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

May 21, 2020 | 3:00 – 4:30 pm ET USA
# Agenda

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
<th>Timing</th>
</tr>
</thead>
</table>
| • 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


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)

WUCA website (no login needed)
https://www.wucaonline.org/publications/index.html
Vision: Climate-resilient water utilities, thriving communities

Mission: Collaboratively advance water utility climate change adaptation
<table>
<thead>
<tr>
<th><strong>Mainstream and Operationalize</strong></th>
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<tbody>
<tr>
<td>Integrate climate change into water utility business practices</td>
<td>Increase climate literacy within member utilities</td>
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<td>Research when and how to use climate information in utility decisions and business practices</td>
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<td>Document mainstreaming practices</td>
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<td>Moving Beyond the Framework</td>
<td>Emily Wasley – WSP</td>
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<tr>
<td>Q&amp;A</td>
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</tbody>
</table>
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.


• 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
### 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

#### 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

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### 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

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**STEP 1a:** Identify all water utility business functions and sub-functions
Select Critical Business Functions and Associated Sub-functions from the Four Case Study Utilities

<table>
<thead>
<tr>
<th>City of Fort Collins – Utilities</th>
<th>San Diego Public Utilities Department</th>
<th>Southern Nevada Water Authority</th>
<th>Tampa Bay Water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stormwater Management</strong></td>
<td>Drinking Water Treatment and Delivery</td>
<td>Administration</td>
<td>Physical and Cyber Security</td>
</tr>
<tr>
<td>Forecasting, water quality management, design and maintenance of collection and storage infrastructure, floodplain management, land use planning and development, regulation</td>
<td>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</td>
<td>Customer care and field services, Environmental, Health, and Safety and security, human resources, information technology, public services</td>
<td>Communications, physical plant management, information technology, detection, sensors, supervisory control and data acquisition systems (SCADA)</td>
</tr>
<tr>
<td><strong>Asset Management</strong></td>
<td>Water Supply</td>
<td>Engineering and Operations</td>
<td>Drinking Water Treatment and Distribution</td>
</tr>
<tr>
<td>Lifecycle analysis, service levels, reliability, maintenance standards, infrastructure development, mapping, strategic planning, data collection</td>
<td>Key Function: Operational Considerations within San Diego's Local Storage/Reservoir System</td>
<td>Energy management, engineering, infrastructure management, operations, resources and facilities, water quality and treatment</td>
<td>Incoming water quality, treatment facility capacity, treatment technology, distribution system, storage, treatment type (physical and chemical), monitoring, desalination</td>
</tr>
<tr>
<td><strong>Engineering and Design</strong></td>
<td>Staff Experience and Training</td>
<td>Finance</td>
<td>Engineering, Design, and Construction</td>
</tr>
<tr>
<td>Surveying, sizing, layout, design standards</td>
<td>Staff operations, risk protocols, operating manuals, capital improvements management, engineering training and protocols, staff outreach, projections, scenarios, integrated long-range planning</td>
<td>Accounting, financial services, purchasing and rate structures</td>
<td>Construction standards, construction specifications, constructability of assets, site selection, design standards, material selection, useful life analysis, physical construction</td>
</tr>
<tr>
<td><strong>Staff Experience and Training</strong></td>
<td>Key Function: Operational Considerations within San Diego's Local Storage/Reservoir System</td>
<td>Engineering and Operations</td>
<td>Drinking Water Treatment and Distribution</td>
</tr>
<tr>
<td>Surveying, sizing, layout, design standards</td>
<td>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</td>
<td>Energy management, engineering, infrastructure management, operations, resources and facilities, water quality and treatment</td>
<td>Incoming water quality, treatment facility capacity, treatment technology, distribution system, storage, treatment type (physical and chemical), monitoring, desalination</td>
</tr>
<tr>
<td><strong>Finance</strong></td>
<td></td>
<td></td>
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<tr>
<td>Accounting, financial services, purchasing and rate structures</td>
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</tbody>
</table>
### Example Cross-Functional Water Utility Representatives

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

**STEP 1b:** Identify a cross-functional team of representatives.
Example Resources for Climate Risk Assessment and Management

<table>
<thead>
<tr>
<th>Scale</th>
<th>Resource Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility</td>
<td>Long-Range Water Resource Plans</td>
</tr>
<tr>
<td></td>
<td>Urban Water Management Plans</td>
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<tr>
<td></td>
<td>Water Supply and Demand Studies</td>
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<tr>
<td></td>
<td>Climate Resilience Evaluation and Awareness Tool (CREAT) 2.0</td>
</tr>
<tr>
<td></td>
<td>Climate Change Sensitivity, Risk, or Vulnerability Assessments or Studies</td>
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<tr>
<td></td>
<td>Integrated Modeling Projects</td>
</tr>
<tr>
<td>Local</td>
<td>Local University Climate Centers/Advisory Panels and Climate Action Plans</td>
</tr>
<tr>
<td></td>
<td>City or Community Vulnerability, Risk, and/or Resilience Assessments or Plans</td>
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<tr>
<td></td>
<td>Local, City, or County Climate Action Plans</td>
</tr>
<tr>
<td></td>
<td>Local Hazard Mitigation Plan</td>
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<td></td>
<td>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)</td>
</tr>
<tr>
<td>State</td>
<td>Technical State Climate Summaries</td>
</tr>
<tr>
<td></td>
<td>States at Risk Reports</td>
</tr>
<tr>
<td></td>
<td>State Hazard Mitigation Plans</td>
</tr>
<tr>
<td>Regional</td>
<td>Third National Climate Assessment (2014)</td>
</tr>
<tr>
<td></td>
<td>Fourth National Climate Assessment, Volume 2: Impacts, Risks, and Adaptation in the United States</td>
</tr>
<tr>
<td></td>
<td>Fourth National Climate Assessment, Volume 1: Climate Science Special Report</td>
</tr>
<tr>
<td>International</td>
<td>Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report</td>
</tr>
<tr>
<td></td>
<td>Country-level Vulnerability Assessments, Climate Profiles, and/or Adaptation Plans</td>
</tr>
<tr>
<td>Federal</td>
<td>Climate Resilience Toolkit: Water Resources Dashboard; Drought Response and Recovery; and Flood Resilience</td>
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<td></td>
<td>U.S. Department of Agriculture (USDA) Cooperative Extension System and Climate Hubs</td>
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<td></td>
<td>U.S. Department of the Interior (DOI) Climate Adaptation Science Centers</td>
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<td></td>
<td>National Oceanic and Atmospheric Administration (NOAA) Climate Program Office, Regional Climate Centers, and Regional Integrated Sciences and Assessment Programs</td>
</tr>
</tbody>
</table>

**STEP 1c:** Identify existing resources, expertise, and capacity for risk assessment and management
**Currently Available Climate-Related Resources by Case Study Jurisdiction**

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Precipitation</th>
<th>Temperature</th>
<th>Drought</th>
<th>Storms</th>
<th>Flooding</th>
<th>Sea Level Rise/Storm Surge</th>
<th>Tropical Cyclones</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tampa Bay Water</td>
<td>29</td>
<td>24</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>7</td>
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<tr>
<td>Fort Collins Utilities</td>
<td>36</td>
<td>28</td>
<td>16</td>
<td>12</td>
<td>9</td>
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<td>9</td>
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<tr>
<td>San Diego PUD</td>
<td>40</td>
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<td>4</td>
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<tr>
<td>Southern Nevada Water Utility</td>
<td>36</td>
<td>27</td>
<td>17</td>
<td>10</td>
<td>7</td>
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*Represents number of currently available resources by water and climate driver*
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?

- 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?
**Example Business Functions and Mapped Climate Impacts**

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

**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
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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

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

**Climate Drivers**

- Increased Intensity of Precipitation
- Temperature Increases
- Wildfire size/frequency increases

**Impacts**

**Health and Safety**
- Outdoor worker risks from high heat and reduced air quality
- Risks from main breaks or dam failure
- Risks from water quality changes/disease vectors

**Infrastructure**
- Pipeline/road damage increase due to heat and flooding
- Potential for failure of major equipment increases

**Water Quality**
- Pretreatment required due to increased sediment loading, pollutants and algae
- Aquatic habitat loss
- Supply operations shifts from flow reduction

**Financial**
- Higher water treatment costs
- Reduced land value from habitat quality changes
- Revenue losses due to drought restrictions
- Impacts on reliability of communication, data, analysis and energy systems

**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

<table>
<thead>
<tr>
<th>Climate Drivers</th>
<th>Impacts</th>
<th>Risks</th>
<th>Opportunities</th>
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</thead>
</table>
| **Increased Intensity of Precipitation** | Health and Safety  
  - Outdoor worker risks from high heat and reduced air quality  
  - Risks from main breaks or dam failure  
  - Risks from water quality changes/disease vectors |  
  - Increased maintenance and replacement costs, increased potential for emergency response |  
  - Maintain larger emergency financial reserves |
| **Temperature Increases** | Infrastructure  
  - Pipeline/road damage increase due to heat and flooding  
  - Potential for failure of major equipment increases |  
  - Costs and public relations problems associated with infrastructure failure increase |  
  - Rate increases or emergency rate structure |
| **Wildfire size/ frequency increases** | Water Quality  
  - Pretreatment required due to increased sediment loading, pollutants and algae  
  - Aquatic habitat loss  
  - Supply operations shifts from flow reduction |  
  - More aggressive maintenance and repair program |  
  - Plan to ensure reliable water and energy supply to at-risk customers |
|  | Financial  
  - Higher water treatment costs  
  - Reduced land value from habitat quality changes  
  - Revenue losses due to drought restrictions  
  - Impacts on reliability of communication, data, analysis and energy systems |  
  - Enhance communications internally and externally |

**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
Project Resources

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

- GUIDEBOOK
  - Water Utility Business Risk and Opportunity Framework
    - A Guidebook for Water Utility Business Function Leaders in a Changing Climate

- CLIMATE RISK & OPPORTUNITY PROFILES
  - San Diego Public Utilities
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

“
Mapping climate exposure to utility business functions

Tirusew Asefa, Ph.D., P.E., D.WRE, F.ASCE
Tampa Bay Water’s Member Governments

- Tampa
- New Port Richey
- St. Petersburg
- Pasco
- Hillsborough
- Pinellas
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
• 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
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Las Vegas Valley Water District
Southern Nevada Water Authority
Springs Preserve™
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