THE Water Research FOUNDATION

WRF WEBCAST

Mapping Climate Exposure and Climate Information Needs to Water Utility Business Functions

May 21, 2020 | 3:00 – 4:30 pm ET USA

WUCA
Water Utility Climate Alliance

Agenda

Topic	Presenter	Timing
• Introductions	• Maureen Hodgins – WRF • Laurna Kaatz – Denver Water	10 minutes
• Project Overview, Findings, and Insights	• Emily Wasley – WSP • Kathy Jacobs – University of Arizona	30 minutes
• Water Utility Project Partners Perspectives . . .	• Khuram Shah – San Diego Public Utilities Department • Tirusew Asefa – Tampa Bay Water • Keely Brooks – Southern Nevada Water Authority • Meagan Smith – City of Fort Collins Utilities	20 minutes
• Moving Beyond the Framework	• Emily Wasley – WSP	10 minutes
• Q&A		20 minutes

Webcast: Ask Questions & Event Resources

If you want to pursue PDH, email Michelle Suazo, msuazo@waterrf.org

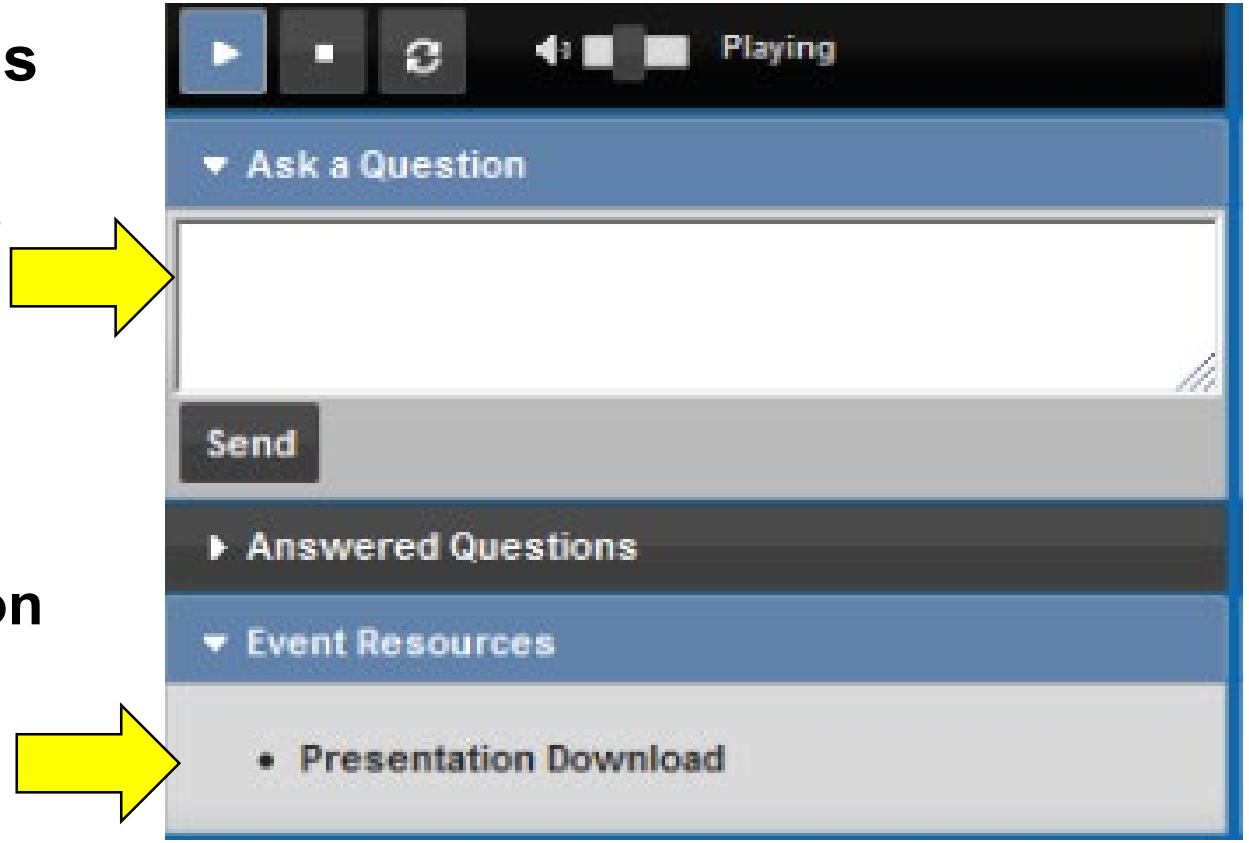
Input your questions during the webcast

Questions on connection difficulties will be answered right away.

I will ask your questions verbally to speakers in Q&A (last 15 minutes).

Now – you may download presentation

Recording will be available within 24 hours after webcast



WRF – 12 RFP Titles Announced

Full RFPs released in August 2020

https://www.waterrf.org/news/water-research-foundation-funds-12-new-projects-seeks-partners

12 projects including

- Holistic and Innovative Approaches for Flood Mitigation Planning and Modeling Under Extreme Wet Weather Events and Climate Impacts (5084), $100,000
- Case Studies on Management of Cross-Sector Dependencies (5086), $200,000 (related to System Level Resilience for Water Infrastructure)
- Developing a Framework for Quantifying Energy Optimization Reporting, $100,000

***Call for volunteers

- Project Advisory Committee, 6/8/20
- Utility Participants in Research, 6/26/20

WRF – Recent Publications

4636, An Integrated Modeling and Decision Framework to Evaluate Adaptation Strategies

4637, Impacts of Climate Change on Honolulu Water Supplies and Planning Strategies for Mitigation

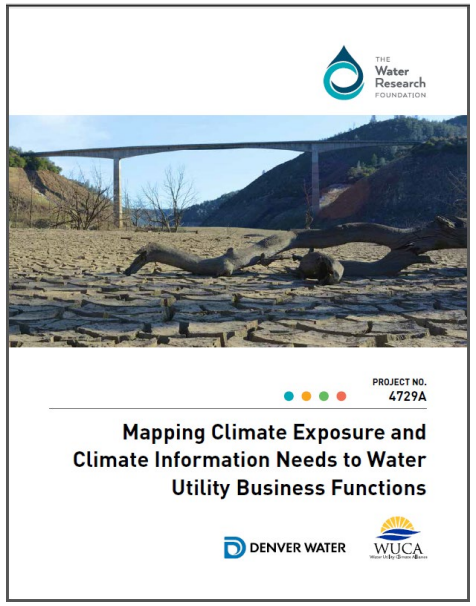
5001, Climate-Resilient Planning for Urban Stormwater and Wastewater Utilities: Workshop Proceedings

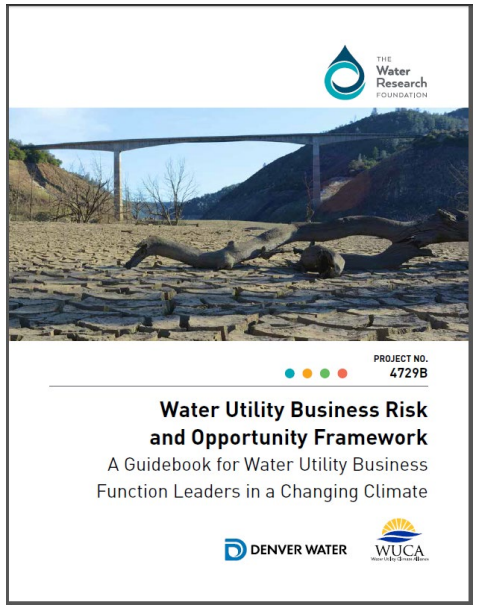
WRF – Ongoing Work

4734, Real-Life Enterprise Resilience (complete 2020)

4842, Enhancement of Resilience to Extreme Weather and Climate Events: Proactive Flood Management (in contracting, complete 2022)

4798 to 4802, Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC); https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/10616/report/0





4729 Products

- Research Report
  - Executive Summary
  - Appendix E
- Guidebook
- Climate Data and Information Spectrum for Case Studies (excel file)

How to Access

Free to public

WRF website (need to login)

https://www.waterrf.org/research/projects/mapping-climate-exposure-and-climate-information-needs-water-utility-business

WUCA website (no login needed)

https://www.wucaonline.org/publications/index.html

Water Utility Climate Alliance

http://www.wucaonline.org

Vision: Climate-resilient water utilities, thriving communities

Mission: Collaboratively advance water utility climate change adaptation

Mainstream and Operationalize Integrate climate change into water utility business practices	Increase climate literacy within member utilities
	Research when and how to use climate information in utility decisions and business practices
	Document mainstreaming practices

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Project Funders and Research Team

WRF Project Advisory Committee
- **Laurna Kaatz**, Denver Water
- **Erica Brown**, Association of Metropolitan Water Agencies
- **Patrick Davis**, Orange Water & Sewer Authority
- **Alexis Dufour**, San Francisco Public Utilities Commission
- **Maureen Holman**, DC Water

WRF Research Manager
- **Maureen Hodgins**, WRF

Principal Investigator
- **Emily Wasley**, Cadmus (now w/ WSP)

Co-principal Investigator
- **Kathy Jacobs**, University of Arizona

Core Research Team
- **Jeremy Weiss**, University of Arizona
- **Morgan Richmond**, Cadmus
- **Karen Sklenar**, Cadmus
- **Ashley Arayas**, Cadmus

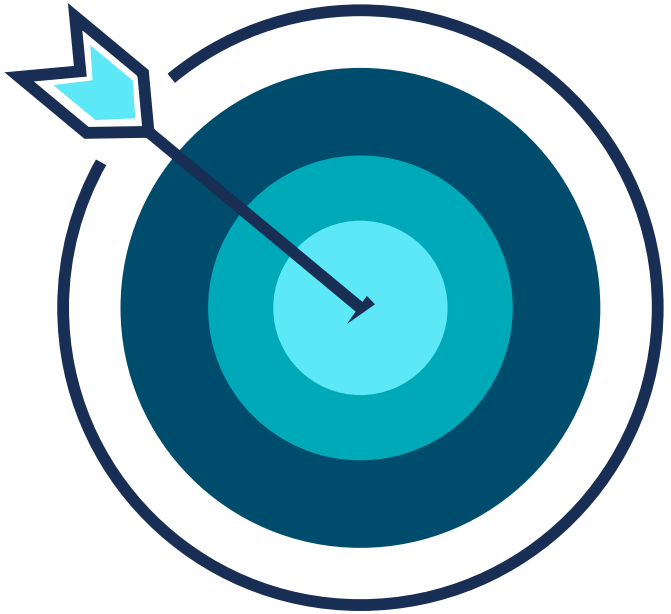
Water Utility Practitioner Group
- **Shannon Halley**, Austin Water
- **Meagan Smith**, City of Fort Collins – Utilities
- **Alan Cohn**, New York City DEP
- **Laura Briefer**, Salt Lake City Corporation
- **Khuram Shah**, San Diego Public Utilities Department
- **Keely Brooks**, Southern Nevada Water Authority
- **Tirusew Asefa**, Tampa Bay Water

Technical Advisory Group
- **Ray Hoffman**, Cascade Water Alliance
- **Chuck Clarke**, Cascade Water Alliance
- **T.C. Richmond**, Cascade Water Alliance
- **Jeff Lukas**, Western Water Assessment
- **Beth Gibbons**, American Society of Adaptation Professionals
- **Marie Pearthree**, Water Utility Management Expert
- **Jeff Arnold**, Climate and Water Scientist
- **Missy Stults**, Private Contractor

Project Overview

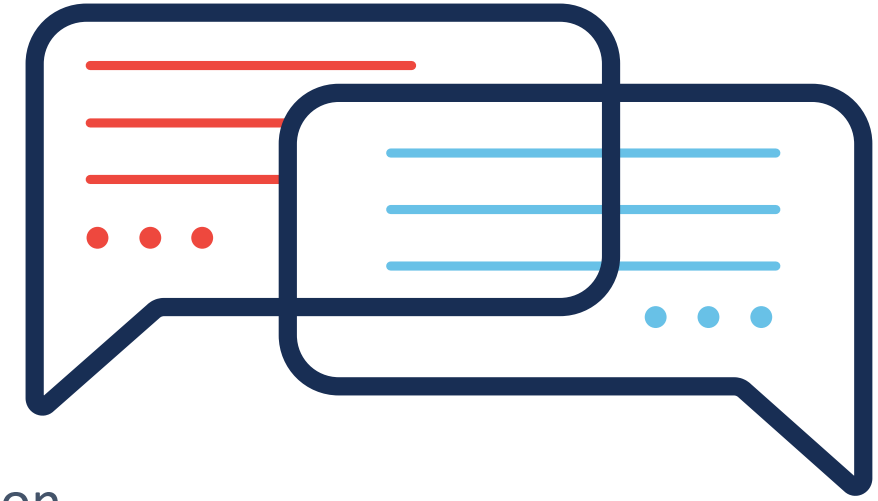
Goal

Develop a comprehensive, enterprise-level framework for understanding the exposure and sensitivities of water utility business functions to a changing climate and for accelerating the mainstreaming of climate considerations into utility management.



Project Overview

Outputs



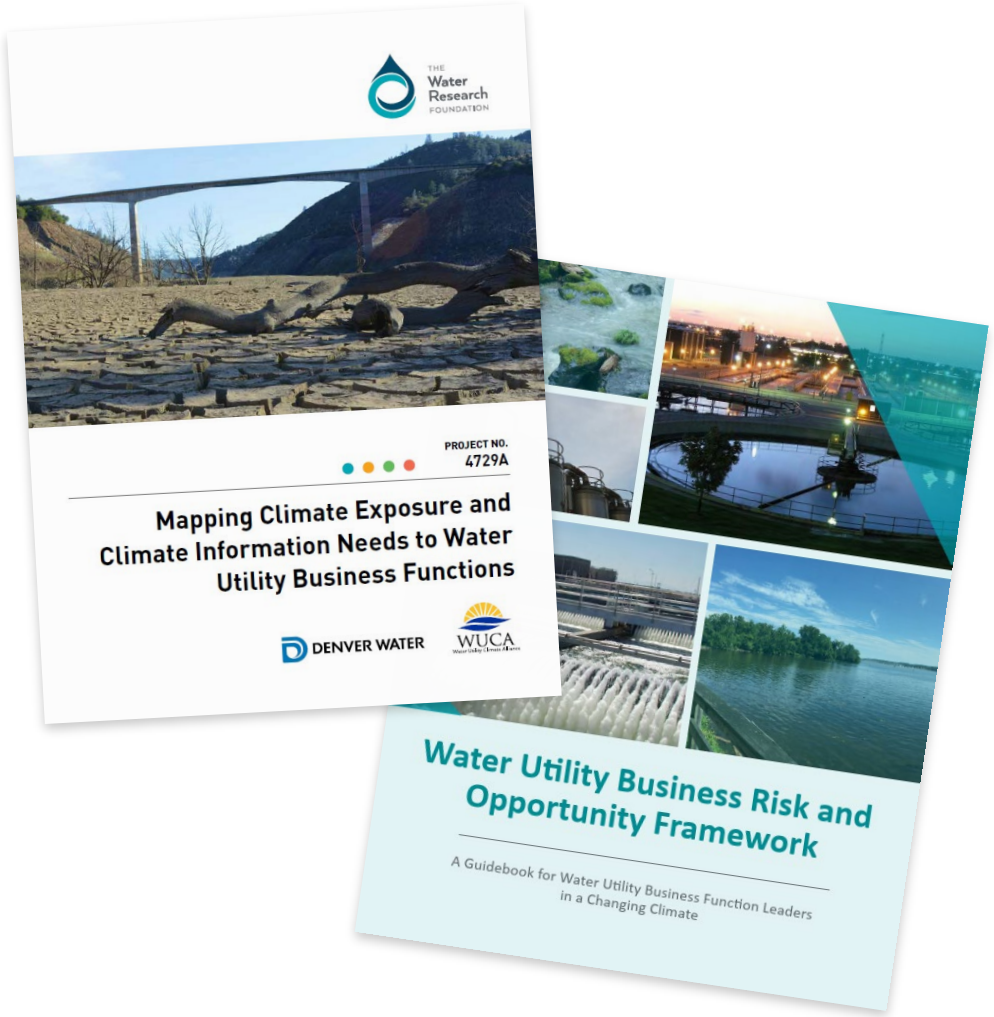
The research team conducted interviews and virtual workshops with seven utilities to achieve the following:

- Developed a suite of common water utility business functions.
- Identified “critical” paths within each business function to be analyzed.
- Assessed the potential risks and opportunities of climate drivers to affect the critical path of water utility business functions.

Project Overview

Outputs

- Compiled relevant climate data and information for business functions.
- Designed a flexible and replicable framework, the ***Water Utility Business Risk and Opportunity Framework*** and associated guidebook, ***Water Utility Business Risk and Opportunity Framework: A Guidebook for Water Utility Business Function Leaders in a Changing Climate***.
- Tested the framework through four case-study utilities.



Key Research Findings

Assessing and mainstreaming climate-related risks and opportunities across critical business functions within water utilities is in its infancy

- Most water utilities have not assessed climate change risks and opportunities from a business function perspective; rather, if considered at all, climate risks and opportunities usually focus on water supply and flood control issues.
- Mainstreaming climate risks and opportunities across water utility business functions is in its infancy; historic or more recent extreme weather events drive actions on assessing climate-related risks and opportunities; regulatory requirements can incentivize considerations of climate risk management with utilities.

Senior leadership with engagement and collaboration across critical business functions is critical to successful relationship building

- Leadership within the utility is critical to innovation and preparedness.
- Bringing an array of utility business function representatives together offers multiple benefits.

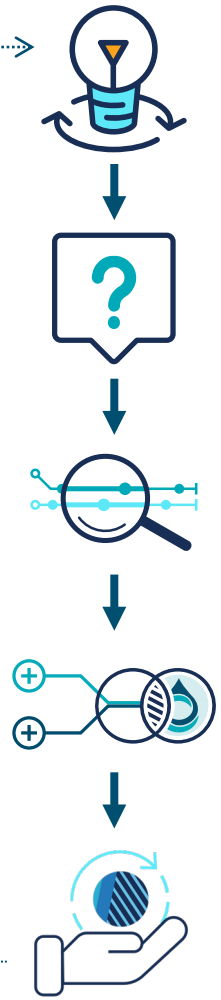
Key Research Findings

Identifying the appropriate and relevant scale, timeframe, and type of climate data remains a challenge	• Length of planning horizon varies across and within utilities making assessments and preparations for climate risks more difficult for utilities with short planning horizons. • Knowing how to find the climate data and what data type, scale, and timeframe to use in evaluating business functions' risk and/or opportunity can prove daunting. • Anticipating extreme weather conditions can be far more challenging than identifying climate trends. • Decision-making under uncertainty remains a challenge.
Taking a co-production approach is essential for true collaboration and continued relationship building	• The process and conversations associated with mapping business functions prove much more important than the maps themselves. • The co-production process is essential.
Starting with assessing underlying conditions before assessing climate drivers is imperative	• Mapping climate drivers and underlying conditions to critical decisions or requirements for business functions leads to a more integrated, systems-based understanding of risks and opportunities.

Key Research Findings

With every risk, there are opportunities	• For almost every risk identified, a potential adaptation strategy or opportunity could minimize the risk's impact.
Guidance is needed to update design standards and integrate acute and chronic climate impacts across water utility business functions	• Improving or updating design standards and protocols to incorporate changing conditions is critical. • A genuine need exists for guidance and implementation of integrated, long-range, capital improvement and financial planning for acute and chronic climate impacts across water utility business functions (mainstreaming risk and resilience).
This framework should align with a utility's comprehensive Effective Utility Management (EUM) program	• This climate risk-based business function assessment should be included as one element of a utility's comprehensive EUM program.

The Framework



STEP 1: Define the focus for risk and opportunity assessment

STEP 2: Ask key questions

STEP 3: Identify key risks relative to mission-critical business functions

STEP 4: Identify and prioritize risks and opportunities across business functions

REGULARLY ASSESS RISKS AND OPPORTUNITIES

Step 1:

Define the Focus for a Risk and Opportunity Assessment

STEP 1a:
Identify all water utility business functions and sub-functions

STEP 1b:
Identify a cross-functional team of representatives

STEP 1c:
Identify existing resources, expertise, and capacity for risk assessment and management

STEP 1a:

Identify all water utility business functions and sub-functions

WATER-SPECIFIC BUSINESS FUNCTIONS

Drinking Water

- Drinking water treatment (sub business function)
- Drinking water distribution

Water Supply

- Conservation
- Drought planning/water shortage stage management
- Seawater desalination
- Recycled water/effluent management
- Reservoir and surface water management
- Groundwater management
- Wholesale water supply

Wastewater

- Wastewater collection
- Wastewater treatment
- Biosolids management

Water/Environmental Monitoring and Management

- Groundwater and surface water quality/management
- Watershed management/land management
- Stream rehabilitation
- Ocean water quality monitoring
- Environmental monitoring
- Environmental compliance

Stormwater Management

- Flood control
- Drainage basins and infrastructure
- Stormwater quality

OTHER BUSINESS FUNCTIONS

Business Affairs, Accounting and Human Resources

- Contracts, business services, recordkeeping, and billing
- Finance and insurance
- Rate setting, charges and fees
- Grant preparation and management
- Human resources, employment, and staff training
- Asset inventories and tracking

Procurement

- Energy procurement and management
- Procurement of goods and services

Planning, Modeling, Forecasting and Analysis

- Water supply planning
- Water demand planning
- Sustainability planning
- Forecasting and analysis

External Affairs

- Customer service (residential, commercial)
- Public education and outreach
- Community relations and advocacy
- Legal services, legislative and regulatory affairs
- Cross-agency coordination
- Communications
- Emergency management/hazard mitigation

Engineering, Design, and Construction

- Infrastructure planning
- Construction

Operations

- Asset management
- Infrastructure maintenance
- Field operations
- Meter reading and maintenance
- Security (physical, computer, and data)
- Information technology
- Laboratory services

Select Critical Business Functions and Associated Sub-functions from the Four Case Study Utilities

City of Fort Collins – Utilities	San Diego Public Utilities Department	Southern Nevada Water Authority	Tampa Bay Water
Stormwater Management Forecasting, water quality management, design and maintenance of collection and storage infrastructure, floodplain management, land use planning and development, regulation	**Drinking Water Treatment and Delivery** Treatment facilities, facility maintenance, pipelines, physical and chemical treatment of raw water, remedial treatment for impaired water, reuse of municipal effluent, stormwater runoff quality, upstream watershed conditions	**Administration** Customer care and field services, Environmental, Health, and Safety and security, human resources, information technology, public services	**Physical and Cyber Security** Communications, physical plant management, information technology, detection, sensors, supervisory control and data acquisition systems (SCADA)
Asset Management Lifecycle analysis, service levels, reliability, maintenance standards, infrastructure development, mapping, strategic planning, data collection	**Water Supply** ***Key Function: Operational Considerations within San Diego's Local Storage/Reservoir System)*** Water supplies, groundwater rights, reservoir water supply and storage agreements with county, water rights agreements with Colorado River water, prioritization process for water purchases, native water, imported water prices, water supply availability	**Engineering and Operations** Energy management, engineering, infrastructure management, operations, resources and facilities, water quality and treatment	**Drinking Water Treatment and Distribution** Incoming water quality, treatment facility capacity, treatment technology, distribution system, storage, treatment type (physical and chemical), monitoring, desalination
Engineering and Design Surveying, sizing, layout, design standards	**Staff Experience and Training** Staff operations, risk protocols, operating manuals, capital improvements management, engineering training and protocols, staff outreach, projections, scenarios, integrated long-range planning	**Finance** Accounting, financial services, purchasing and rate structures	**Engineering, Design, and Construction** Construction standards, construction specifications, constructability of assets, site selection, design standards, material selection, useful life analysis, physical construction

STEP 1a:

Case Study Examples

Example Cross-Functional Water Utility Representatives

Title and Division
Director, Procurement
Managing Director, Integrated Water Management or Water System Management and Operations
Project Manager, Water Supply Planning and Water Supply Assessments
Policy Analyst, Climate Change
Manager, Planning and Decision Support
Engineer, Water Resources
Deputy Director, Long Range Planning
Deputy Director, Environmental Monitoring & Technical Services
Chief Financial Officer
Manager, Legal Services
Director, Human Resources
Manager, Information Technology
Deputy Director, Public Services and Customer Relations

STEP 1b:

Identify a cross-functional team of representatives

Example Resources for Climate Risk Assessment and Management

Scale	Resource Type
Utility	Long-Range Water Resource Plans
	Urban Water Management Plans
	Water Supply and Demand Studies
	Climate Resilience Evaluation and Awareness Tool (CREAT) 2.0
	Climate Change Sensitivity, Risk, or Vulnerability Assessments or Studies
	Integrated Modeling Projects
Local	Local University Climate Centers/Advisory Panels and Climate Action Plans
	City or Community Vulnerability, Risk, and/or Resilience Assessments or Plans
	Local, City, or County Climate Action Plans
	Local Hazard Mitigation Plan
	Corporate Sustainability or Responsibility Plan/Strategy (these occasionally include or have been informed by materiality, risk, and/or vulnerability assessments with findings and actions that can be useful to review)
State	Technical State Climate Summaries
	States at Risk Reports
	State Hazard Mitigation Plans
Regional	Third National Climate Assessment (2014)
	Fourth National Climate Assessment, Volume 2: Impacts, Risks, and Adaptation in the United States
	Fourth National Climate Assessment, Volume 1: Climate Science Special Report
International	Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report
	Country-level Vulnerability Assessments, Climate Profiles, and/or Adaptation Plans
Federal	Climate Resilience Toolkit: Water Resources Dashboard; Drought Response and Recovery; and Flood Resilience
	U.S. Department of Agriculture (USDA) Cooperative Extension System and Climate Hubs
	U.S. Department of the Interior (DOI) Climate Adaptation Science Centers
	National Oceanic and Atmospheric Administration (NOAA) Climate Program Office, Regional Climate Centers, and Regional Integrated Sciences and Assessment Programs

STEP 1c:

Identify existing resources, expertise, and capacity for risk assessment and management

Currently Available Climate-Related Resources by Case Study Jurisdiction

	Precipitation	Temperature	Drought	Storms	Flooding	Sea Level Rise/Storm Surge	Tropical Cyclones	Air
Tampa Bay Water	29	24	11	7	7	7	9	7

	Precipitation	Temperature	Drought	Wildfire	Storms	Runoff
Fort Collins Utilities	36	28	16	12	9	9

	Precipitation	Temperature	Drought	Wildfire	Humidity
San Diego PUD	40	29	17	14	4

	Precipitation	Temperature	Drought	Wildfire	Storms	Flooding
Southern Nevada Water Utility	36	27	17	10	7	7

**Represents number of currently available resources by water and climate driver*

STEP 1c:

Identify existing resources, expertise, and capacity for risk assessment and management

Step 2:
Ask Key Questions

STEP 2a:
With the team, discuss the underlying conditions and vulnerabilities within the business functions

STEP 2b:
Discuss what climate change-related drivers you already care about most

STEP 2c:
Discuss how the underlying conditions and vulnerabilities identified above might intersect with climate drivers you already know about, leading to significant impacts for business functions

Ask The Climate Question:

How are the assets, people, resources, activities, and/or projects within your business function affected, either negatively (risks) or positively (opportunities) by climate change today and into the future?

STEP 2a:

With the team, discuss the underlying conditions and vulnerabilities within the business functions

- What underlying conditions and existing sources of vulnerability are you dealing with within the business functions at your utility?
- What are the climate change drivers (historic, current, and future) you are already most worried about?
- How do existing vulnerabilities and climate drivers affect the operation and functionality of your critical business functions?

STEP 2b:

Discuss what climate change-related drivers you already care about most

STEP 2c:

Discuss how the underlying conditions and vulnerabilities identified above might intersect with climate drivers you already know about, leading to significant impacts for business functions

Example Business Functions and Mapped Climate Impacts

Business Function		Impacts from Climate Change
	**Administration**	• Intensity of heat and flood events from extreme storms put employees and communication systems at risk
	External Affairs	• Increased need to apply for hazard mitigation and resiliency funding • Following major events, External Affairs is called upon to communicate to public, state, Federal, and municipal decision-makers • Opportunities to communicate with customers and disclose each utility's future planning processes
	Employee Education	• Uncertainties about future climate conditions can impair a utility's ability to consider risks in large-scale planning
	**Engineering Design, Construction, and Operations**	• Wildfires, extreme heat, and drought require more energy and costs to pump and treat water before distribution to customers • Failure to consider climate change projections in design and throughout master planning could have serious impacts on critical business functions and the ability to meet demand • Cost-effective management of equipment requires robust material analyses as climate-related uncertainties persist • Cascading impacts from flooding and algal blooms have affected operations as infrastructure has required extensive repairs
	Physical and Cyber Security	• Field electronics and servers are sensitive to increased heat, humidity, and precipitation
	**Finance**	• Intensity of drought and unstable economic futures resulting from extreme temperatures in the region could reduce the utility's consumer base due to inhospitable living conditions • Bond rating impacts are associated with revenue loss from drought restrictions
	Asset Management	• Increased frequency of extreme climate-related events may increase asset maintenance and replacement costs • Infrastructure cracking and failure may result from aridification
	Procurement	• Major events spur a rush to procure disaster clean-up services to respond to infrastructure challenges
	Business Affairs	• Extended drought and conservation efforts reduce water demand and impact revenue, resulting in required rate structure adjustments

STEP 2b:

Discuss what climate change-related drivers you already care about most

STEP 2c:

Discuss how the underlying conditions and vulnerabilities identified above might intersect with climate drivers you already know about, leading to significant impacts for business functions

Example Business Functions and Mapped Climate Impacts

Business Function	Impacts from Climate Change
Environmental Monitoring and Management	• Increased difficulty in balancing Clean Water Act compliance and adaptation measures • Increased spending to comply with the Safe Drinking Water Act
Stormwater Management	• Storm surge and sea level rise impact flood mitigation measures and a utility's stormwater system capacity • Precipitation intensity puts utility stormwater management systems at risk
Drinking Water Treatment and Delivery	• Sea level rise threatens water quality and existing delivery structures • Water quality and delivery become increasingly risk-prone as temperatures and storms become more intense
Water Supply	• Water supplies are increasingly exposed to pollutants from wildfires and high temperatures
Wastewater Treatment	• Employees have difficulty accessing major wastewater treatment plants during large flooding events
Planning, Modeling, Forecasting, and Analysis	• Utilities may need to consider a broader array of future conditions in planning, including changes in precipitation, temperature, and evaporation projections • Long-term climate projection trends and extremes may change

Step 3:

Identify Key Risks Relevant to Mission-Critical Business Functions

STEP 3a:
Identify the critical path activities, functions, and equipment for each business function

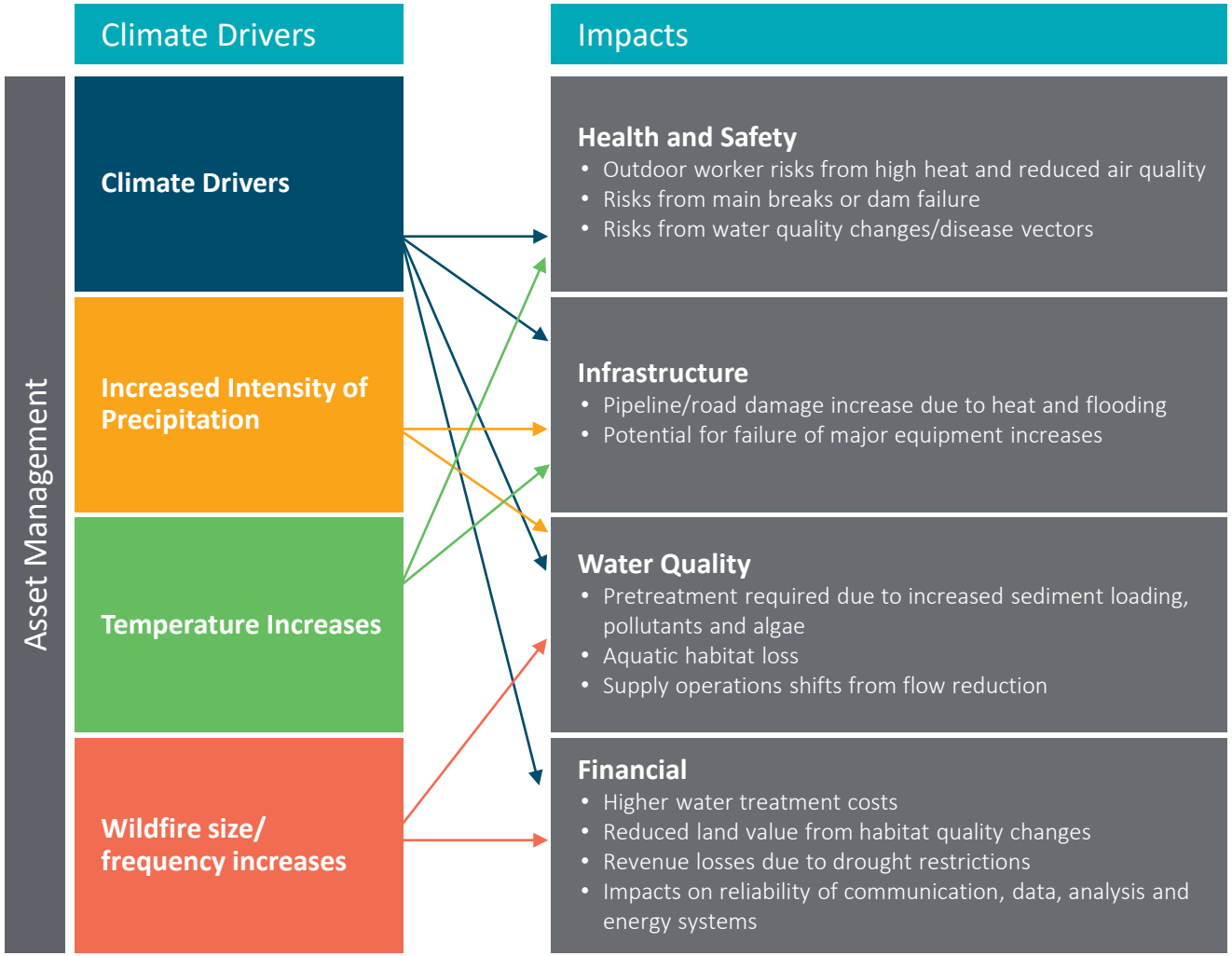
STEP 3b:
Map business functions to underlying conditions, climate drivers, and associated impacts

REPEAT UNTIL ALL BUSINESS FUNCTIONS HAVE BEEN MAPPED

Fort Collins Utilities

Asset Management

Sub Functions: Lifecycle Analysis, Service Levels, Reliability, Maintenance Standards, Infrastructure Development, Mapping, Strategic Planning, Data Collection



STEP 3:

Case Study Examples

Step 4:

Identify and Prioritize Risks and Opportunities Across all Business Functions

STEP 4a:
Compare climate drivers, impacts, and risks across business functions and establish a risk priority list

STEP 4b:
Identify the opportunities to manage impacts and/or create innovative services

STEP 4c:
Select business functions requiring further analysis

Fort Collins Utilities

Asset Management

Sub Functions: Lifecycle Analysis, Service Levels, Reliability, Maintenance Standards, Infrastructure Development, Mapping, Strategic Planning, Data Collection

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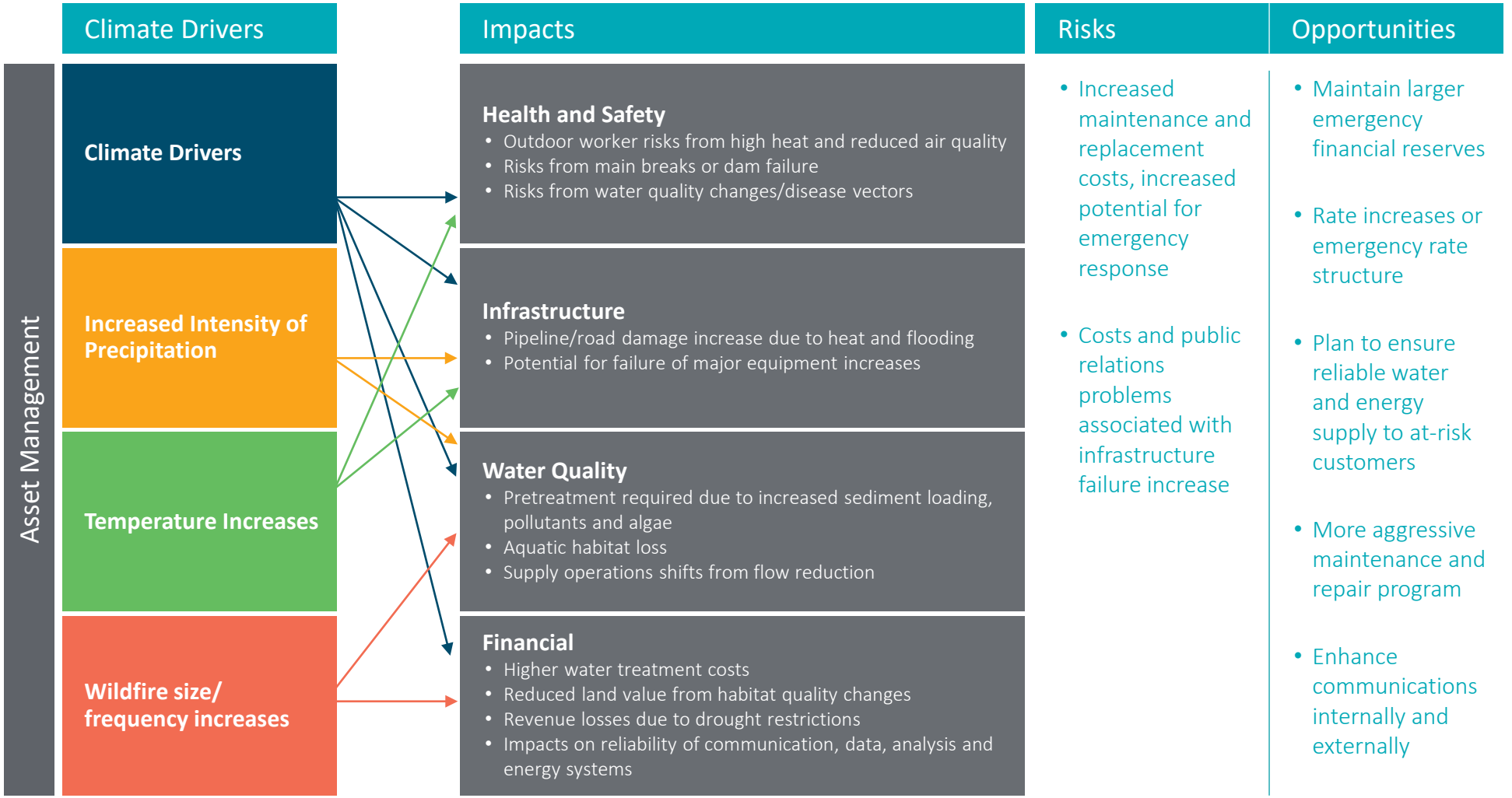
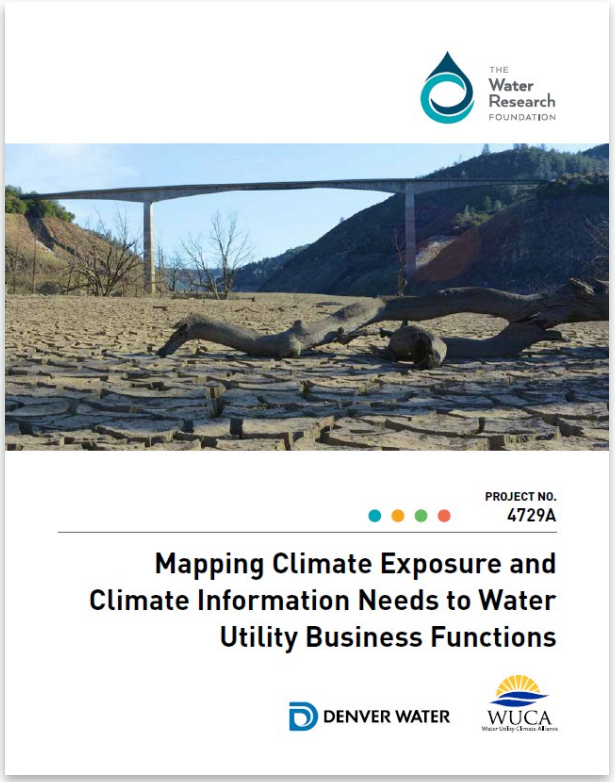
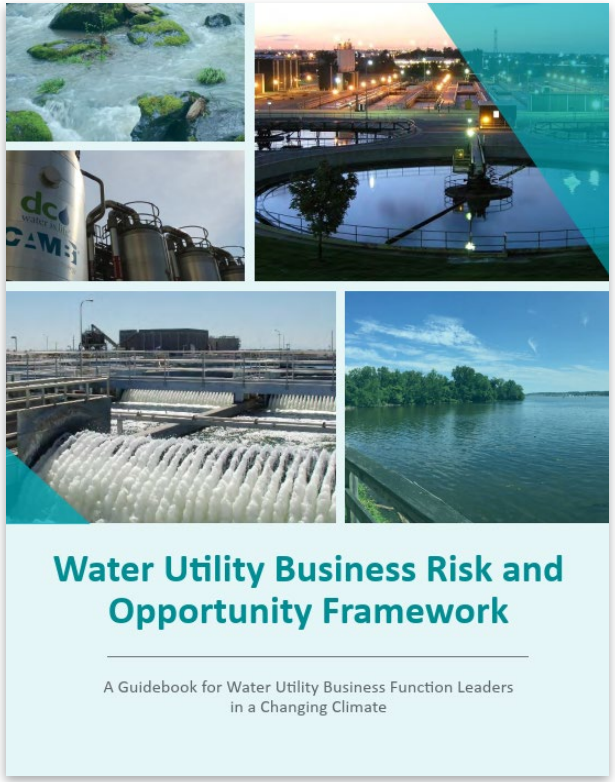


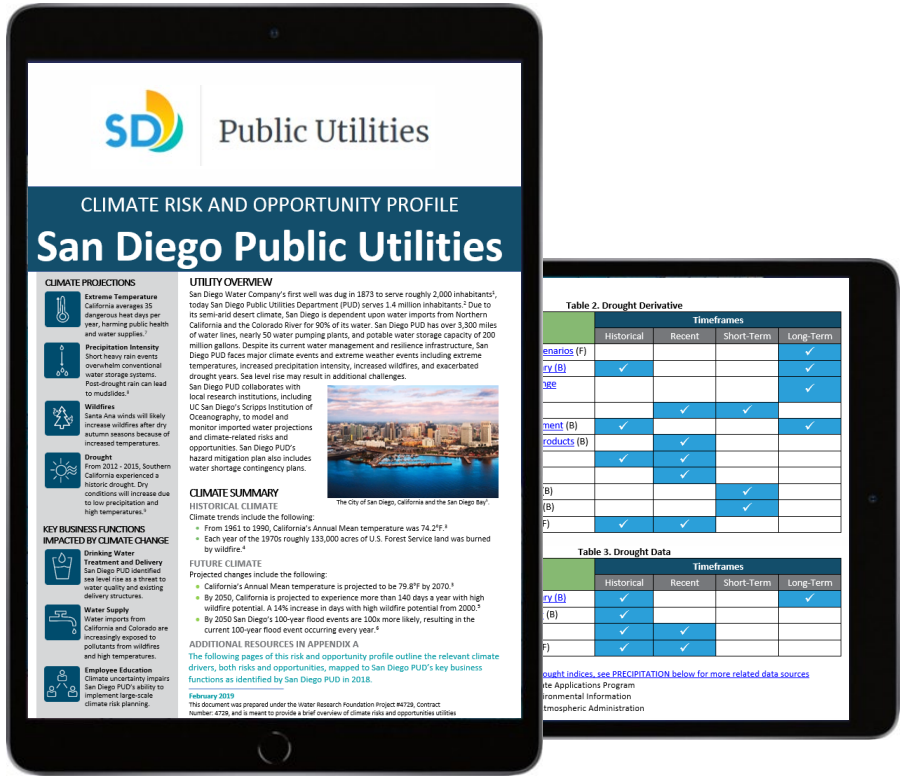
Project Resources



REPORT



GUIDEBOOK



CLIMATE RISK & OPPORTUNITY PROFILES

Feedback from our Partners

What was an eye opening for us through this project, was that we were able to see potential climate change impacts into different business functions that we may not have thought about before. We typically tend to concentrate climate change impact assessments on demand and supply. But it is much more than that.

Tirusew Asefa, Tampa Bay Water

All projects with opportunities for cross-departmental brain-storming sessions provide value to Utility planning efforts. This research process was no exception. It created the venue for targeted conversations around the risks of climate change to individual business unit operations, highlighting the need for coordinated efforts across the Utility departments.

Meagan Smith, City of Fort Collins Utilities

This project helped SNWA think beyond water supply impacts. It helped us think more broadly about how risks to the organization can change from climate change.

Keely Brooks, Southern Nevada Water Authority

The City of SAN DIEGO

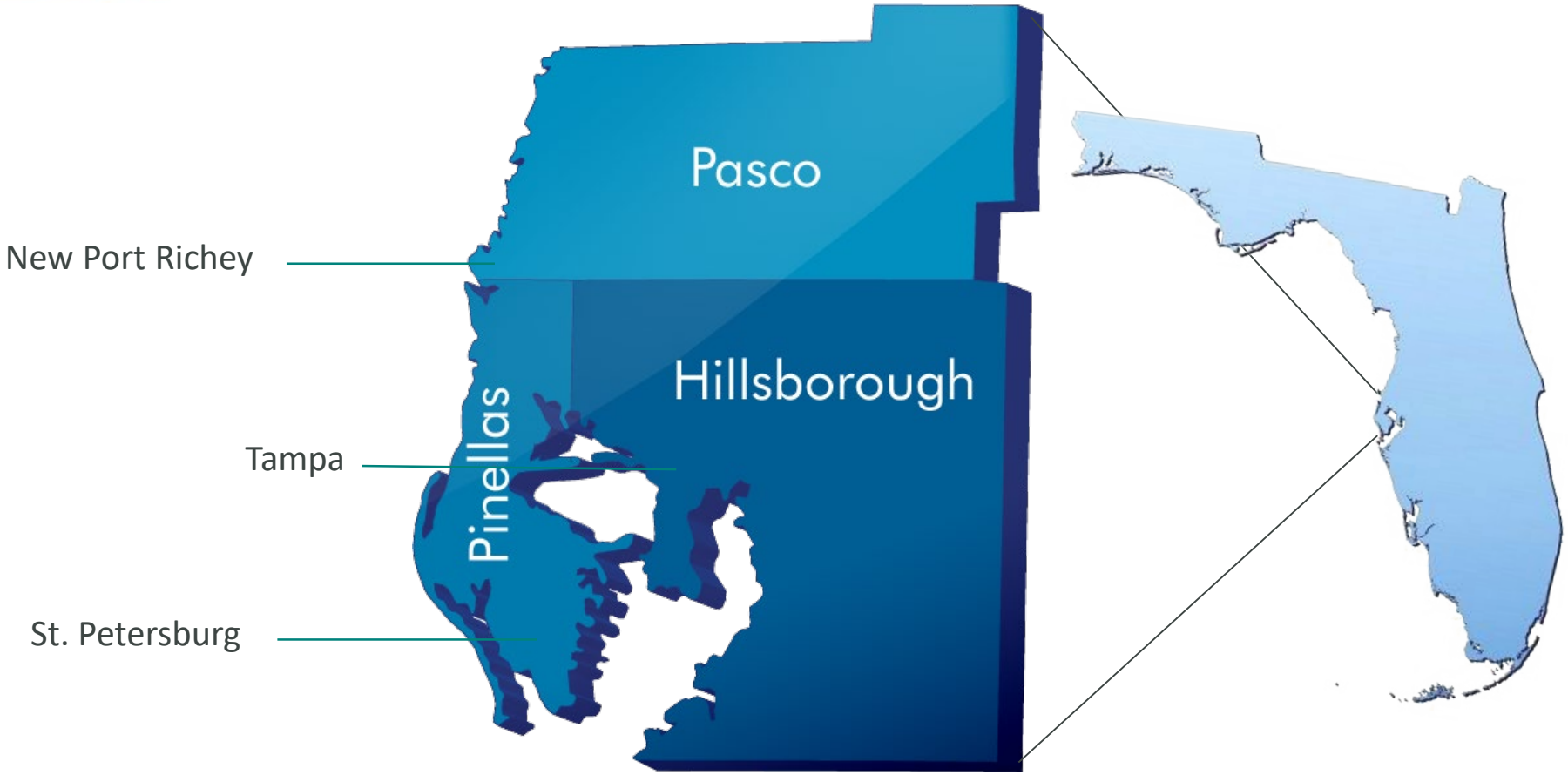
Khuram Shah
Water Planning, San Diego Public Utilities Department
khshah@sandiego.gov

Mapping climate exposure to utility business functions

Tirusew Asefa, Ph.D., P.E., D.WRE, F.ASCE

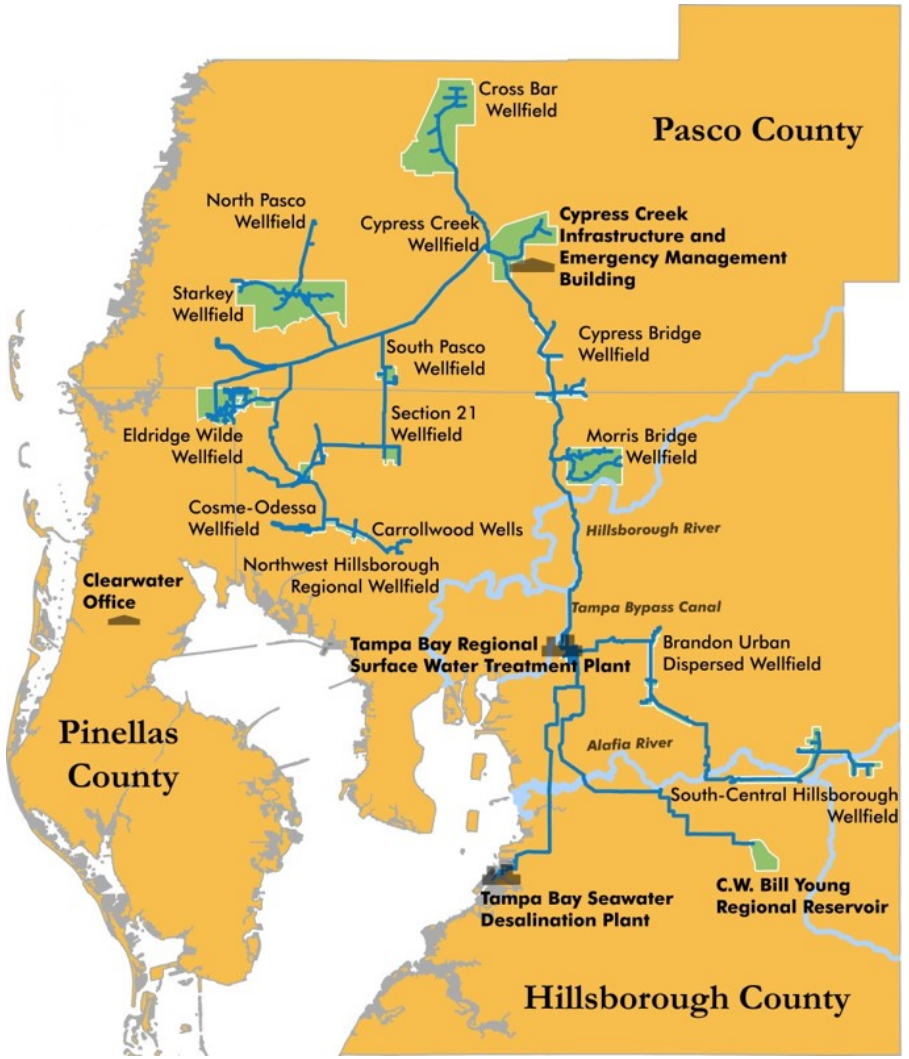
TAMPA BAY WATER
Supplying Water To The Region

Tampa Bay Water's Member Governments



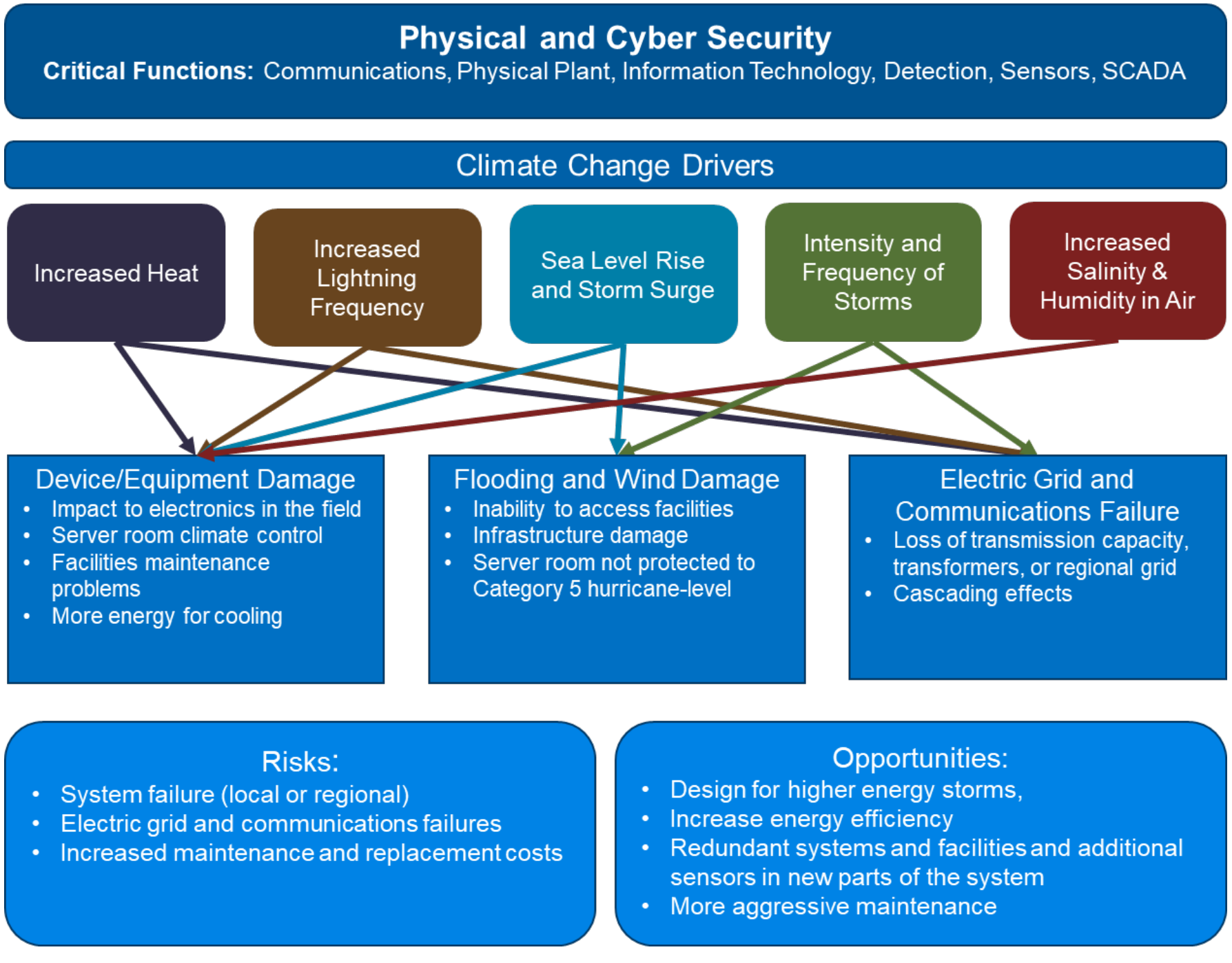
Tampa Bay Water's Supply System

- Integrated drought-resistant supply system
  - 13 wellfields
  - 8 groundwater treatment facilities
  - Surface Water Treatment Plant
  - Desalination Treatment Plant
  - 9 pump stations
  - 270 miles of transmission mains



Critical business function

- Physical and Cyber Security
  - Communications, physical plant management, information technology, detection, sensors, supervisory control and data acquisition systems (SCADA)
- Drinking Water Treatment and Distribution
  - Incoming water quality, treatment facility capacity, treatment technology, distribution system, storage, treatment type (physical and chemical), monitoring, desalination
- Engineering, Design, and Construction
  - Construction standards, construction specifications, constructability of assets, site selection, design standards, material selection, useful life analysis, physical construction


Physical and Cyber Security
Critical Functions: Communications, Physical Plant, Information Technology, Detection, Sensors, SCADA
Climate Change Drivers
Increased Heat
Increased Lightning Frequency
Sea Level Rise and Storm Surge
Intensity and Frequency of Storms
Increased Salinity & Humidity in Air
Device/Equipment Damage
• Impact to electronics in the field
• Server room climate control
• Facilities maintenance problems
• More energy for cooling
Flooding and Wind Damage
• Inability to access facilities
• Infrastructure damage
• Server room not protected to Category 5 hurricane-level
Electric Grid and Communications Failure
• Loss of transmission capacity, transformers, or regional grid
• Cascading effects
Risks:
• System failure (local or regional)
• Electric grid and communications failures
• Increased maintenance and replacement costs
Opportunities:
• Design for higher energy storms,
• Increase energy efficiency
• Redundant systems and facilities and additional sensors in new parts of the system
• More aggressive maintenance

What we are doing next…….

- WUCA
- Florida Water and Climate Alliance

- New initiatives
  - Source water qualify and change in rainfall/hydrologic extremes
  - Climate adaptation plan

Keely Brooks, Climate Change Policy Analyst

keely.brooks@snwa.com

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Las Vegas Valley Water District
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Moving Beyond the Framework

Testing the framework through tabletop exercises (TTX) with Denver Water and San Francisco Public Utilities Commission (SFPUC) and exploring steps to mainstream adaptation and resilience across critical water utility business functions (Phase 2).

- Conduct a literature review and compare other climate-related risks, opportunity, and resilience mainstreaming frameworks to the WRF4729 Framework and identify how the Framework relates to existing corporate and utility risk and resilience management processes or can be incorporated into existing processes;
- Pilot test the Framework across three critical business functions with two Water Utility Climate Alliance (WUCA) members: Denver Water and SFPUC through interactive, virtual tabletop exercises (TTX);
- Expand the Framework (version 1) to begin identifying steps or opportunities useful in mainstreaming climate risks and resilience across select critical water utility business functions (version 2);
- Update and enhance the Guidebook to reflect lessons learned from testing the Framework and identifying opportunities for resilience; and
- Engage staff through the pilot testing and exercises while generating train-the-trainer materials to create awareness across Denver Water and SFPUC about climate-related risks and opportunities and measures to mainstream climate resilience through critical business functions.

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Thank you