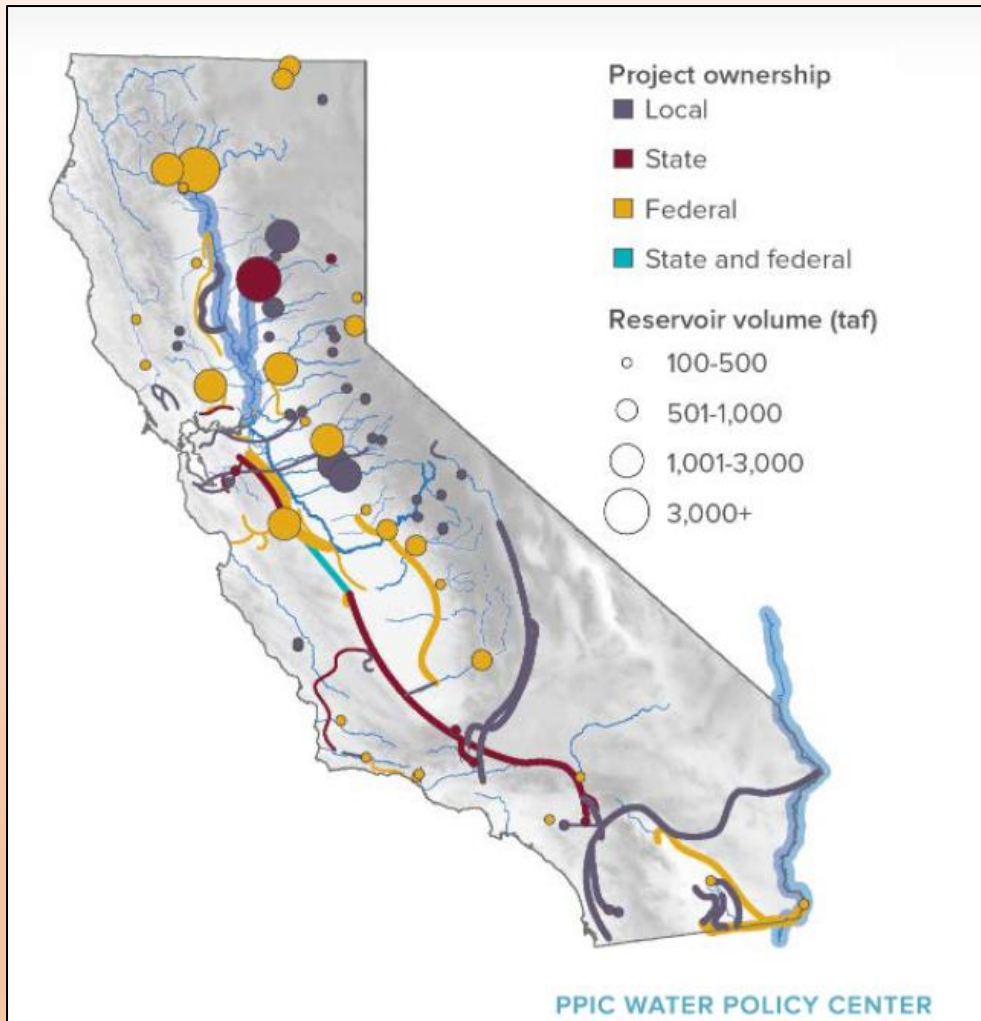


# Climate change stresses the water grid feeding our storage



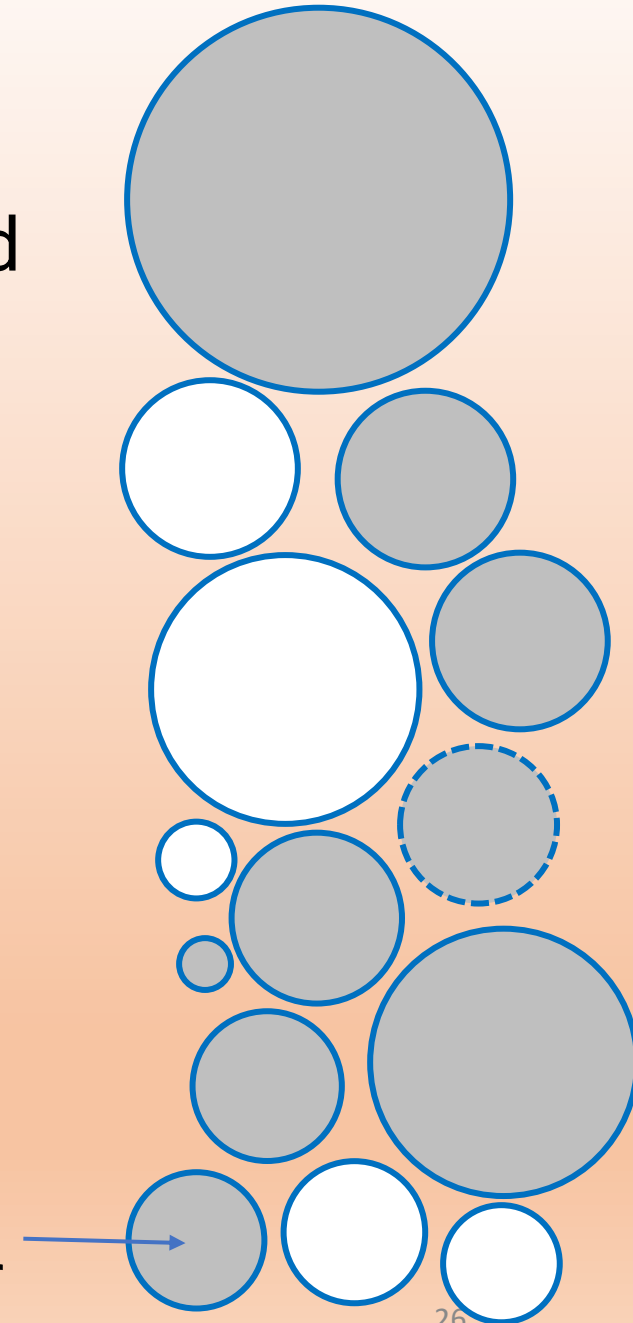
- Less snow/more fire
- Big atmospheric river events get bigger
- Flooding increases dramatically
- Dry years (probably) get drier

# Preserving storage requires action

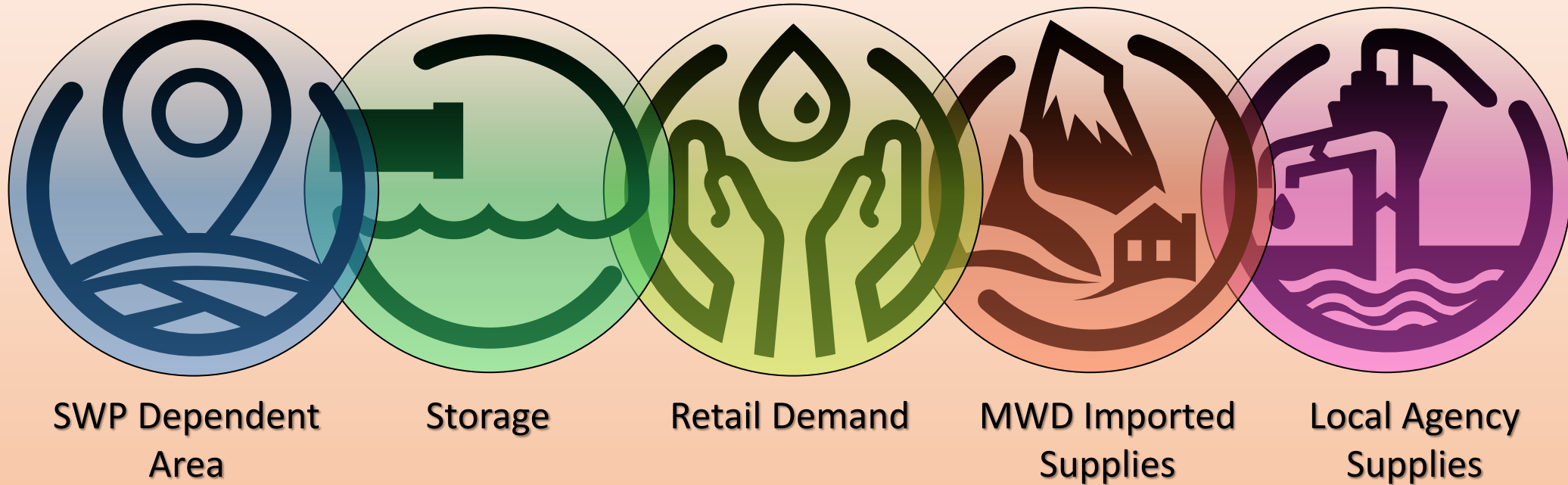


- Modernize the state and regional water grid
  - Connect storage to demand
  - Ensure replenishment in wet years
- Adapt to contaminants and invasive species
- Renegotiate storage agreements

Agreements expiring in  
2037 or earlier

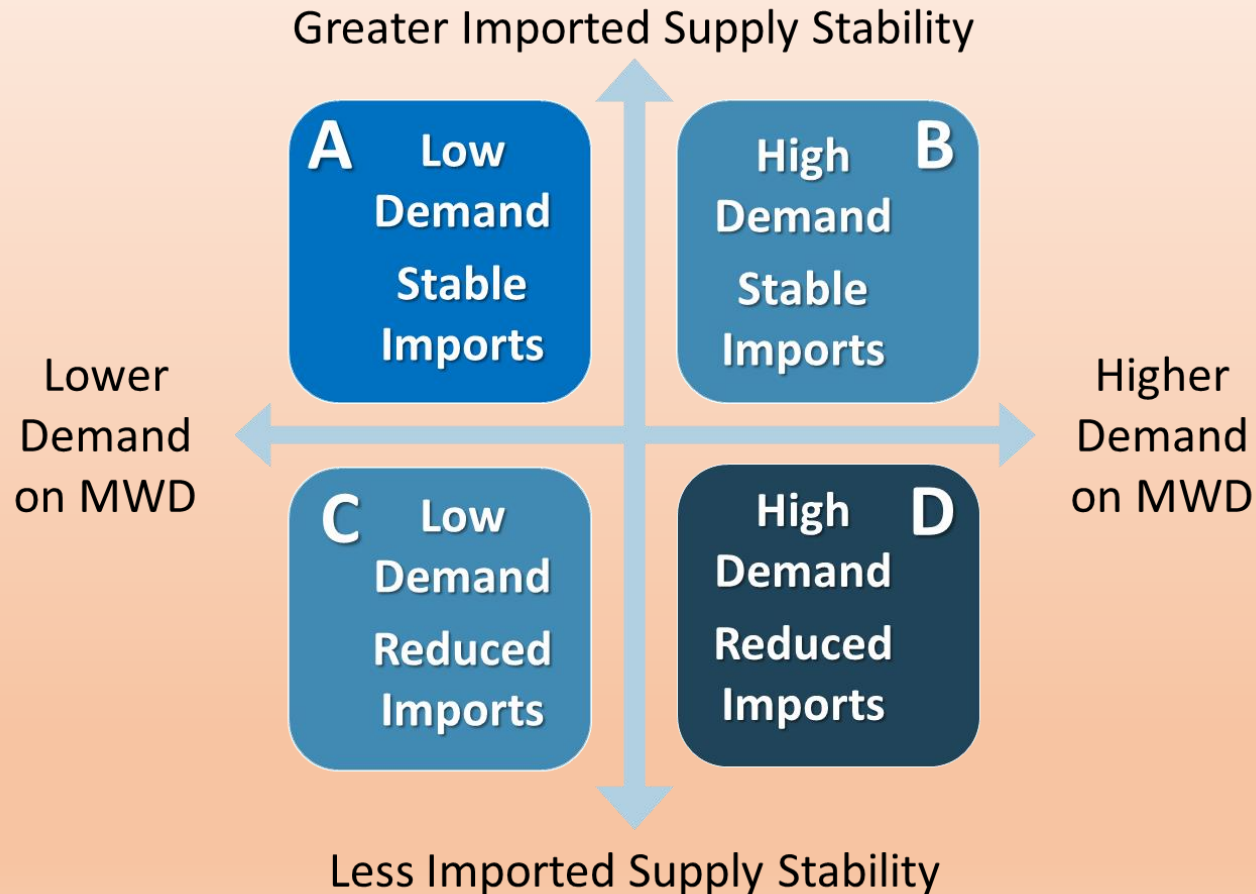


# IRP needs assessment identified vulnerabilities and findings



- Surplus/Shortage - Quantified for each scenario
- Portfolio Categories - Examined for effectiveness
- Findings - Grouped into five focus areas

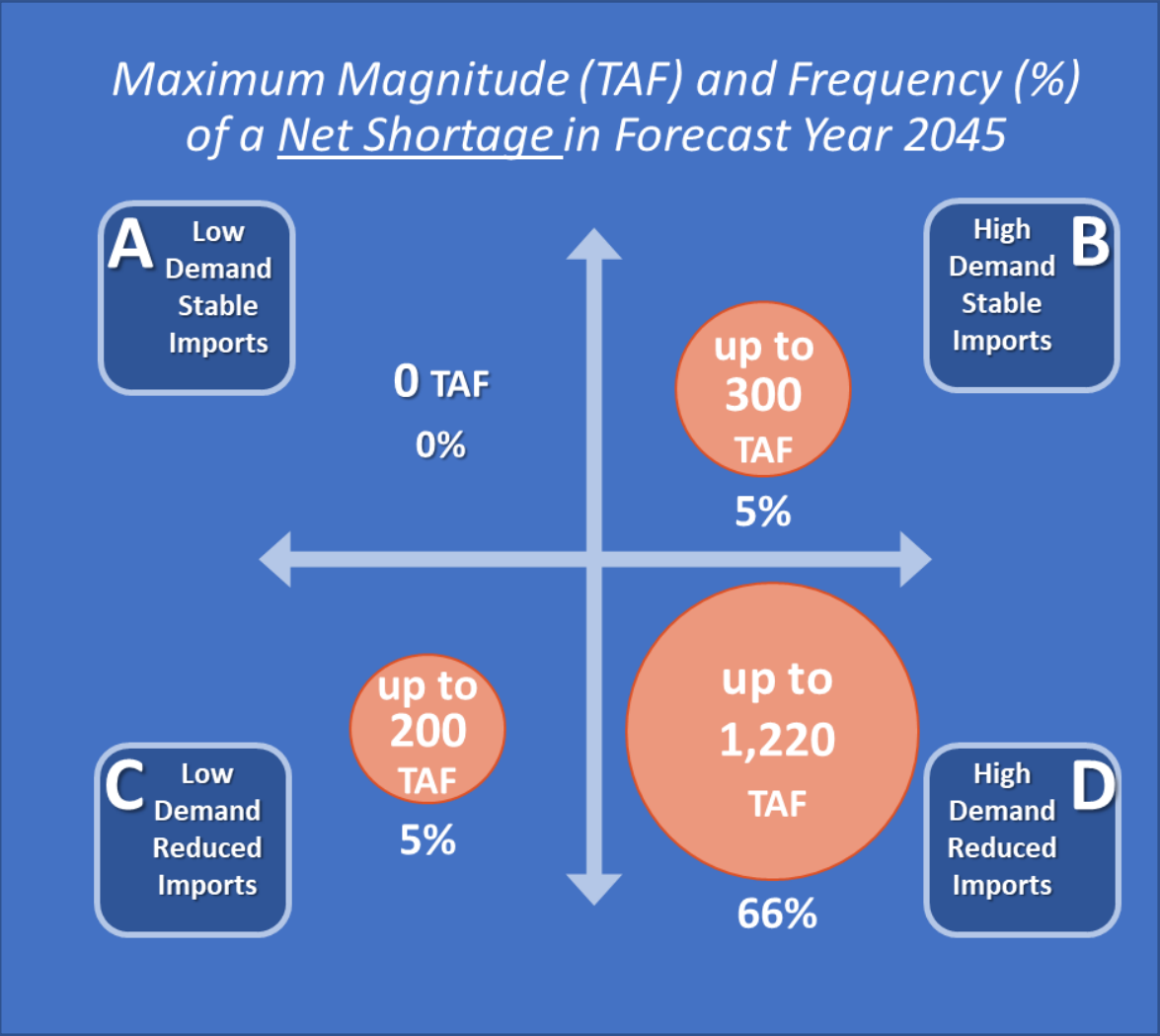
# 2020 IRP scenarios encompassed wide range of climate outcomes



- **State Water Project**  
Used DWR's severe impact analysis with additional 25% degradation by 2035
- **Colorado River**  
Used severe climate change (RCP 8.5); 26% decrease in runoff; 4.5% increase in evaporation by 2045
- **Local Agency Supplies**  
Adjusted groundwater yields;  
Adjusted Los Angeles Aqueduct supply;  
Increased frequency/intensity of extreme wet/dry years



# IRP needs assessment rang an alarm for action—and opportunity

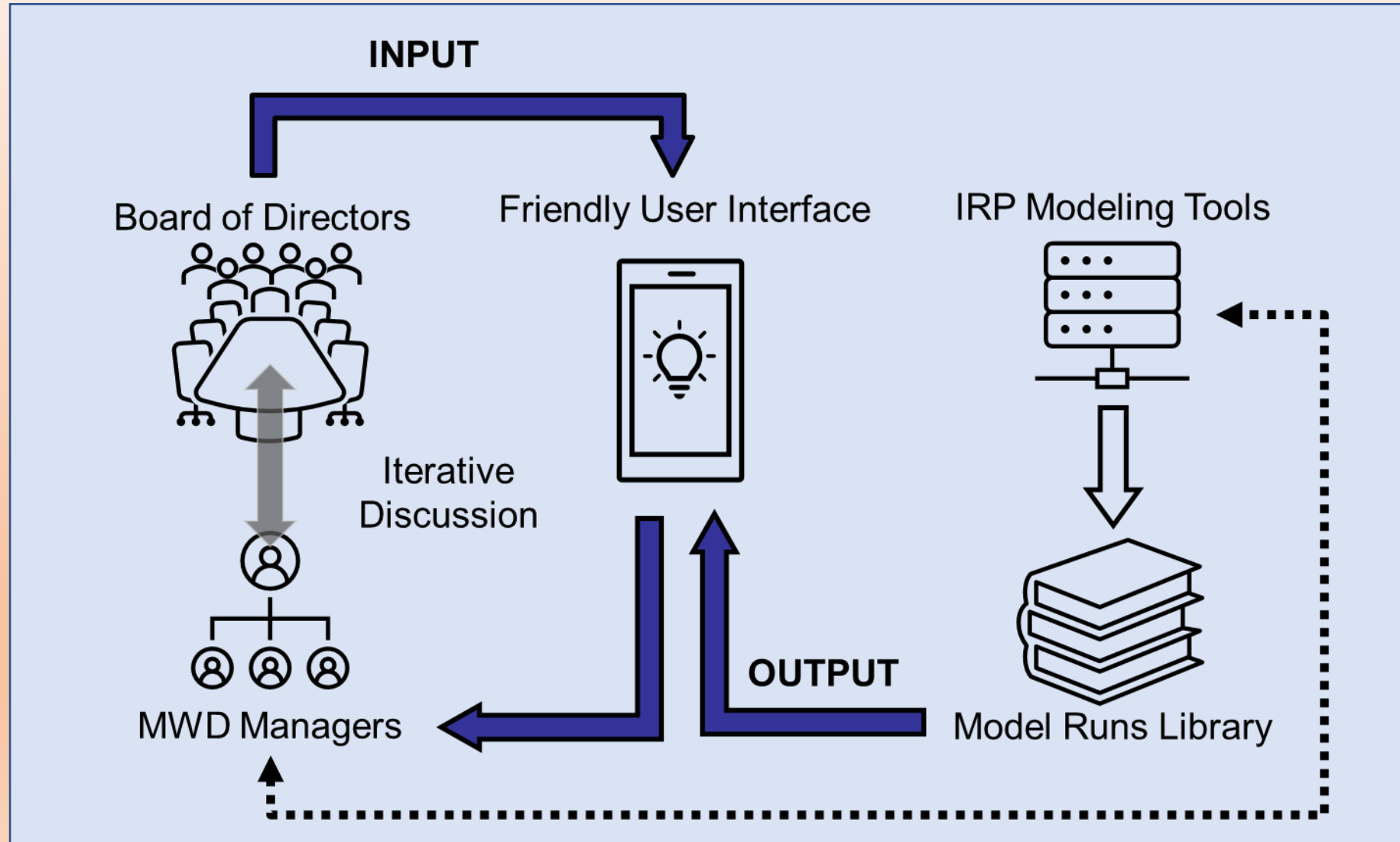


| Scenario D Modeling |                                 |
|---------------------|---------------------------------|
| New Storage (AF)    | Core Supply Needed by 2045 (AF) |
| 0                   | 650,000                         |
| 100,000             | 600,000                         |
| 250,000             | 550,000                         |
| 500,000             | 500,000                         |

# IRP implementation objectives

- Fully use analysis and tools from Phase 1 Assessment
- Develop user/process interface to structure and respond to Board questions
- Identify policy/strategy choices and tradeoffs to simulate under current and future scenarios
- Refine elements and investment options under assessment targets

# IRP implementation objectives



# What does Climate Action look like?

## Reduce Emissions

- Inventory, track and measure GHGs
- Commit to be carbon neutral
- Public-facing dashboard to be transparent
- Focus on electricity use and new renewable energy sources

## Build Resilience

- Evaluate projects and programs through a climate lens
- Plan to be integrated, redundant, flexible, adaptable
- Empower the workforce and protect assets
- Adopt an adaptive business model

## Ensure Equity

- Manage supplies and operations to protect the most vulnerable
- Maximize external engagement

## Embrace Uncertainty

- Use best available and evolving science
- Conduct risk analyses
- Innovate
- Use adaptive management

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Research  
Definition of  
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Resilience is the capacity of any entity – an individual, a community, an organization, or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience.



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