

# Water system resilience in an uncertain climate future

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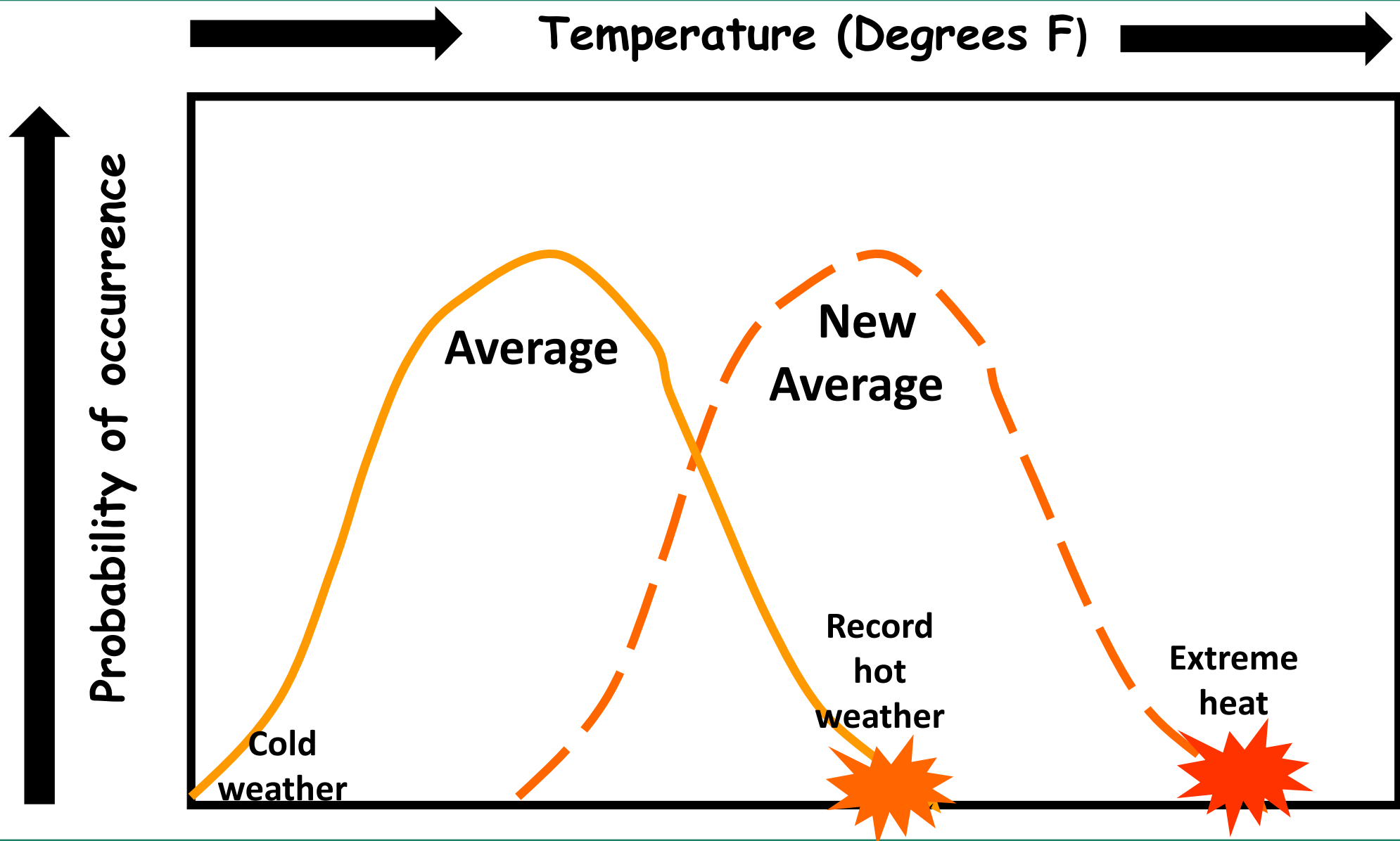
**AWWA Sustainable Water Management Conference**

**March 28, 2018**





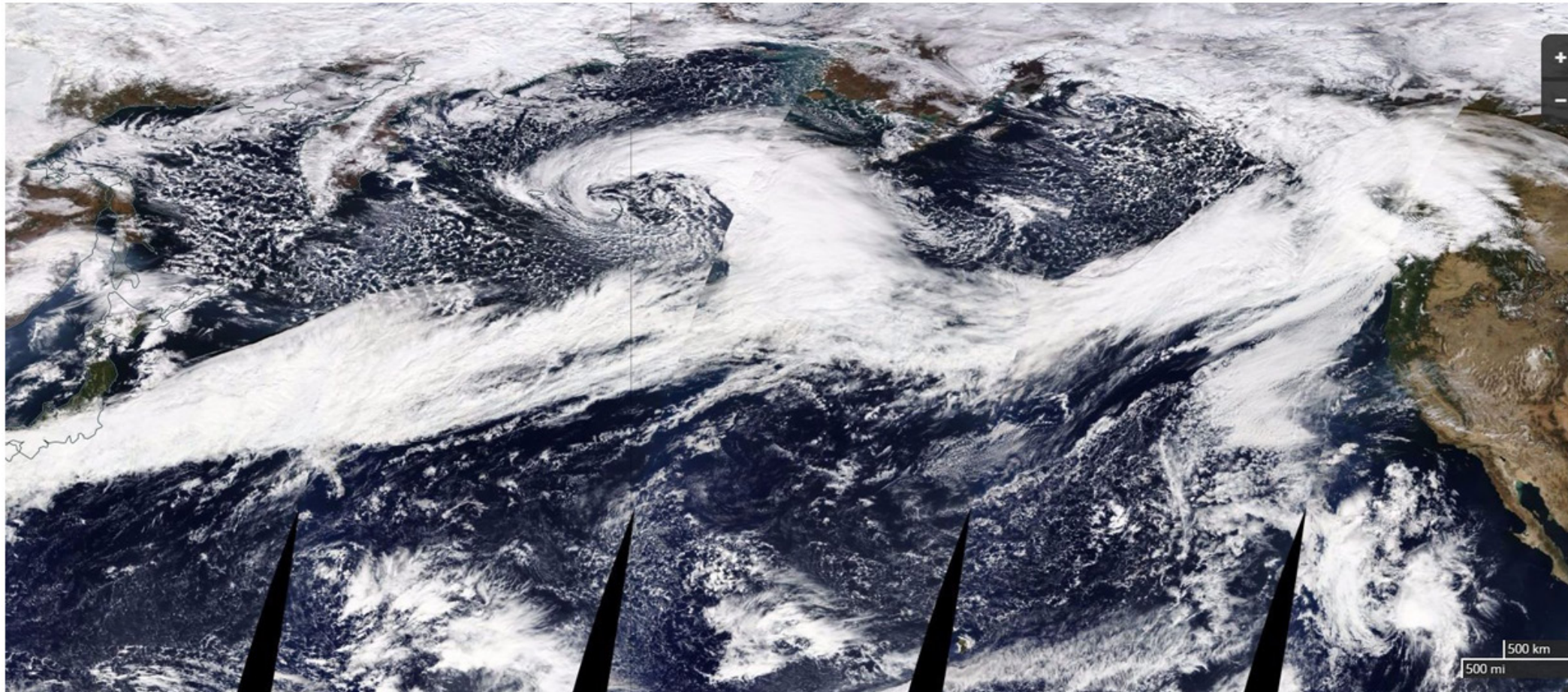
# Resilience challenge 1: Increased risk of failure



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## CW3E Atmospheric River Update – Outlook

Source: Center for Western Weather & Water Extremes, Scripps, UCSD



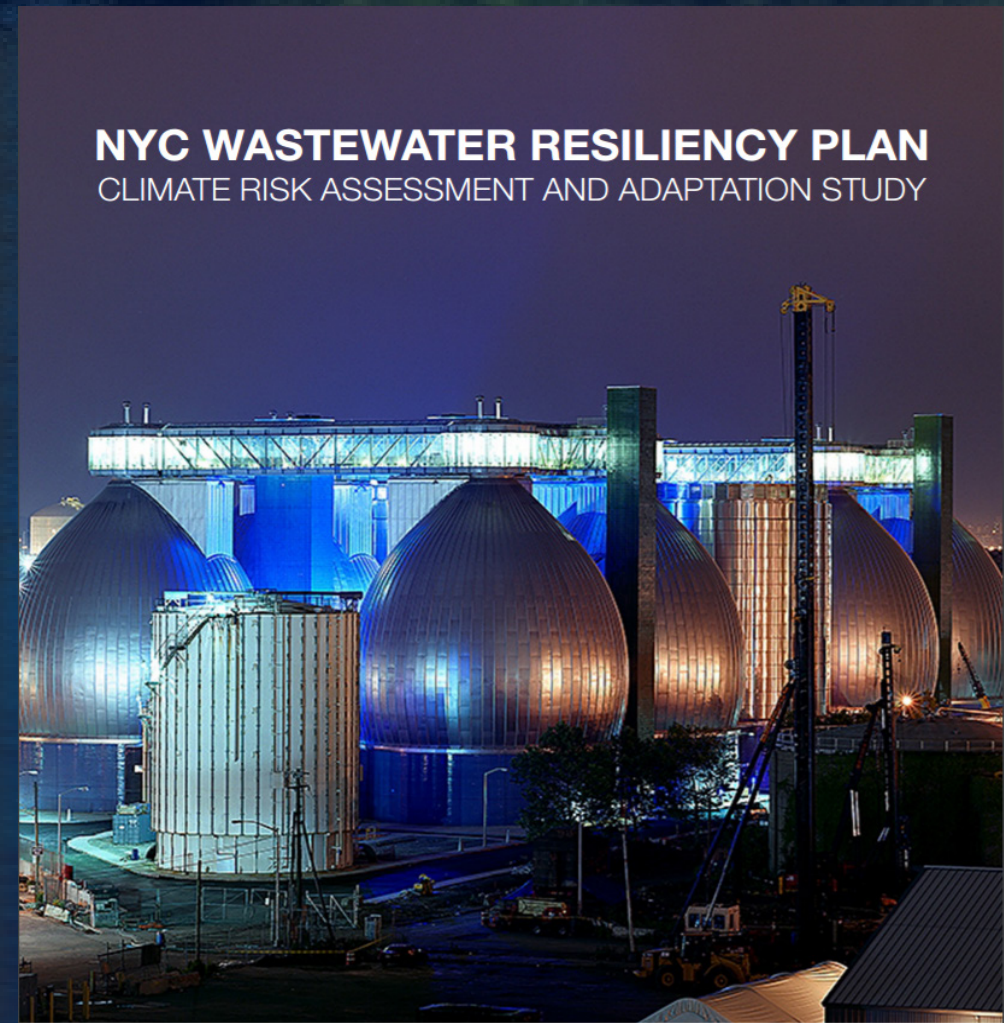
The synoptic scale configuration that is leading to these consecutive ARs over the Pacific Ocean is providing impressive satellite imagery that exhibits a cloud band that spans the entire northern Pacific Ocean (~5,000-miles). Photo credit NWS Seattle.



# Resilience strategy 1: Design for a range of extremes



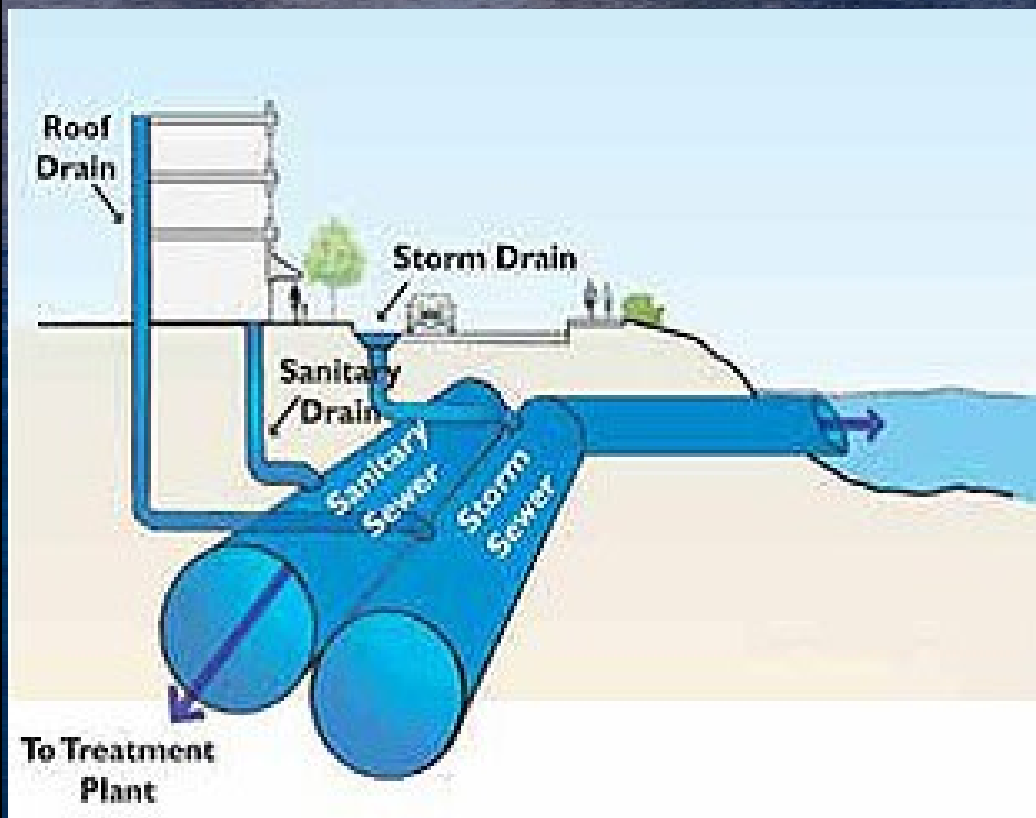
Tarrant Regional Water District



**NYC WASTEWATER RESILIENCY PLAN**  
CLIMATE RISK ASSESSMENT AND ADAPTATION STUDY

# Resilience strategy 1: Design for a range of extremes

Modify the System to Adapt to Climate Change	
	New infrastructure must accommodate expected sea level rise within the service life of the asset. (i.e., 16 inches by 2050, 25 inches by 2070, 55 inches by 2100).
	Existing infrastructure will be modified based on actual sea level rise.



## Climate Risks to Water Utility Built Assets and Infrastructure

A synthesis of interviews with national and international water utilities

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# Resilience challenge 2: A spectrum of impacts

Changing hydrology

Changing demand

Changing hydrology,  
warmer water temperatures

More extreme events  
(floods, heatwaves, SLR)

Water supply  
planning

CIP Planning

Operations &  
treatment

Asset  
management

Emergency  
preparedness

Maintenance  
& construction

Regulatory  
compliance

Finance &  
Rates

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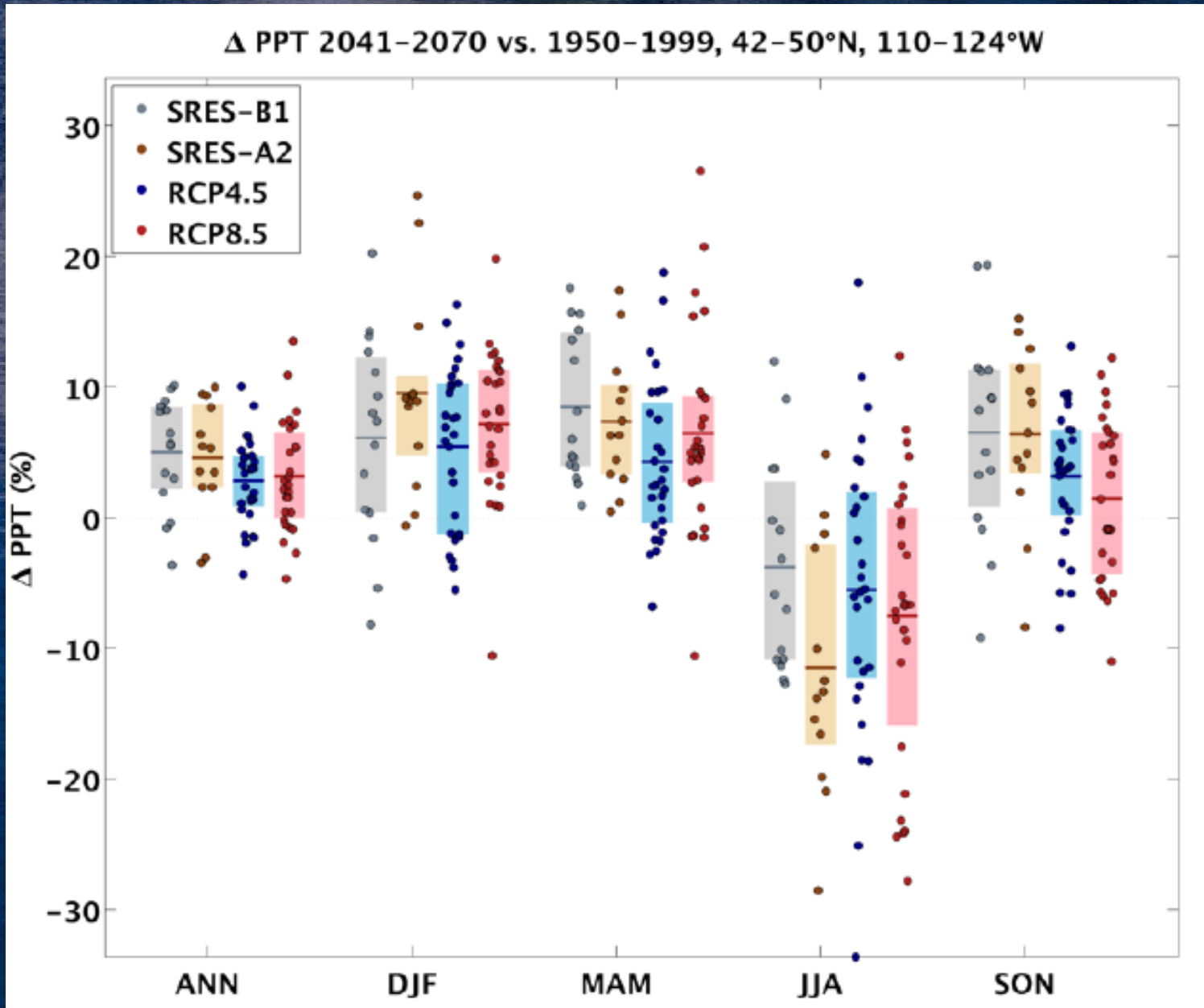
Warmer water temperatures

Credit ratings

# Resilience strategy 2: Build adaptive capacity



# Resilience challenge 3: Uncertainty

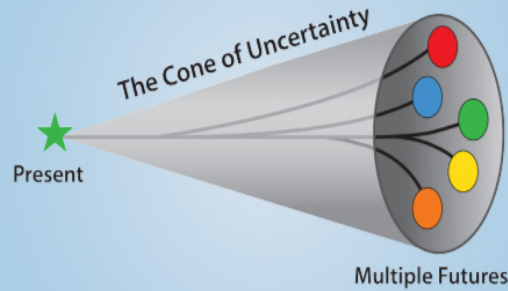




# Resilience strategy 3: Plan for multiple futures

## EMBRACING UNCERTAINTY

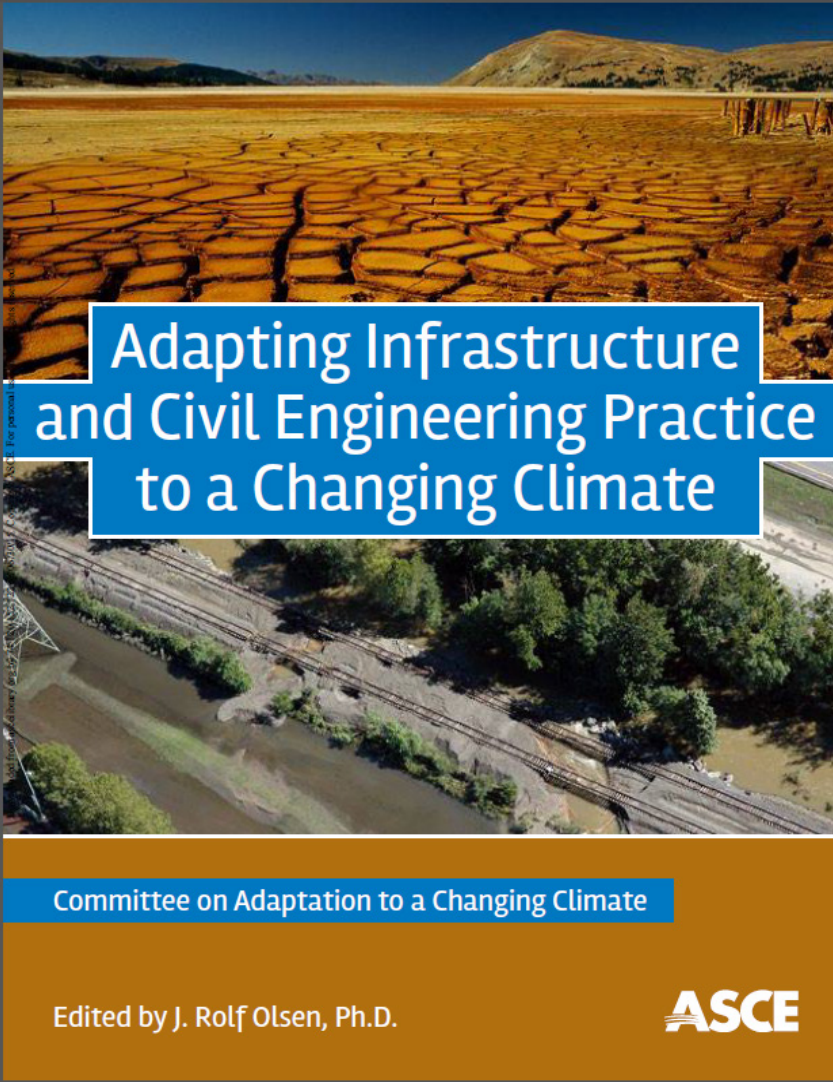
A Case Study Examination of How Climate Change is Shifting Water Utility Planning



Prepared for:

Water Utility Climate Alliance (WUCA)  
American Water Works Association (AWWA)  
Water Research Foundation (WRF)  
Association of Metropolitan Water Agencies (AMWA)

Project Manager: Laurna Kaatz, Denver Water

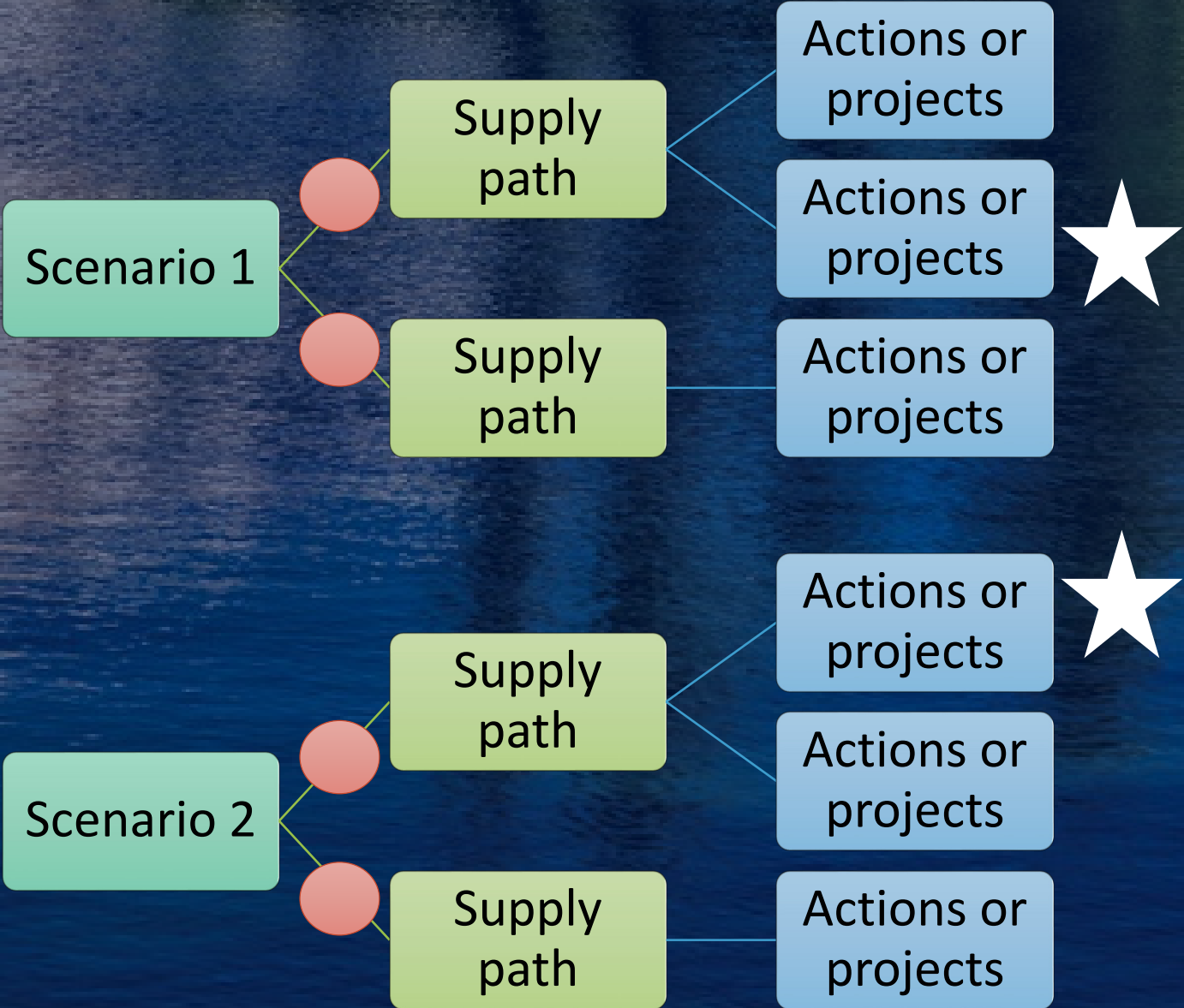


“Engineers should seek alternatives that do well across a range of possible future conditions.”

*Adapting Infrastructure and Civil Engineering Practice to a Changing Climate, Ed. Olsen, American Society of Civil Engineers, 2014*

<https://www.wucaonline.org/>

# Resilience strategy 3: Plan for multiple futures





## Climate resilience strategies:

1. Design for a range of extremes
2. Build adaptive capacity and expertise
3. Plan for multiple futures, and monitor conditions as they unfold