



# *Introduction to the Climate Resilience Evaluation & Awareness Tool*

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Climate Ready Water Utilities  
Webinar Series

Curt Baranowski, US EPA  
Jim Hawhee, Albemarle-Pamlico NEP  
February 27, 2013

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bubble icons in the top left corner of your  
screen to view accompanying script text for  
each slide.*





## CRWU Webinar Series

Topic	Next Event
Extreme Events Workshop Planner	March 6, 2013
Adaptation Strategies Guide	March 13, 2013
Workshop Planner/ Adaptation Strategies Guide	April 10, 2013
Using CREAT for Planning and Decision Support	TBD
Introduction to CRWU Initiative	TBD
Climate Change and the Water Sector	TBD
Introduction to CREAT	TBD

- Additional topics and dates under consideration
- Visit <http://www.epa.gov/climateredyutilities> for updates



## *Housekeeping*

- Polling questions
- Mute/un-mute
- Hand raise function
- Questions
- Technical difficulties



# *Climate Ready Water Utilities (CRWU)*

## CRWU Mission Statement

*To provide the water sector (drinking water, wastewater, and stormwater utilities) with the practical tools, training, and technical assistance needed to adapt to climate change by promoting a clear understanding of climate science and adaptation options.*



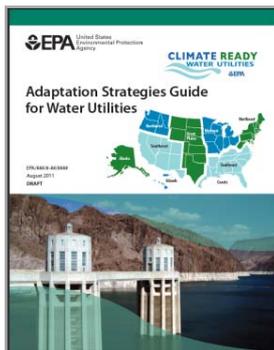
## Climate Ready Process

### Adaptive Response Framework



Explore Elements of Climate Readiness

### Adaptation Strategies Guide



Learn Climate and Adaptation Basics

### Toolbox

-  **Featured Resource**
-  **Region Map**
-  **Activities**
-  **Funding**
-  **Publications and Reports**
-  **Tools and Models**
-  **Training, Workshops and Seminars**

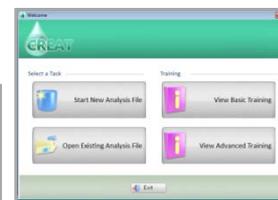
Research and Gather Information

### Extreme Events Workshop Planner



Collaborate with Partners

### Climate Resilience Evaluation and Awareness Tool



Assess Risks and Evaluate Opportunities



- About CREAT
- Building awareness
  - Using climate data
  - Identifying challenges
  - Researching adaptation
- CREAT Training





## *Climate Resilience Evaluation & Awareness Tool (CREAT)*

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Assess risks and evaluate opportunities



## *About CREAT*

- Software tool for conducting **risk assessment** of potential climate change impacts at your utility
- Multiple climate scenarios provided to help **capture uncertainty**
- Assessments will help inform **adaptation planning**
- Results from CREAT help utilities compare potential **costs, risk reduction and energy implications** of different options



# *What Can You Do In CREAT?*



**Build  
Awareness**

- Explore local climate data
- View links to publications, models and other tools



**Assess  
Risk**

- Catalog data and assumptions
- Understand and assess climate impacts



**Plan  
Adaptation**

- Compare adaptation options
- Generate reports to support decisions

## CREAT Process

### Setup



CREAT captures a variety of information about your utility, including size and ownership structure. You also specify other options used during analysis.

### Threats



CREAT provides a set of descriptive narratives regarding climate change impact and potential threats associated with them. You can select the threats applicable to your utility and define custom ones.

### Assets



CREAT provides a standardized list of assets. You can modify the asset inventory to reflect your specific facility.

### Baseline Analysis



After establishing your initial facility setup, you can determine your current risk level associated with asset/threat combinations over the specified time periods.

### Resilience Analysis



After conducting a baseline analysis, you can move forward and consider potential adaptations to your facility to lower the risk associated with specific asset/threat combinations.

### Adaptation Planning



Use Adaptation Planning to review your existing and potential adaptive measures, and to develop packages of adaptive measures that you may consider for implementation over future time periods.

### Results & Reports



Generate reports of the analysis results developed around your inventories of assets, threats, time periods, or various sorting of any analysis you have conducted.



# Setup and Assets

- Utility and system information
- Locations and time periods
- Infrastructure and natural resources
- Analysis parameters
  - Likelihood method
  - Consequence definitions

## Utility Business Impacts

Revenue or operating income loss evaluated in terms of the magnitude and recurrence of service interruptions.

## Utility Equipment Damage

Costs of replacing the service equivalent provided by a utility or piece of equipment evaluated in terms of the magnitude of damage (minimal, minor,

## Source/Receiving Water Impacts

Degradation or loss of source water or receiving water quality and/or quantity evaluated in terms of the recurrence.” (minimal, temporary, seasonal or episodic,

## Environmental Impacts

Evaluated in terms of environmental damage or loss (aside from source water or other assets) and compliance with environmental regulations (minimal, short term,

## Community Public Health Impact

Evaluated in terms of the duration (short or long-term) and extent (minimal, minor, localized, or widespread)



# CREAT Worksheets

- Template for collecting information in preparation for using CREAT
- Four worksheets provided:
  - Pre-assessment discussion
  - Climate data
  - Setup data
  - Adaptation preparation

**CREAT** Climate Resilience Evaluation and Awareness Tool (CREAT)  
PRE-ASSESSMENT DISCUSSION-WORKSHEET 1

Before you begin using CREAT, you may want to take the opportunity to discuss some fundamental questions related to the process with others at your utility, including managers, operators, engineers, and technical staff. These discussions will lay a foundation for the anticipated scope of the assessment.

**Analyst:** \_\_\_\_\_

CREAT allows you to identify a person or office as the analyst conducting the assessment. This person or group would be identified in some of the reports as the point-of-contact and follow-up.

Name: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Email: \_\_\_\_\_ Dept: \_\_\_\_\_

**Overall Goals:** \_\_\_\_\_

It is beneficial to set priorities for your assessment before starting the CREAT process. These priorities may involve consideration of only a portion of your facility, a single aspect of climate change, specific challenges that may be experienced as the climate changes, or some combination of these focus areas. Begin with your goals for the current application of CREAT. You should revisit goals and additional conditions as new assessments are planned for future CREAT sessions.

Consider climate impacts on only a portion of utility assets     Focus on one aspect of climate change  
 Identify a short list of climate change-related challenges (e.g., floods, droughts)  
 Review climate data and information for my location

Overall goals of CREAT assessment:  
 \_\_\_\_\_

**Participants:** \_\_\_\_\_

The process of using CREAT to learn more about projected climate change and assess the potential risks to your operations and assets is an opportunity to collaborate with others at your utility, stakeholders, and partners in the region. Those parties that could inform data needs for use of CREAT (see other worksheets) or are critically dependent on your utility for services should be involved in parts of the CREAT process.

Customers and stakeholders    List specific persons and organizations:  
 Watershed partners  
 Nearby utilities  
 Scientific community  
 Others (specify)

*Continued on page 2*



## *Building Awareness: Using Climate Data*

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Quantify projected changes and potential threats



- Many sites provide access to climate projection data online
- Users may be uncertain about
  - Which data to use: Model? Time period?
  - How to access data?
  - How to apply data?
- CREAT provides data for utilities within a risk assessment framework
- If available, users can enter and use their own data as well



Climate Browser

Region Tabs

X

Regions

National
Northeast
Southeast
Midwest
Great Plains
Southwest
Northwest
Alaska
Islands
Coasts


Sea-level Rise Information


Projected Climate Data

## National

Projected climate change in the U.S. will continue trends that are already observable. As summarized in The U.S. Global Change Research Program (USGCRP 2009), the following changes are projected to occur by late this century under a higher emissions scenario (IPCC SRES A2):

- A further increase in U.S. average temperature building on the 2° F increase observed over the past 50 years; how much more depends primarily on the amount of heat-trapping gases emitted globally and how sensitive the climate is to those emissions
- Additional sea-level rise along most of the coast
- More frequent and intense extreme weather events, such as heat waves and regional droughts
- Less winter precipitation falling as snow and more as rain
- Reduced snowpack, earlier breakup of ice on lakes and rivers, and earlier spring snowmelt resulting in earlier peak river flows
- Continued rapid decline of Arctic sea ice
- Continuation of the trend towards increases in the amount of rain falling in the heaviest downpours, with the largest increases in the wettest regions
- Cold-season storm tracks shifting northward, with the strongest storms likely to become stronger and more frequent
- Continued increase in the intensity of Atlantic and eastern Pacific hurricanes
- Wetter conditions in Northern U.S.; drier conditions in Southern U.S., particularly in the West

Related Information:

[Projected U.S. Temperature Changes](#)

[Increases in Intense Precipitation](#)

[Trends in Peak Streamflow Timing](#)

[Projected U.S. Precipitation Changes](#)

Threat Tabs

Threat Types

Reduced Groundwater Recharge

Lower Lakes and Reservoir Levels

Reduced Snowpack

Other Drought Impacts

Saline Intrusion Into Aquifers

Altered Surface Quality

High Flow Events

Coastal Storm Surges

Loss of Coastal Landforms and Wetlands

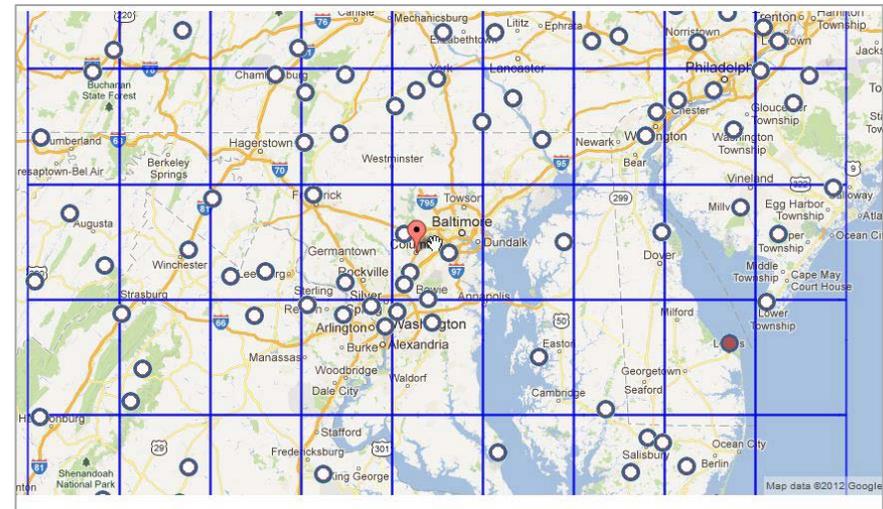
Altered Vegetation/Wildlife Risk

Volume & Temperature Challenges

Agricultural Practice Changes

Changes in Energy Sector Water Needs

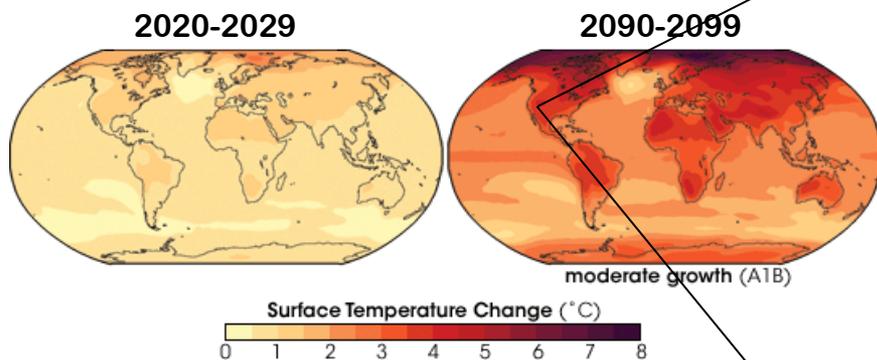
- 30-year (1971-2000) annual and monthly averages of temperature and precipitation
- Data provided at ½ degree by ½ degree resolution (32x32 mi.)
- Intense precipitation data sourced from NOAA climate stations
- Select the station that best matches your historical data OR enter your own



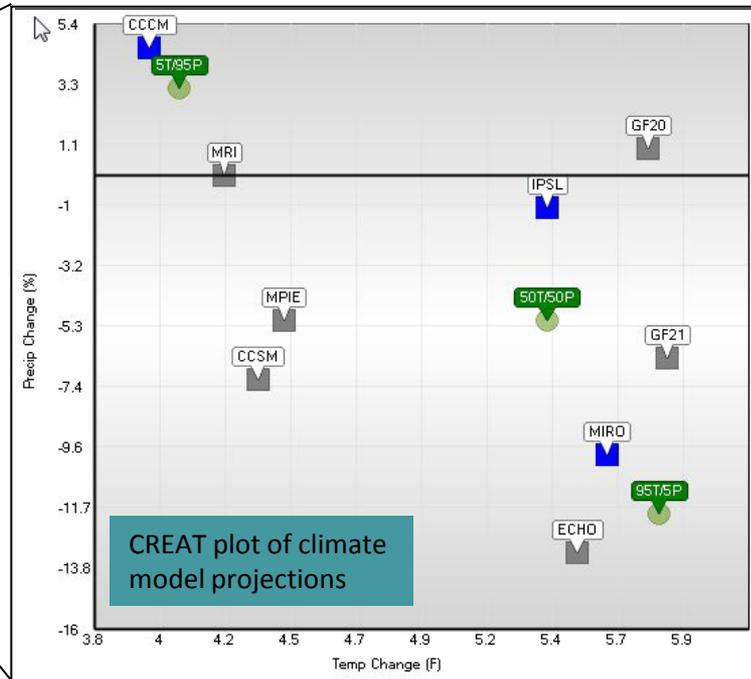
Location (📍) with available climate stations (🕒) in CREAT

# What Information and Data are Available?

- Models as basis for climate projections
- Down-scaling efforts to extend to local scales
- Challenge: connect changing climate to more direct consequences to water resources



Source: IPCC AR4 Projected Temperature Changes for SRES A1B





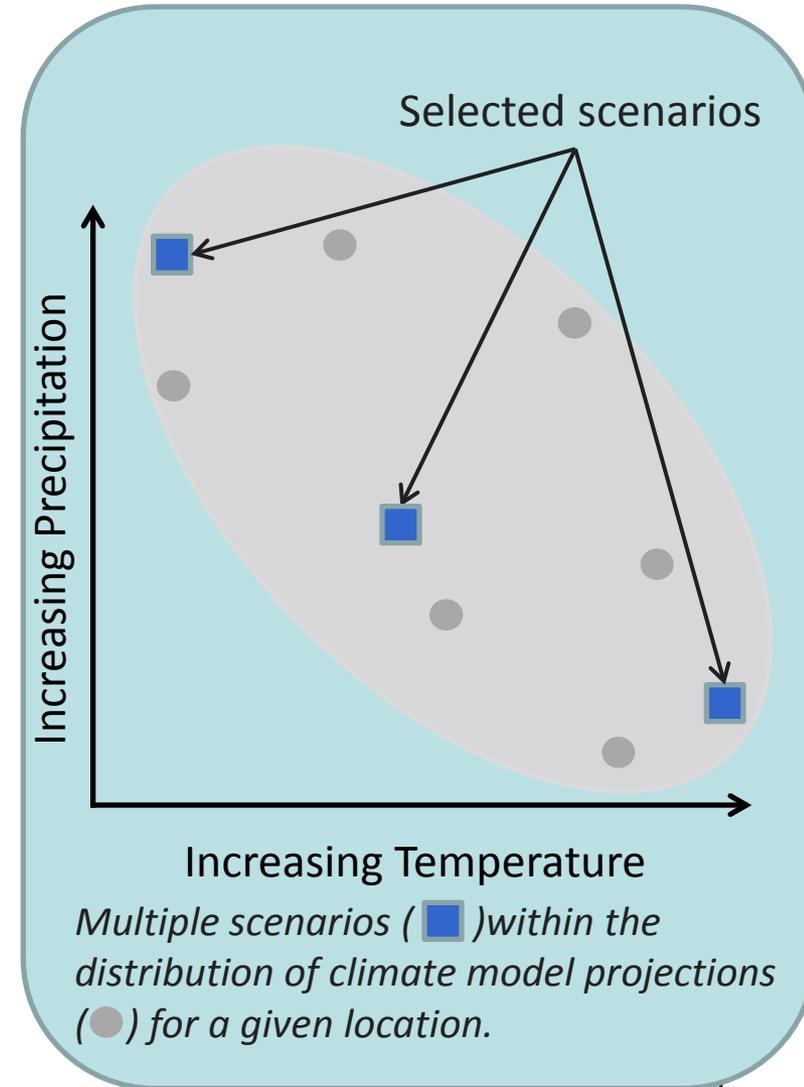
# *Projected Climate Change*

- CREAT provides projected changes in
  - Temperature
  - Precipitation
  - Intense precipitation
  - Sea level
- Rather than rely on a single projection, three scenarios are provided to support assessments over a range of possible future conditions

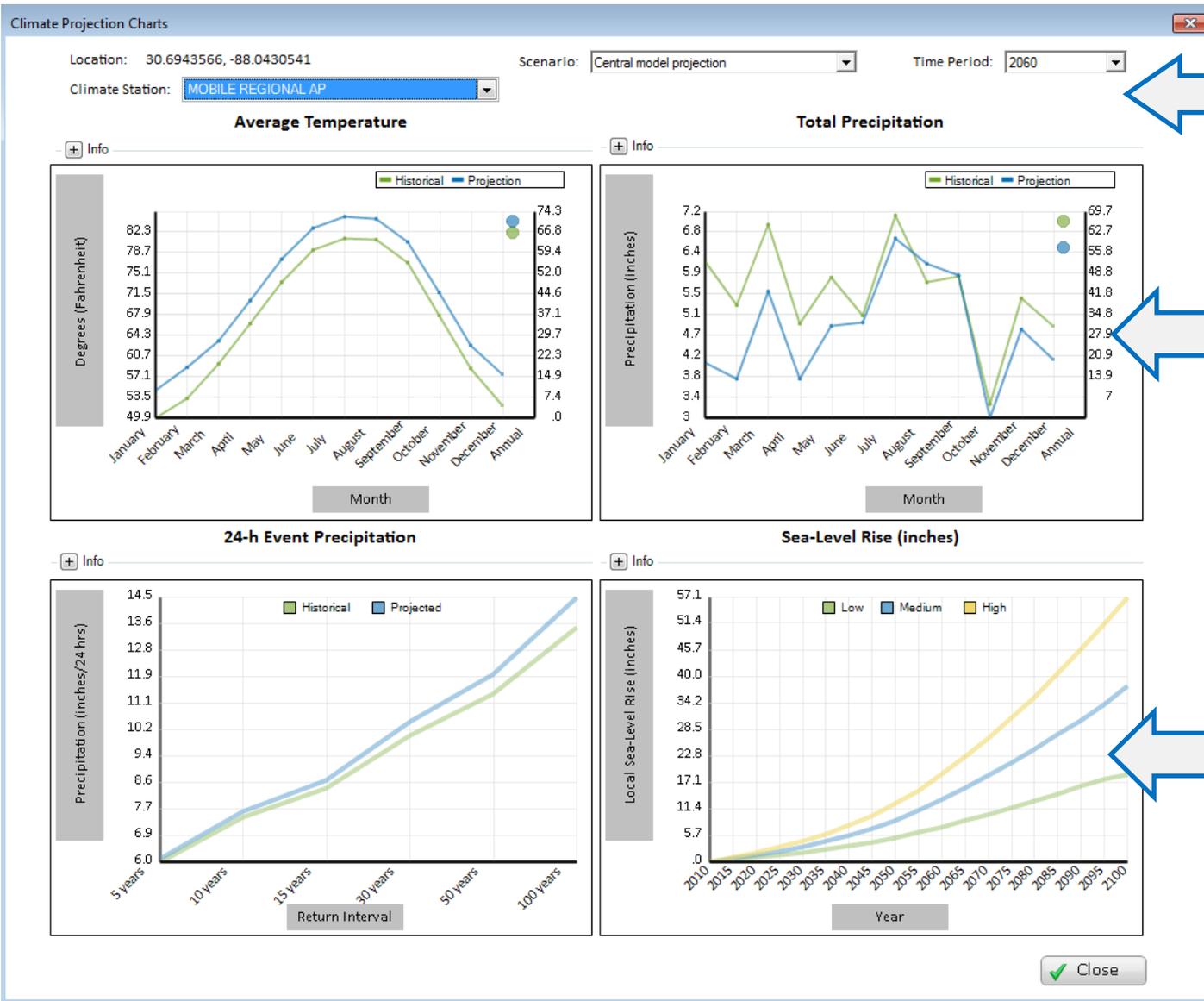


## Climate Scenarios

- Scenarios, based on a single model projection, selected for each grid cell
  - Hot and Dry model
  - Central model
  - Warm and wet model
- Data provided for two time periods (2020-2050 and 2045-2075)



# Climate Data in CREAT



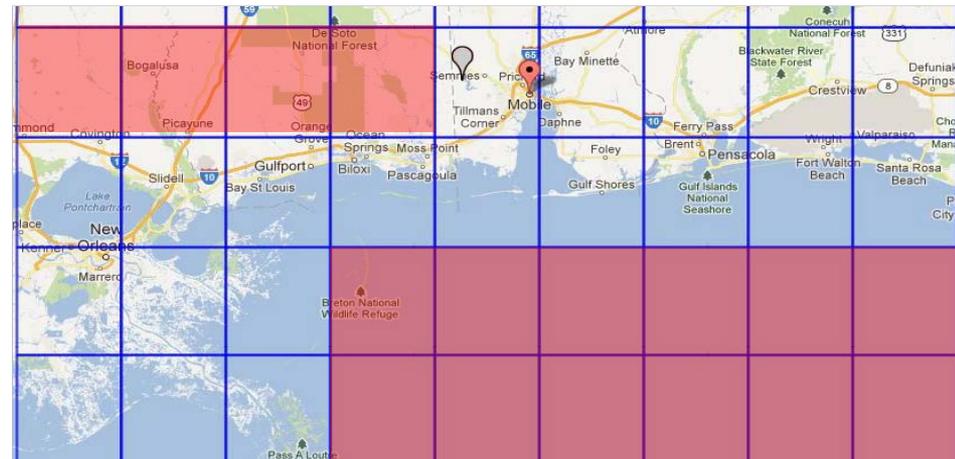
View data from multiple climate stations, scenarios, and time periods

Annual and monthly temperature and precipitation

Intense precipitation events and sea-level rise

## *Sea-Level Rise Factors*

- Two components of global sea-level rise (SLR)
  - Thermal expansion: varies regionally due to ocean currents, salinity and other factors
  - Ice melt: from glaciers and ice sheets over land (Antarctica, Greenland)
- Latest scientific literature suggests global SLR of up to 1.5 m by 2100 for planning purposes
- CREAT provides regional SLR data for coastal grid cells



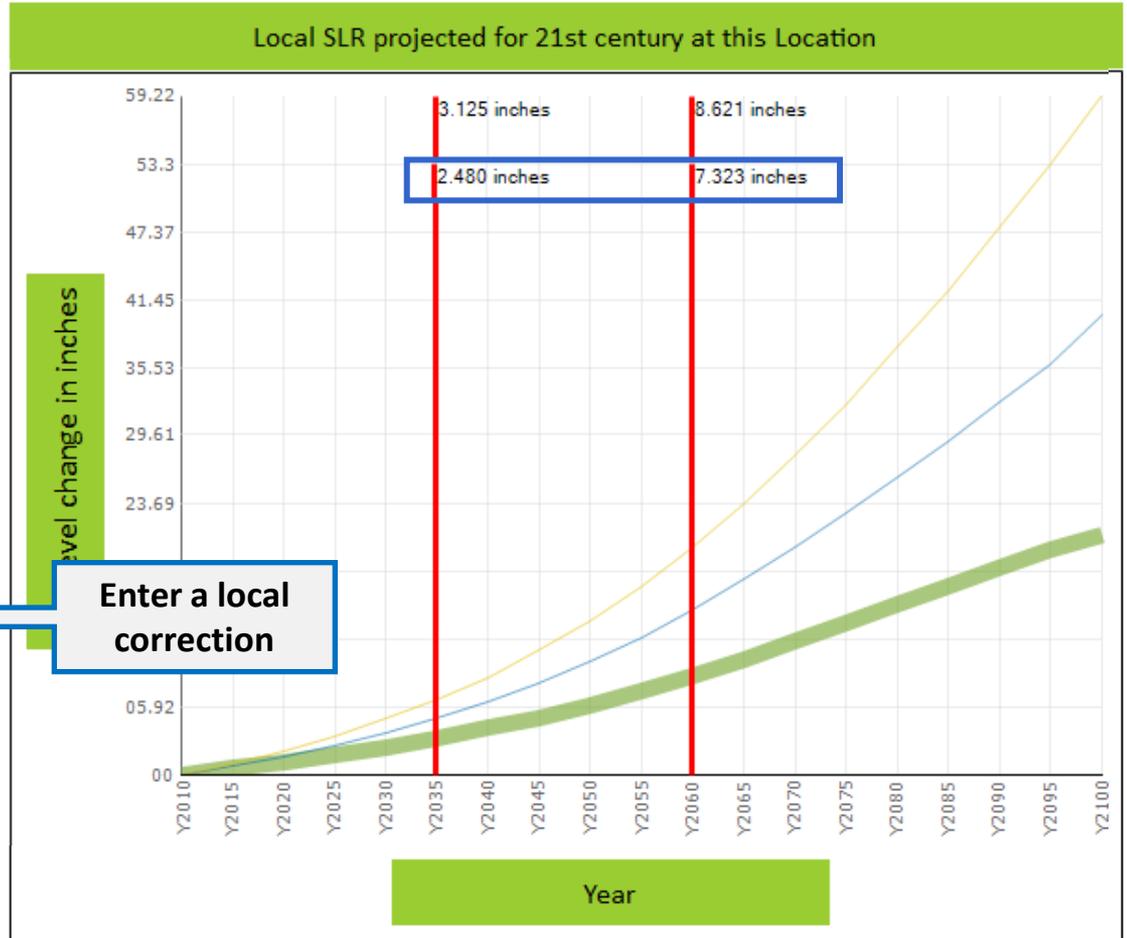
Select the Global (2100) SLR value you would like to consider for your location

- 4.92 feet by 2100 (1.5 m) (High)
- 3.28 feet by 2100 (1.0 m) (Med)
- 1.62 feet by 2100 (0.5 m) (Low)

Scalar for this location:

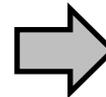
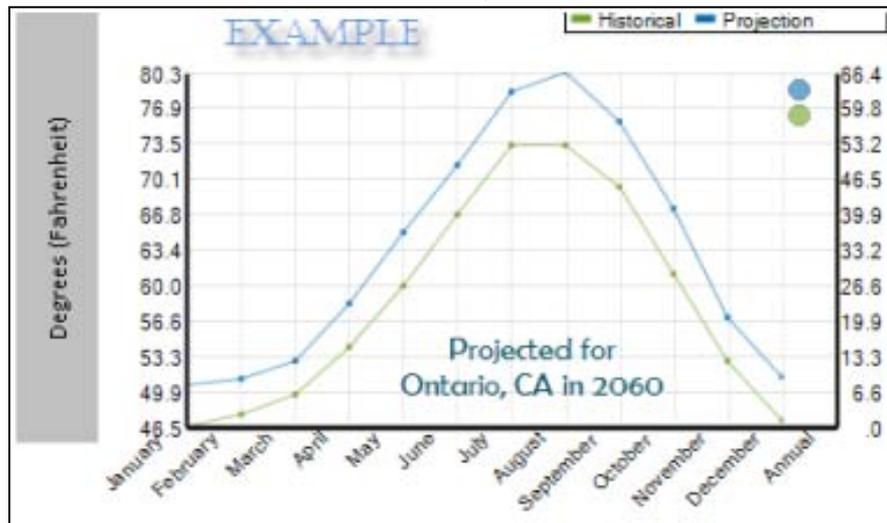
Local Corrections to Global SLR Values

- None
- Tide Gauge  inches/y
- Subsidence  inches/y



# Data Needs for Threats

Combination of qualitative and quantitative information are a good start for understanding climate change and identifying challenges



Challenges / Threats
Altered demand and competing use
Changes in agricultural practices & outdoor use
Changes in energy sector water needs
Changes in influent flow & temperature
Changes in residential use
Altered or loss of ecosystem services
Altered vegetation / wildfire risk
Loss of coastal landforms
Loss of wetlands
Degraded water quality
Altered surface water quality
Saline intrusion into aquifers
Increased flood frequency & extent
Coastal storm surges
High flow events
Increased incidence of droughts
Lower lake and reservoir levels
Reduced groundwater recharge
Reduced snowpack



## *Building Awareness: Identifying Challenges*

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Use climate information to identify climate challenges relevant to your utility



## *Translating Data into Challenges*

- CREAT provides projected changes in temperature, precipitation and sea level
- Users need to provide system- and location-specific information and tools to complement data provided in CREAT
- To conduct assessments, scenarios based on climate data will need to be translated into threat scenarios with magnitude information



## *Threat Groups in CREAT*

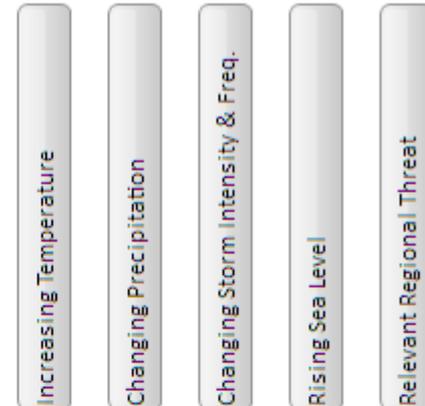
- Increased incidence of droughts
- Increased flood frequency and extent
- Degraded water quality
- Altered or loss of ecosystem services
- Altered demand and competing use



# Selecting Threats



## Climate Change Drivers



Climate Change Drivers

The list of threats below are those related to at least one selected driver. You can filter to see the threats that are a

Filter capability provided

Related Threats

Challenges / Threats	Increasing Temperature	Changing Precipitation	Changing Storm Intensity & Freq.	Rising Sea Level	Relevant Regional Threat
Altered demand and competing use					
Changes in agricultural practices & outdoor use	X	X	X		
Changes in energy sector water needs	X	X			X
Changes in influent flow & temperature	X	X			
Changes in residential use	X				
Altered or loss of ecosystem services					
Altered vegetation / wildfire risk	X	X			X
Loss of coastal landforms			X	X	
Loss of wetlands	X	X	X	X	
Degraded water quality					
Altered surface water quality	X	X	X	X	
Saline intrusion into aquifers		X		X	
Increased flood frequency & extent					
Coastal storm surges			X	X	

Indicates residential use driven by increasing temperature



*Climate Ready Water Utilities:  
An abridged case study from coastal  
North Carolina*

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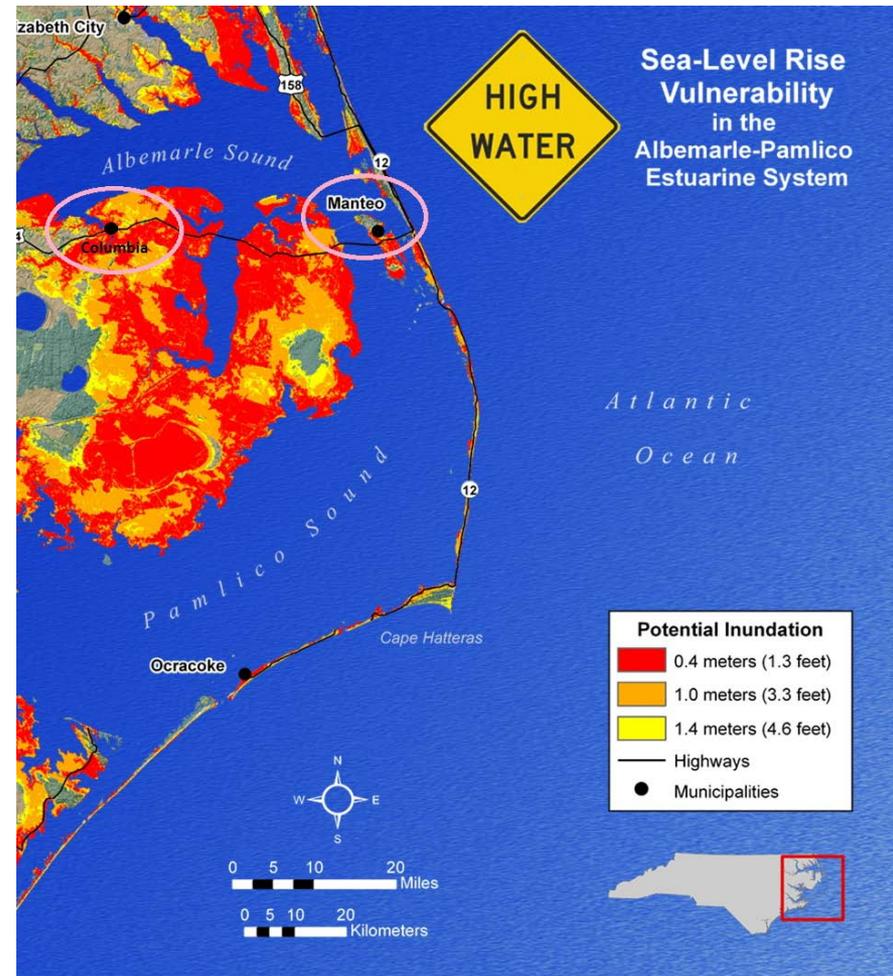
Jim Hawhee

Albemarle-Pamlico National Estuary Partnership



## Regional Challenges

- Flat topography
- Small tax base
- Storm surge vulnerability (including Hurricanes Irene and Sandy)
- Projected sea-level rise and associated land use changes

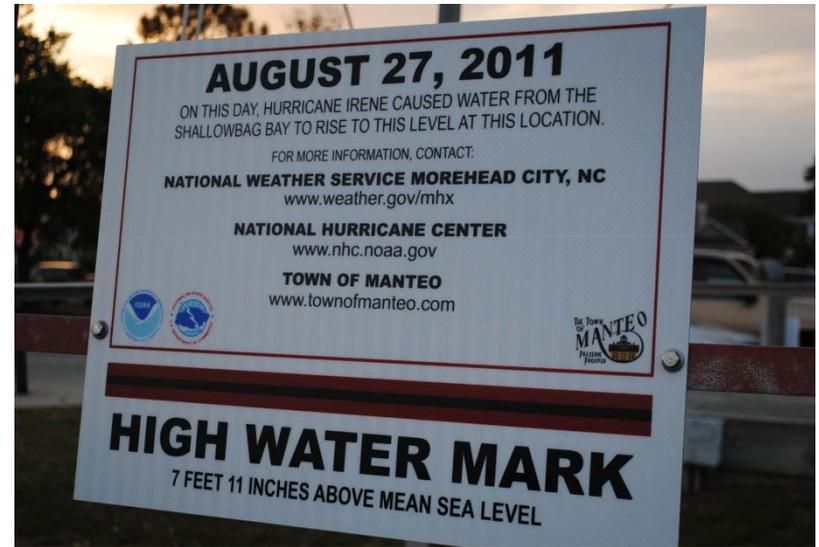


- Saltwater intrusion
- Damage to infrastructure from hurricanes and coastal storms
- Flooding from heavy precipitation events
- Projected land use change



# Addressing the Issue

- Secured resources and assembled a project team
- Identified national, state, and local information sources
- Used EPA’s CREAT software to identify assets, threats, and cost-effective management approaches
- Incorporate project recommendations into existing planning processes



SLR Scenarios in Manteo and Columbia: CREAT		
	2035	2060
High (1.5m by 2100)	8 inches	23 inches
Medium (1m by 2100)	7 inches	18 inches
Low (.5m by 2100)	5 inches	12 inches



## *Lessons Learned*

- Local, state, and national information resources, consulted at an early stage, will improve the planning process.
- Consider enlisting a small support team of utility, climate, environmental, and public health experts.
- CREAT provides a methodical framework to examine climate pressures on water utility systems and develop practical solutions.
- Short-term climate scenarios (25-50 years), provided by CREAT, are instructive for utility planning purposes.
- CREAT is an iterative process, and can be updated as new assets, threats, or solutions are identified.



## *Building Awareness: Researching Adaptation*

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Learn about options for adapting to changing conditions

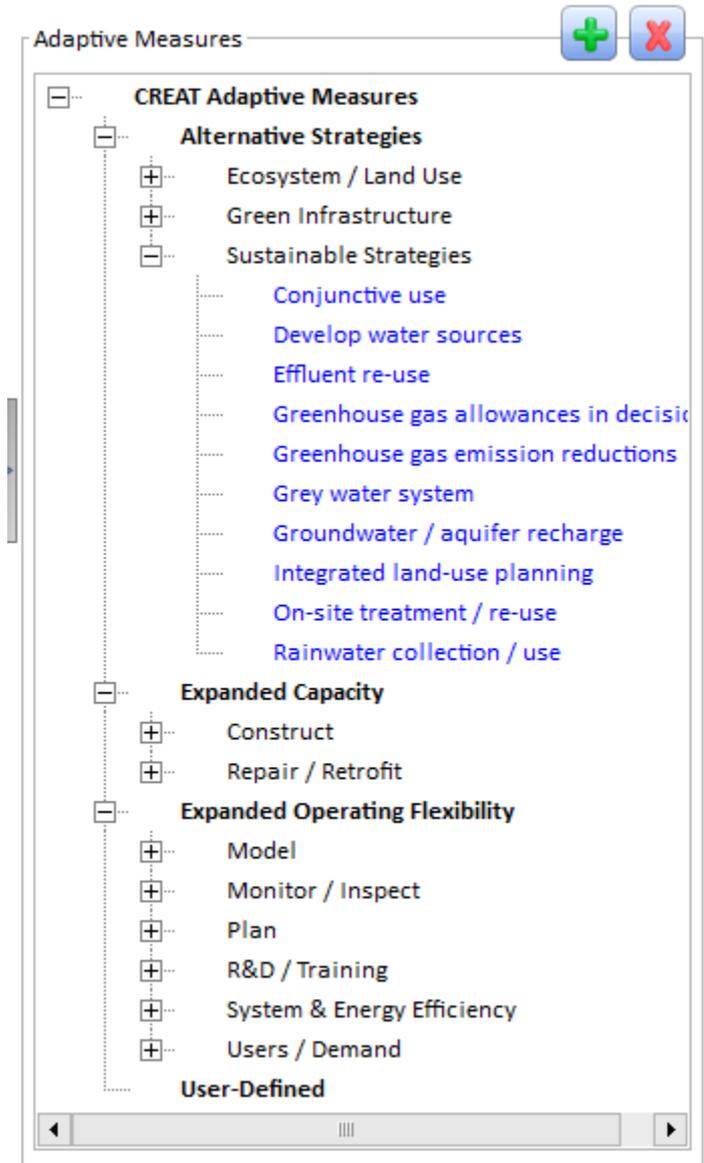


## *Adaptation Basics*

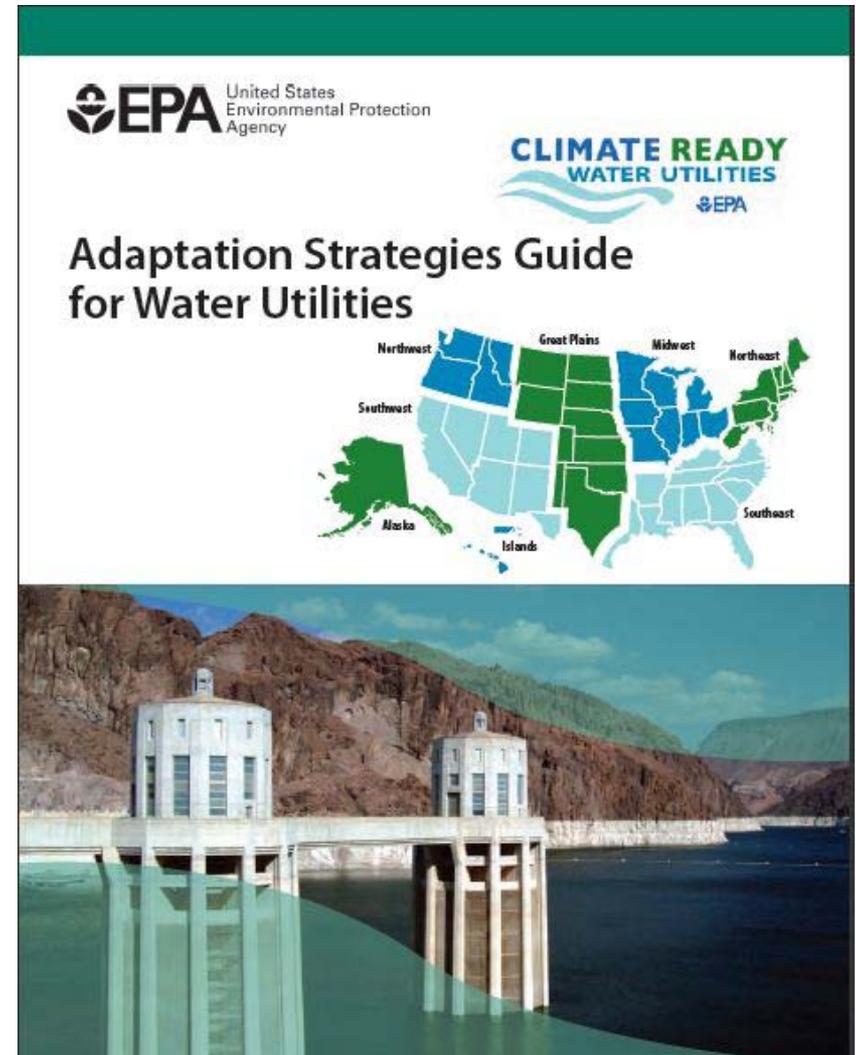
- When possible, adaptation can be incorporated into existing planning practices
- A range of activities could build resilience at your utility
  - Enhanced operational flexibility
  - Expanded capacity
  - Alternate strategies
- Information on adaptation options currently being employed by water utilities and communities is needed

# Adaptation Library

- Browse over 100 adaptive measures in CREAT
- Review descriptions and threat relevance to select those measures to include in assessments
- Keep track of existing and potential measures



- Other resources for identifying adaptive measures include the Adaptation Strategies Guide
- Guide provides adaptation options by region and threat type to browse and use in CREAT



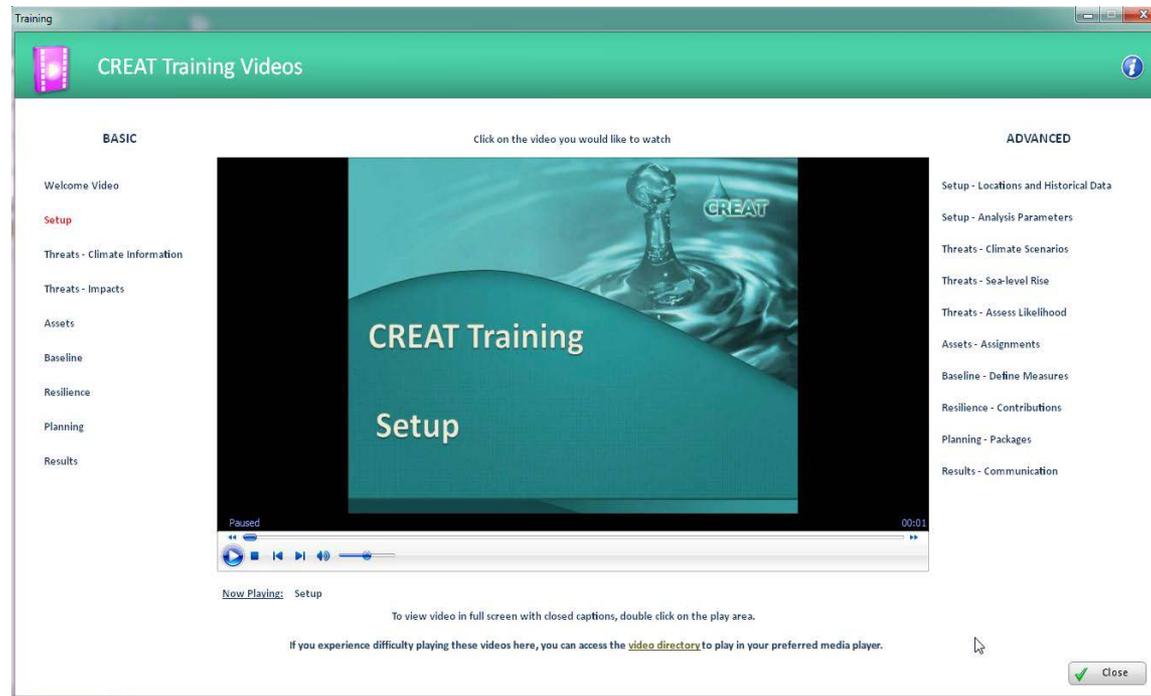


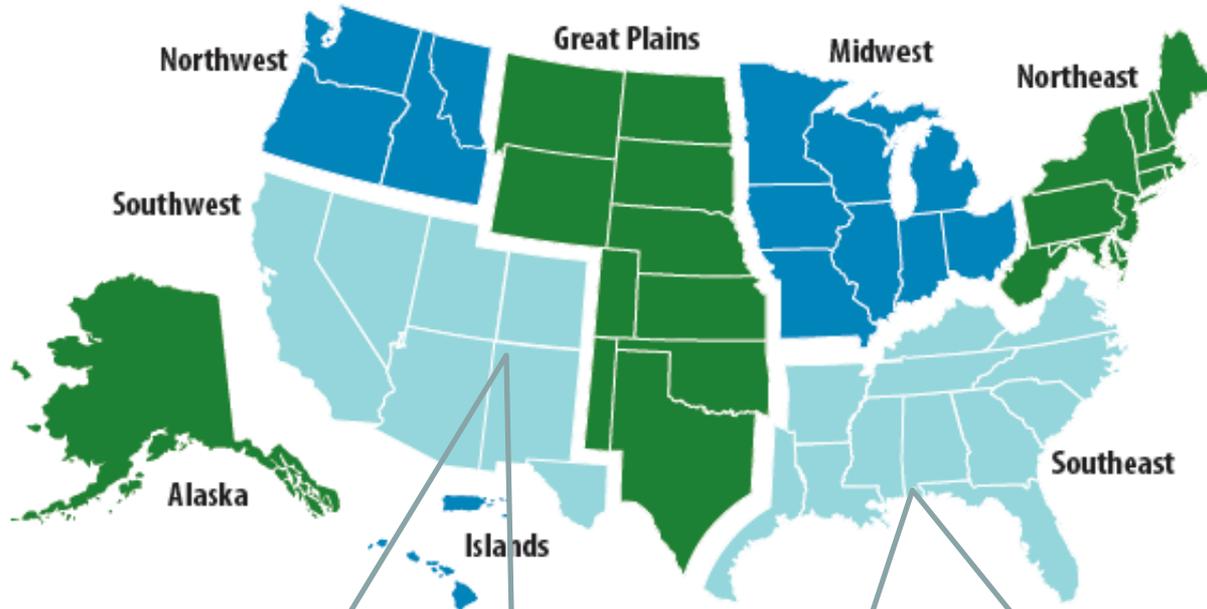
## *Summary*

CREAT provides:

- Support for building climate awareness
- Climate data within a risk-assessment framework
- Links to other climate-related resources
- Adaptation options for consideration

- CREAT 2.0 is freely available for download from the CRWU website
- Training videos are integrated into software with example analysis files





## Basic Training



Small, drinking water utility



Increasing drought severity with climate change

## Advanced Training



Large, combined utility



Floods and water quality following storm events



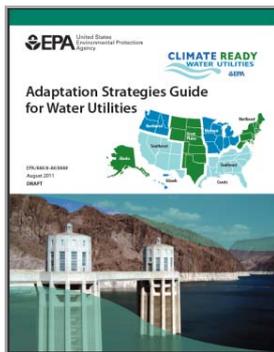
## Climate Ready Process

### Adaptive Response Framework



Explore Elements of Climate Readiness

### Adaptation Strategies Guide



Learn Climate and Adaptation Basics

### Toolbox

-  **Featured Resource**
-  **Region Map**
-  **Activities**
-  **Funding**
-  **Publications and Reports**
-  **Tools and Models**
-  **Training, Workshops and Seminars**

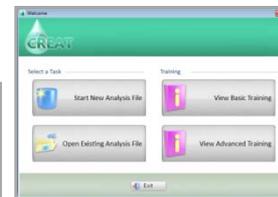
Research and Gather Information

### Extreme Events Workshop Planner



Collaborate with Partners

### Climate Resilience Evaluation and Awareness Tool



Assess Risks and Evaluate Opportunities



## *Connect with CRWU*

Please send questions and feedback to  
[CRWUhelp@epa.gov](mailto:CRWUhelp@epa.gov)

- Host pilot projects and exercises to improve and learn about available tools
- Share your success stories with CRWU and other utilities as part of future releases
- Visit EPA climate change page:  
<http://epa.gov/climatechange>



## Upcoming Events

Next Event	Date
Extreme Events Workshop Planner	March 6, 2013
Coming soon	Date
Adaptation Strategies Guide	March 13, 2013
Workshop Planner/ Adaptation Strategies Guide	April 10, 2013
Using CREAT for Planning and Decision Support	TBD

**To register for these events and download resources, visit the CRWU website:**

[www.epa.gov/climate-ready-utilities](http://www.epa.gov/climate-ready-utilities)



## *Next CREAT Webinar*

- Assessing risk
  - Consider “baseline” risk assessment
  - Evaluate risk reduction through adaptation
- Planning adaptation
  - Build packages of adaptive measures to plan implementation
  - Consider costs and energy implications of adaptation choices to support decisions



*Thank you*

*Any questions?*

Curt Baranowski

[Baranowski.Curt@epa.gov](mailto:Baranowski.Curt@epa.gov)

John Whitler

[Whitler.John@epa.gov](mailto:Whitler.John@epa.gov)

Amy Posner

[Posner.Amy@epa.gov](mailto:Posner.Amy@epa.gov)

Laura Dubin

[Dubin.Laura@epa.gov](mailto:Dubin.Laura@epa.gov)

[CRWUhelp@epa.gov](mailto:CRWUhelp@epa.gov)

