Adaptation and Resilience:
CRWU Tools, Concepts and Making the Business Case

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Office of Ground Water and Drinking Water
Creating Resilient Water Utilities (CRWU) Initiative
Overview

- Resilience building process in the water utility
  - EPA’s Creating Resilient Water Utilities (CRWU) Program
    - Resilient Strategies Guide
    - Adaptation Case Study and Information Exchange
  - Other EPA resources and tools
- Making the business case for resilience planning
- Communicating resilience planning and efforts
The CRWU initiative provides drinking water, wastewater and stormwater utilities with the practical tools, training, and technical assistance needed to increase resilience to extreme weather events.

Through a comprehensive planning process, CRWU assists water sector utilities by promoting a clear understanding of potential long-term adaptation options.
Resilience Building Process

LEARN
Explore, research and gather information on climate readiness and adaptation basics.

ASSESS
Use EPA's tools and maps to understand potential climate change impacts and assess the related risks at your own utility.

PLAN
Find the materials you need to plan and conduct a customized workshop on extreme events such as flooding and drought.

COLLABORATE
Work with other drinking water and wastewater utilities using EPA's Case Studies Map.

RESILIENT STRATEGIES GUIDE

ADAPTIVE RESPONSE FRAMEWORK

CLIMATE READY PROCESS

TOOLBOX

WATER UTILITY CASE STUDIES MAP

CLIMATE RESILIENCE EVALUATION AND AWARENESS TOOL (CREAT 3.0)

SCENARIO-BASED PROJECTED CHANGES MAP

STORM SURGE INUNDATION AND HURRICANE STRIKE FREQUENCY MAP

WORKSHOP PLANNER

EPA
Begin the Resilience Building Process

• There is no one-size-fits-all solution for utilities
• Develop a plan that fits available resources and priorities
  – No Regrets
  – Complements or is built into other utility priorities/funding
    • Sustainability planning
    • Capital planning
    • Capacity building
    • Emergency response activities
  – Varying implementation timeframes
  – Triggers/thresholds
• Collaborate with state and federal authorities, local interdependent sectors (energy, agriculture, forestry) and other nearby utilities
Critical Decision Points

- Why develop a plan for additional resilience?
- How do I plan for resilience?
- What are the options for strategies to include in plans?
- How do I assess these plans and decide what to pursue?
- How do I communicate resilience and the plans I choose?
Critical Decision Points

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• How do I plan for resilience?

• What are the options for strategies to include in plans?

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• How do I communicate resilience and the plans I choose?
Climate Scenarios Projection Map

Provides scenarios that capture the range of projected changes.

These scenarios, from the hottest (and driest) to the wettest model results, define a range of future climate conditions that can be considered for each time period provided. A central scenario, representing results close to the median of both temperature and precipitation projections, is also provided.

Once you have selected a scenario of interest, zoom into your location and click on a grid cell to view the projected change in annual temperature.

The uncertainty inherent in using models to project future climate conditions makes it difficult to choose any one value or model to use in planning. Consider any or all of these scenarios to evaluate your resilience to the impacts that could result from these possible future climates.

What if the future is significantly hotter?

Temperature increases represent challenges to sustaining water supply, managing water demand, and maintaining water quality. Examples of the type of concerns and challenges that water utilities may need to deal with as temperatures increase include:

- Water Quality Management
- Water Supply Management
- Drought
- Ecosystem Changes
Storm Surge Inundation Map

Illustrates potential for flooding in coastal areas, based on hurricane surge models and FEMA flood zones.
Critical Decision Points

• Why develop a plan for additional resilience?

• How do I plan for resilience?

• What are the options for strategies to include in plans?

• How do I assess these plans and decide what to pursue?

• How do I communicate resilience and the plans I choose?
Resilient Strategies Guide

- **Web-based tool**, based on previous Adaptation Strategies Guide publication, for reviewing resilient strategies being used by water utilities

- **Guided process** to review and select priorities, vulnerable assets, and relevant strategies

- Final report documents selected strategies to explore during **adaptation planning**
Resilient Strategies Guide

Assets
Select the vulnerable assets in your organization or system.

Filter:
- **Vulnerability**
  - □ Potentially Vulnerable (9)

- □ Telecommunications / Data Network
- □ Buildings and Offices
  - Potentially Vulnerable Asset
- □ Data Acquisition Systems
- □ Process Control - SCADA
  - Potentially Vulnerable Asset
- □ Distributed Control Systems
- □ Forested Lands
- □ Managed Species
- □ Flood Protection
  - Potentially Vulnerable Asset

Strategies
Select your strategies in this section. Use the filters on the left to narrow the strategies.

Filter:
- □ Participate in community planning and regional collaborations
  - Planning
  - More Info +
  - S-SS

- □ Acquire and manage ecosystems
  - Ecosystem & Land Use
  - More Info +
  - SSS

- □ Implement green infrastructure on site and in municipalities
  - Ecosystem & Land Use
  - More Info +
  - S-SS

- □ Implement watershed management
  - Ecosystem & Land Use
  - More Info +
  - S

- □ Integrate flood management and modeling into land use planning
  - Ecosystem & Land Use
  - More Info +
  - S

- □ Update fire models and practice fire management plans
  - Ecosystem & Land Use
  - More Info +
  - S-SS

- □ Conduct sea-level rise and storm surge modeling
  - Modeling
  - More Info +
  - S

- □ Develop models to understand potential water quality changes
Congratulations! You are done with the Resilient Strategies Guide!

Generate your report
You can now generate your report, which includes the information and descriptions of your selections.
1. Review the Summary to the right. If you want to change your summary, you can go to the progress bar above to go to that section.
2. Generate your report.

Assess the effectiveness of your strategies
You can also use the data to use in EPA's CREAT, a risk assessment tool that will walk you through an assessment of how effective your selected strategies are at addressing your priorities.
1. Export your CREAT data file.
3. Once in CREAT, import your "RSG Export" file to begin your assessment.
WORKSHOP PLANNER FOR
Climate Change and Extreme Events Adaptation

Understanding and adapting to climate change threats is an important part of decision making for water, wastewater and stormwater utilities. Extreme events including floods, drought, sea-level rise, wildfires and reduced snowpack may become more frequent or intense due to climate change. Planning for these extreme events can help protect utility infrastructure and operations, allowing utilities to provide reliable and sustainable service to their customers.

Through a four-step process, the Workshop Planner assists drinking water and wastewater utility personnel, technical assistance providers and other water sector stakeholders with conducting a climate change adaptation workshop. To provide
Continue the Resilience Building Process

• Document planning process and revisit periodically (changing priorities, new threats)

• Share and gather experiences with others as part of utility community pursuing additional resilience
  – Common priorities and/or threats
  – Successful strategies
  – Lessons learned
Drought conditions in many regions of the United States impact water utilities by changing water levels in aquifers and reservoirs, reducing snowpack, and altering surface water flows. Water sector utilities facing drought should employ strategies to prepare for, respond to and recover from limited water supply.
Adaptation Case Study and Information Exchange

Case Study:
Water and Wastewater Utilities Planning for Resilience

CITY OF FARIBAULT, MINNESOTA

Background
The City of Faribault provides wastewater services to residential and industrial customers in Faribault, Minnesota, which is located about one hour south of Minneapolis, Minnesota. About 92 to 95% of all wastewater flow is from industrial customers, including a laundry facility and a food packaging plant. The water reclamation facility (WRF) is designed to treat an average flow of approximately 3.5 million gallons per day (MGD) and a peak wet weather flow of 7 MGD.

Challenges
The WRF is located near the confluence of the Straight River and Cannon River and is at risk of flooding. The City previously experienced issues related to overflows and bypass as well as infiltration and inflow (I/I) from heavy precipitation events. The WRF was impacted by previous flooding events due to high river levels. During a flooding event in 2010, the WRF was inundated and taken completely offline for approximately two weeks due to a damaged siphon box through which all flows are conveyed under the Straight River to the WRF. During that time, a temporary above-ground collection system had to be constructed to convey the wastewater from the City to the WRF for treatment. Following that flooding event, WRF assets were relocated away from the river, however, flooding concerns still exist if the river re-channels within the floodway. It is expected that floodwaters could still damage infrastructure assets at their new locations.

Planning Process
To better understand the resilience of their wastewater infrastructure and operations to extreme flooding, the City of Faribault assessed potential impacts of environmental change and extreme weather events using the U.S. Environmental Protection Agency’s (EPA’s) CREAT and enhanced resilience through long-term planning using EPA’s Planning for Sustainability Handbook. The assessment brought together individuals from the City of Faribault, state agencies and EPA staff to think critically about potential impacts, priority assets, and possible resilience strategies.

Resilience Strategies and Priorities
Based on experience with prior intense precipitation events, the City of Faribault has already taken action to protect their WRF from flooding and improve their overall resilience to extreme weather impacts. Using CREAT results, the City was able to evaluate the performance and costs of two priority actions that, if implemented, will provide additional protection to the facility: constructing a berm and building streambank stabilization. The City will continue to use the CREAT results and the information from EPA’s Planning for Sustainability Handbook to conduct additional long-term infrastructure and financial planning. See the table below for all potential measures that were considered.

CITY OF BLAIR, NEBRASKA

Background
The city of Blair, Nebraska provides drinking water and wastewater services to residential, industrial and commercial customers. The city of Blair owns and operates the entire municipal water system, including a 20 million gallons per day (MGD) water treatment plant that draws from the Missouri River. Drinking water demand for residential, commercial and industrial customers is described in Table 1. The city of Blair has an interconnection with Omaha through a rural system that can provide up to 1 MGD in case of an emergency.

Table 1. City of Blair Drinking Water Demand

<table>
<thead>
<tr>
<th>CUSTOMER</th>
<th>WATER DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Average: 1 MGD; Peak demand: 4 MGD</td>
</tr>
<tr>
<td>City of Blair:</td>
<td>population 0,000</td>
</tr>
<tr>
<td>Industrial</td>
<td>Additional small rural systems outside the city:</td>
</tr>
<tr>
<td>Cargill biocampus</td>
<td>population of 2,000 – 4,000</td>
</tr>
<tr>
<td>Industrial – Omaha</td>
<td>10-15 MGD; higher demand in summer months</td>
</tr>
<tr>
<td>Public Power Plant</td>
<td>OPPD switches over to the city of Blair’s water</td>
</tr>
<tr>
<td>(OPPD) nuclear</td>
<td>source in warmer months when the temperature in</td>
</tr>
<tr>
<td>power plant</td>
<td>their usual source water is too high and could</td>
</tr>
<tr>
<td></td>
<td>cause the nuclear plant to violate their National</td>
</tr>
<tr>
<td></td>
<td>Pollution Discharge Elimination System thermal</td>
</tr>
<tr>
<td></td>
<td>discharge criteria</td>
</tr>
<tr>
<td>Additional</td>
<td>0.4 MGD</td>
</tr>
<tr>
<td>commercial and</td>
<td></td>
</tr>
<tr>
<td>industrial</td>
<td></td>
</tr>
<tr>
<td>customers</td>
<td>2 MGD</td>
</tr>
</tbody>
</table>

Challenges
Other EPA Tools and Resources

- Drought Response and Recovery Guide
- Flood Resilience Guide and checklist
- Hazard Mitigation for Natural Disasters Guide
- FedFUNDS
- Water Finance Clearinghouse
Making the Business Case for Resilience

• Financial, operational, and reputational benefits of resilience
  – Continuity and sustained quality of service
  – Benefits associated with avoided costs
    • O&M, treatment, service revenue loss, equipment
  – Adequate water quality and quantity
  – Protection of assets against gradual change and extreme events
Capital Planning and Asset Management

• Proper asset management supports planning for capital improvements and investment

• Asset management and capital planning can support adaptation and resilience planning
  – Build asset risk assessment into asset management plans to identify key assets and risks if damaged/destroyed
  – To prepare for future uncertainty, incorporate capital costs associated with extreme weather events into capital planning
Critical Decision Points

• Why develop a plan for additional resilience?

• How do I plan for resilience?

• What are the options for strategies to include in plans?

• How do I assess these plans and decide what to pursue?

• How do I communicate resilience and the plans I choose?
Making the Business Case for Resilience

• Evaluate adaptation and resilience options quantitatively to make the case to decision makers
  – Cost/benefit analysis approach
  – Data collection to support justification of adaptation and resilience options
    • Understand the consequence costs of past events
    • Understand adaptation option costs
    • Investment costs vs. savings over time
Cost/Benefit Approach

How to decide what adaptation options to implement

<table>
<thead>
<tr>
<th>Cost to adapt</th>
<th>Cost of impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>$$</td>
<td>$$$$$$</td>
</tr>
<tr>
<td>$$$$$$</td>
<td>$$$</td>
</tr>
<tr>
<td>$$$</td>
<td>$$$</td>
</tr>
</tbody>
</table>
Making the Business Case with CREAT

- Climate Resilience Evaluation and Awareness Tool (CREAT) supports making the case for investment in resilience
  - Analysis which compares implementation costs to risk reduction to support decision making
Climate Resilience Evaluation and Awareness Tool (CREAT) 3.0

- **Web-based tool** for assessing risk of potential extreme weather impacts
- **Module-based process** with clearly defined goals and reports
- Multiple scenarios provided to help **capture uncertainty**
- **Assessment of current resilience** will help inform adaptation planning
- Results help utilities compare **risk reduction** and **implementation costs**
CREAT Modules

**CLIMATE AWARENESS**
- Provide basic utility information
- Increase awareness of climate impacts

**SCENARIO DEVELOPMENT**
- Understand utility risk
- Design scenarios of threats based on climate data

**CONSEQUENCES & ASSETS**
- Outline potential consequences
- Catalog critical assets

**ADAPTATION PLANNING**
- Inventory current actions that provide resilience
- Design adaptation plans

**RISK ASSESSMENT**
- Assess risk from a changing climate
- Evaluate adaptation plans
# CREAT Outputs: Risk Results

## Results Overview - Plan 1: WWTP Protection Measures

<table>
<thead>
<tr>
<th>Category</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Measures Total Consequences</td>
<td>$23,767,150 - $46,869,850</td>
</tr>
<tr>
<td>Adaptation Plan Total Consequences</td>
<td>$418,000 - $15,668,300</td>
</tr>
<tr>
<td>Total Monetized Risk Reduction</td>
<td>$8,514,000 - $46,036,700</td>
</tr>
<tr>
<td>Adaptation Plan Total Cost</td>
<td>$4,057,500 - $8,125,000</td>
</tr>
</tbody>
</table>

[View Public Health Consequences]

![Bar Chart]

- Current Measures Total Consequences: $45,000,000
- Adaptation Plan Total Consequences: $20,000,000
- Total Monetized Risk Reduction: $35,000,000
- Adaptation Plan Total Cost: $5,000,000
Example Cost Benefit Analysis

1. Identify and measure costs of the practice
   – Capital expenditures, operating and ongoing costs
2. Identify and measure benefits of the practice
   – Avoided costs, service reliability, revenue continuity

Some costs and benefits (e.g., regulatory compliance, quality of life, socioeconomic, public health) may be hard to quantify and can be assigned qualitative values.
Example Cost Benefit Analysis: Avoided Cost Assessment

**Strategy Costs**

- Certain adaptive measures focused on drought mitigation may prevent need for new supply
  - Costs for adaptive measures
    - Conservation Rate Structure (Adaptive Rates)
      - $150,000 for first year
      - $2,000 annually to manage
    - Install external pumps (can be raised/lowered in river as level changes to ensure consistent supply)
      - $400,000 in capital costs
      - $10,000 in annual O&M

### Strategy Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital Cost+Rate Structure</th>
<th>O&amp;M+Rate Structure Management</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>$550,000</td>
<td>$0</td>
<td>$550,000</td>
</tr>
<tr>
<td>2019 - 2027</td>
<td>$0</td>
<td>$12,000 per year</td>
<td>$108,000</td>
</tr>
<tr>
<td>Total (10 years)</td>
<td>$550,000</td>
<td>$108,000</td>
<td>$658,000</td>
</tr>
</tbody>
</table>
Benefit = avoided cost of new augmentation reservoir for high demand (or drought) periods
- $1,000,000 in capital costs
- $50,000 in annual O&M
- Added cost to fill the reservoir

<table>
<thead>
<tr>
<th>Year</th>
<th>Avoided O&amp;M Costs for Augmentation Reservoir</th>
<th>Avoided Costs of Capital Cost for New Supplies</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>2022</td>
<td>$0</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>2023-2027</td>
<td>$50,000 per year</td>
<td>$0</td>
<td>$1,200,000</td>
</tr>
<tr>
<td>Total (10 years)</td>
<td>$200,000</td>
<td>$1,000,000</td>
<td>$1,200,000</td>
</tr>
</tbody>
</table>

Savings over 10-year period = $1,200,000 - $658,000 = $542,000
Case Study Example

• Camden County Municipal Utilities Authority is initiating a number of sustainable measures
  – Switched to 100% green energy sources by implementing number of measures funding by $10,000,000 SRF loan.
  – Utility receives about $600,000 in annual energy savings which is more than the yearly payments for the loan.
  – Further, as added benefit, the infrastructure improvements were made when the equipment was also at end of useful life.
Critical Decision Points

• Why develop a plan for additional resilience?

• How do I plan for resilience?

• What are the options for strategies to include in plans?

• How do I assess these plans and decide what to pursue?

• How do I communicate resilience and the plans I choose?
How to Communicate Resilience Planning

• Communicating the importance of resilience planning is vital to actual implementation.
• One size does not fit all when communicating resilience planning – understand your audience and know whose support is needed.
  – Local government/planning/mitigation/financial officials
  – Representatives from other sectors (public health, transportation)
  – Non-profit or other community groups/leaders
  – Community members/rate payers
• Provide quantitative and qualitative support data
  – Value of water
  – Impacts of extreme events on services/benefits of resilience efforts
• Plan outreach/engagement events (workshops, meetings) to share information and gain support
• Anticipate concerns and questions
How to Communicate Resilience Planning

• During today’s small group session, we will:
  – Exchange and capture ideas and lessons learned about integrating resilience and adaptation activities into utility operations, as well as strategies to gain support and build partnerships for resilience planning
  – Identify next steps to advance resilience planning efforts
America’s Water Infrastructure Act

• America’s Water Infrastructure Act (AWIA) became law in 2018.

• AWIA requires each community water system serving more than 3,300 people to assess the risks to and resilience of its system to malevolent acts and natural hazards.

• AWIA has a list of water system components that the risk assessment must include, but AWIA does not require the use of a specific method to conduct the assessment.

• Water systems must submit a certification to EPA that the system conducted the assessment.

# America’s Water Infrastructure Act Deadlines

## Certification Deadlines

<table>
<thead>
<tr>
<th>Population Served</th>
<th>Risk Assessment</th>
<th>Emergency Response Plan*</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥100,000</td>
<td>March 31, 2020</td>
<td>September 30, 2020</td>
</tr>
<tr>
<td>50,000-99,999</td>
<td>December 31, 2020</td>
<td>June 30, 2021</td>
</tr>
<tr>
<td>3,301-49,999</td>
<td>June 30, 2021</td>
<td>December 30, 2021</td>
</tr>
</tbody>
</table>

*Emergency response plan certifications are due six months from the date of the risk assessment certification. The dates shown above are certification dates based on a utility submitting a risk assessment on the final due date.
Thank you!

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