# *Introduction to Climate Ready Water Utilities Initiative (CRWU)*

John Whitler, Water Security Division, US EPA

Olga Morales, Rural Community Assistance Corporation and Chair of the National Drinking Water Advisory Council

January 23, 2013

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# CRWU Webinar Series

| Topic | Next Event |
|---|---|
| **Introduction to CRWU Initiative** | *TBD* |
| **Climate Change and the Water Sector** | *February 13, 2013* |
| **Introduction to CREAT** | *February 27, 2013* |
| **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* |

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

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# *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.*




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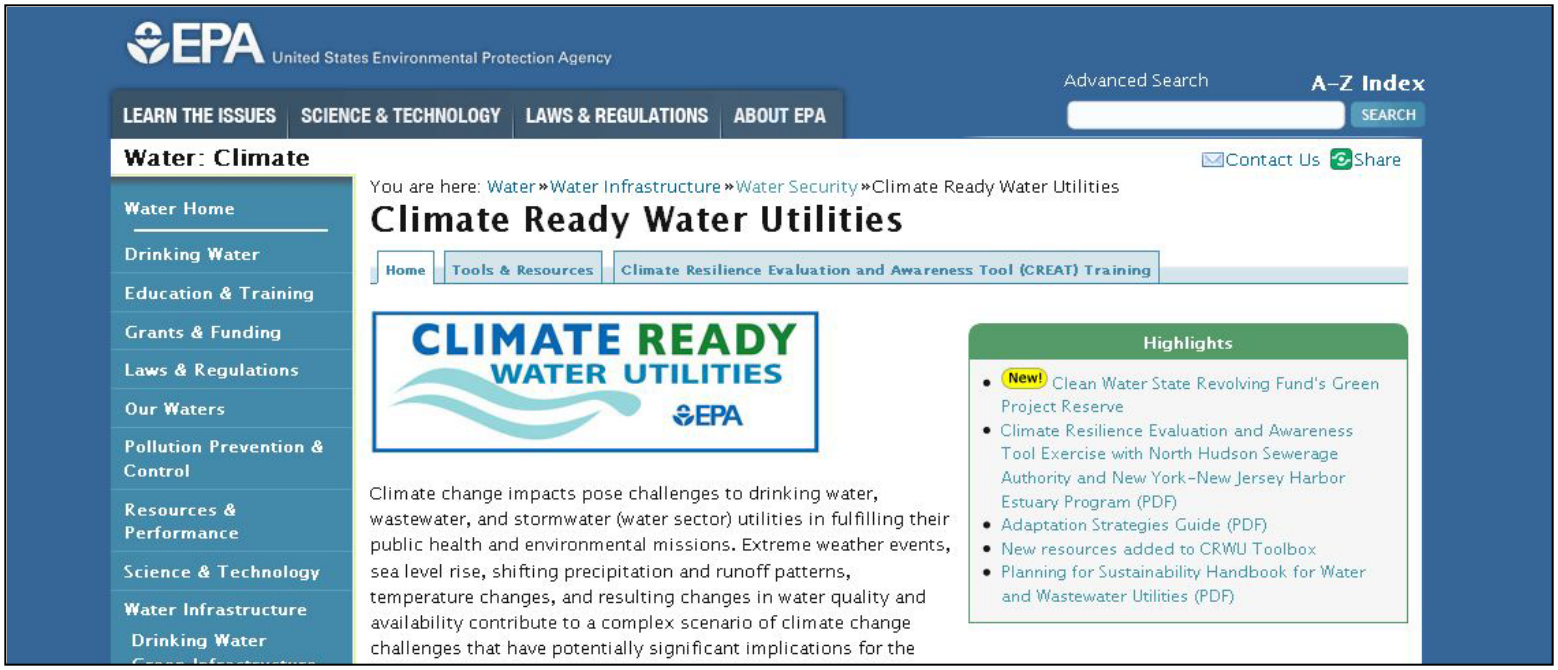
# *Overview*

- Background on climate change and CRWU
- CRWU Tools & Resources
- Implementation – collaboration with utilities and their partners

# Connect with CRWU

- Visit us on the web at:
  www.epa.gov/climatereadyutilities
- Contact us for questions, help and feedback at:
  CRWUhelp@epa.gov



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# What Types of Changes Are Expected?

- Increasing temperatures
- Changing precipitation patterns
  - Less in some areas, more in others
  - Frequency and magnitude of extreme precipitation events
  - Changes in snowfall and snowpack
- Changing patterns of extreme weather events
- Rising sea level


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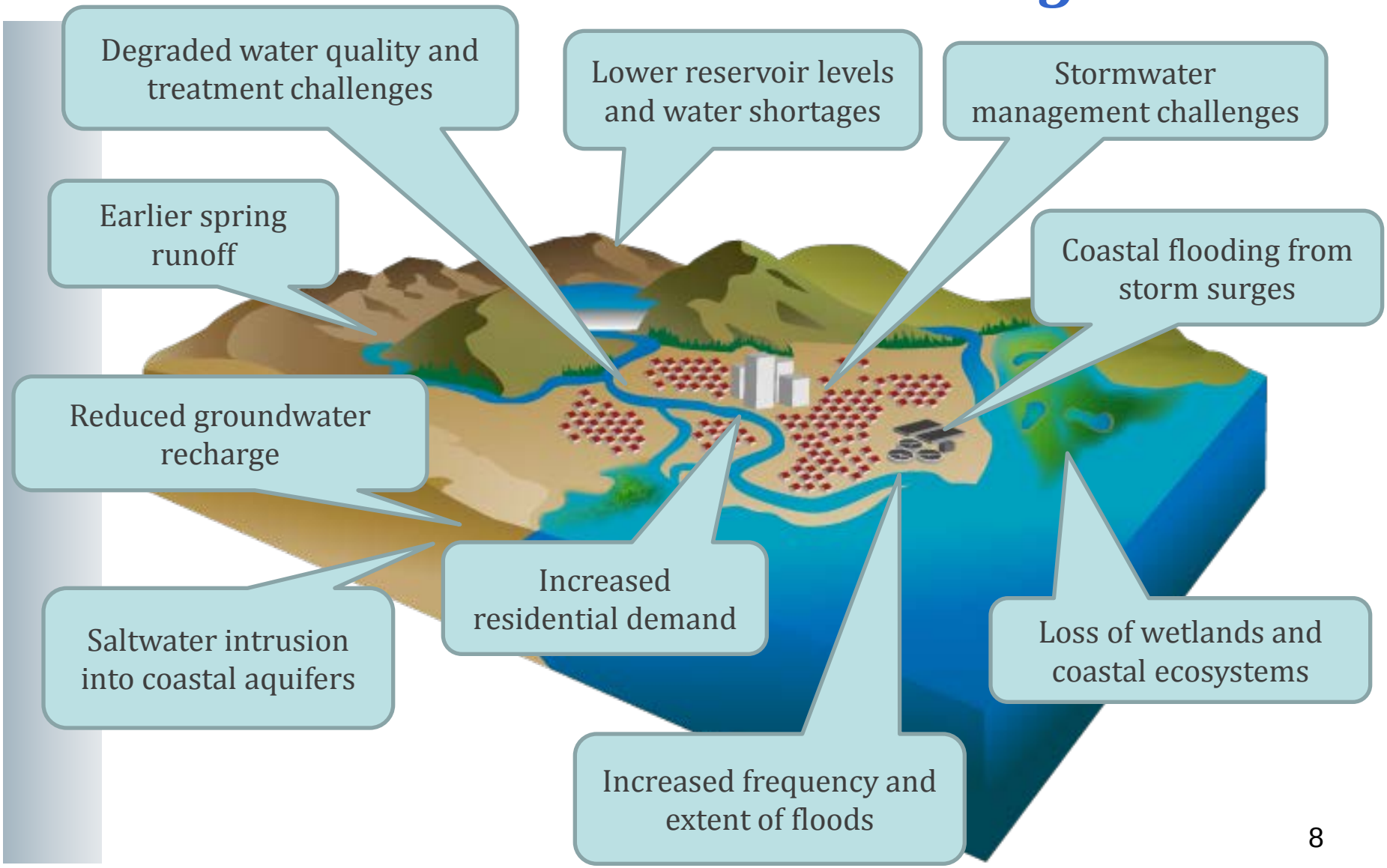
# Impacts of Climate Change



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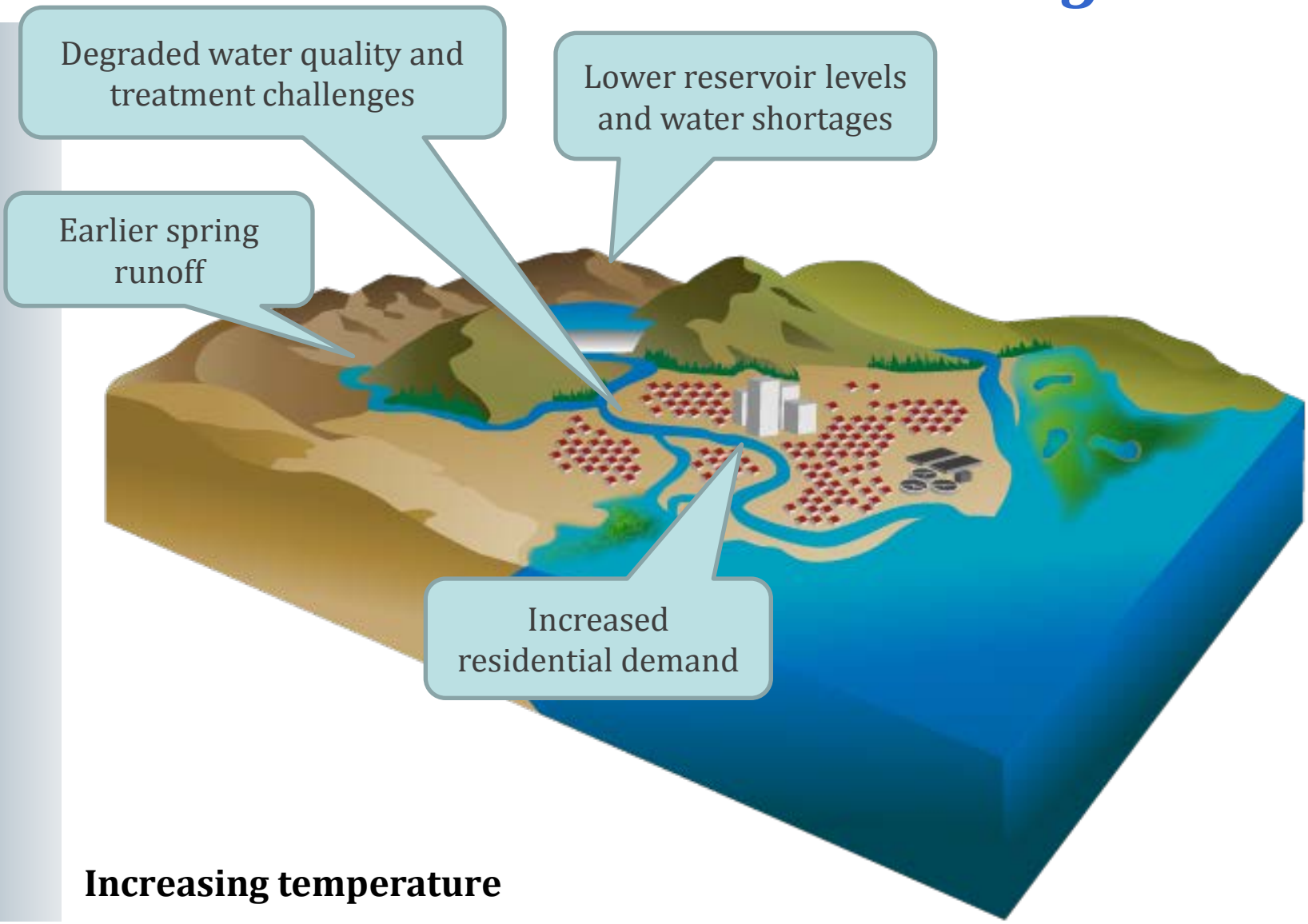
# *Impacts of Climate Change*




**Increasing temperature**

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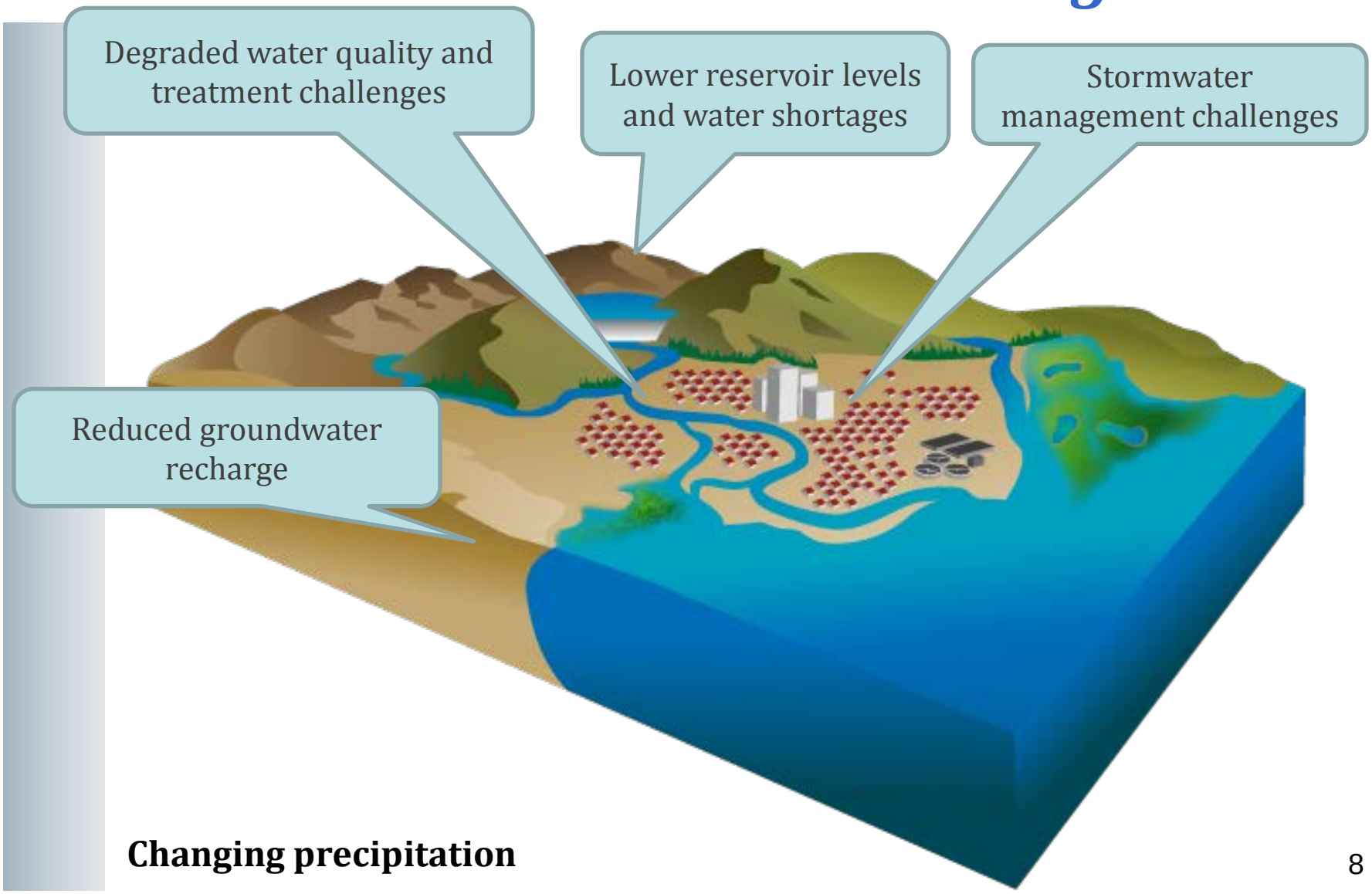
# *Impacts of Climate Change*




**Changing precipitation**

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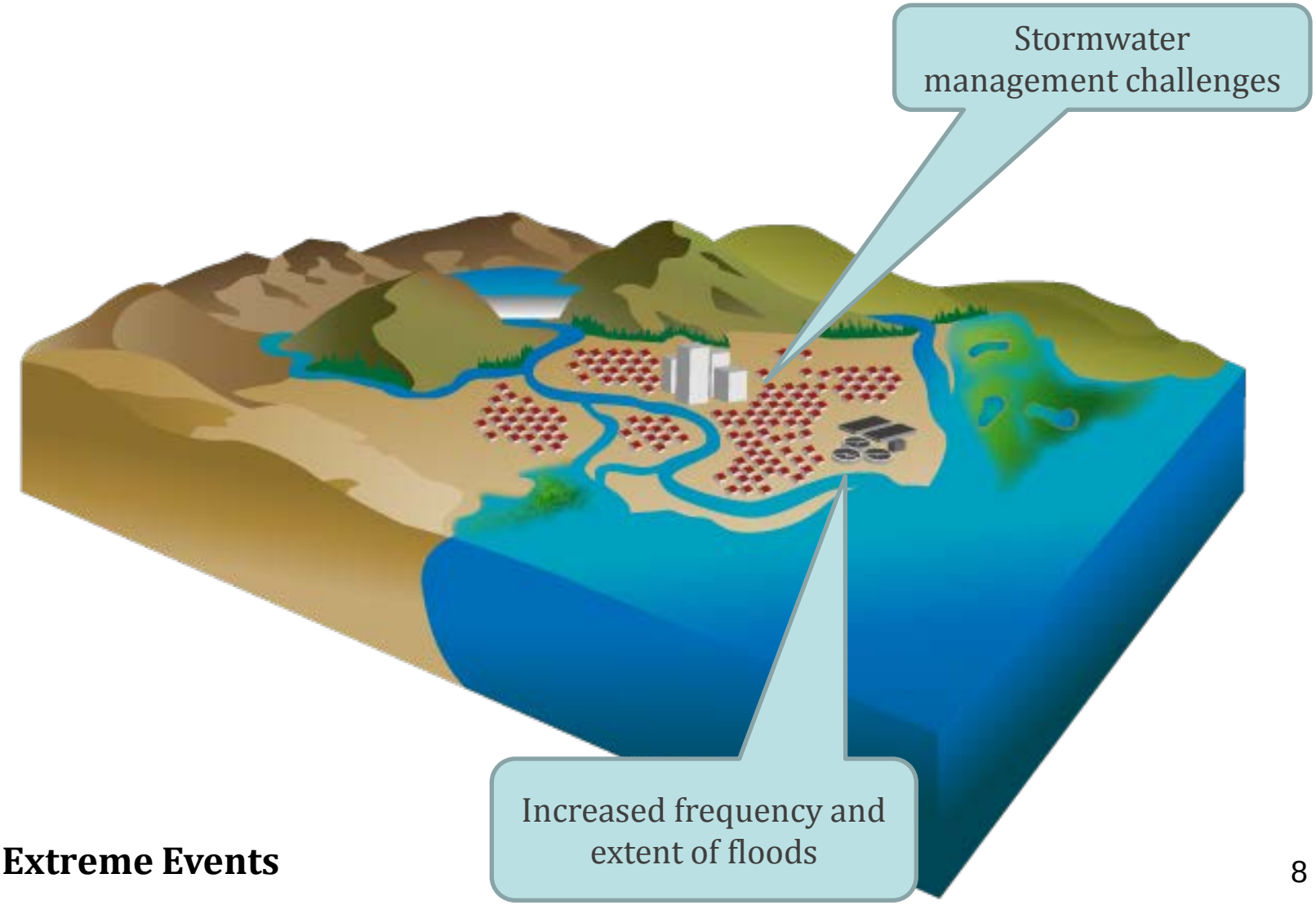
# *Impacts of Climate Change*




**Extreme Events**

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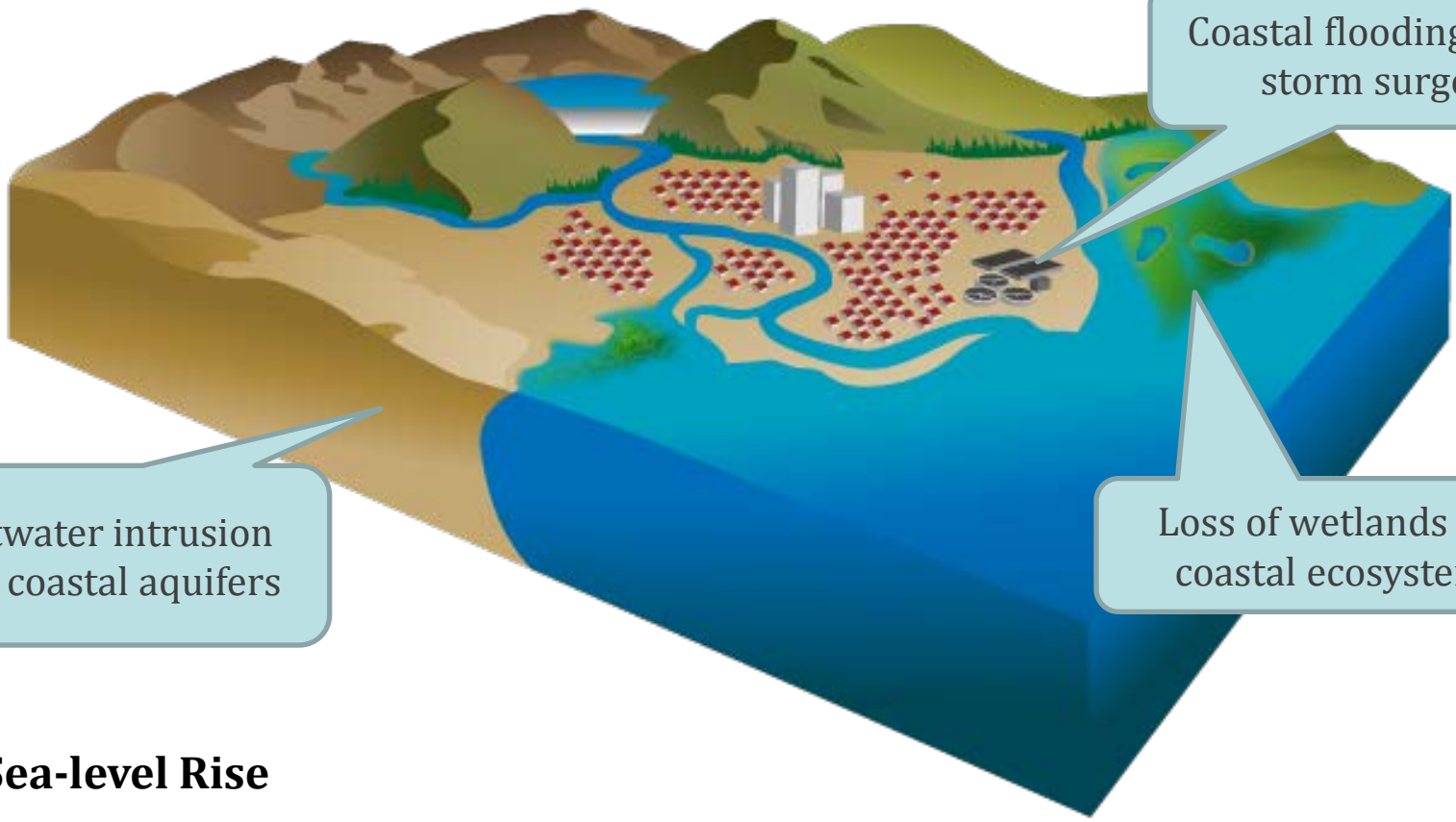
# *Impacts of Climate Change*




**Sea-level Rise**

# What is a Climate Ready Water Utility?

The National Drinking Water Advisory Council (NDWAC) approved the formation of a working group to evaluate "Climate Ready Water Utilities"

Charge included identifying:

- Behaviors that characterize a climate ready utility
- Needed tools, trainings and products that would help utilities engage in climate ready behaviors
- Mechanisms that would facilitate adaptation and mitigation by the water sector

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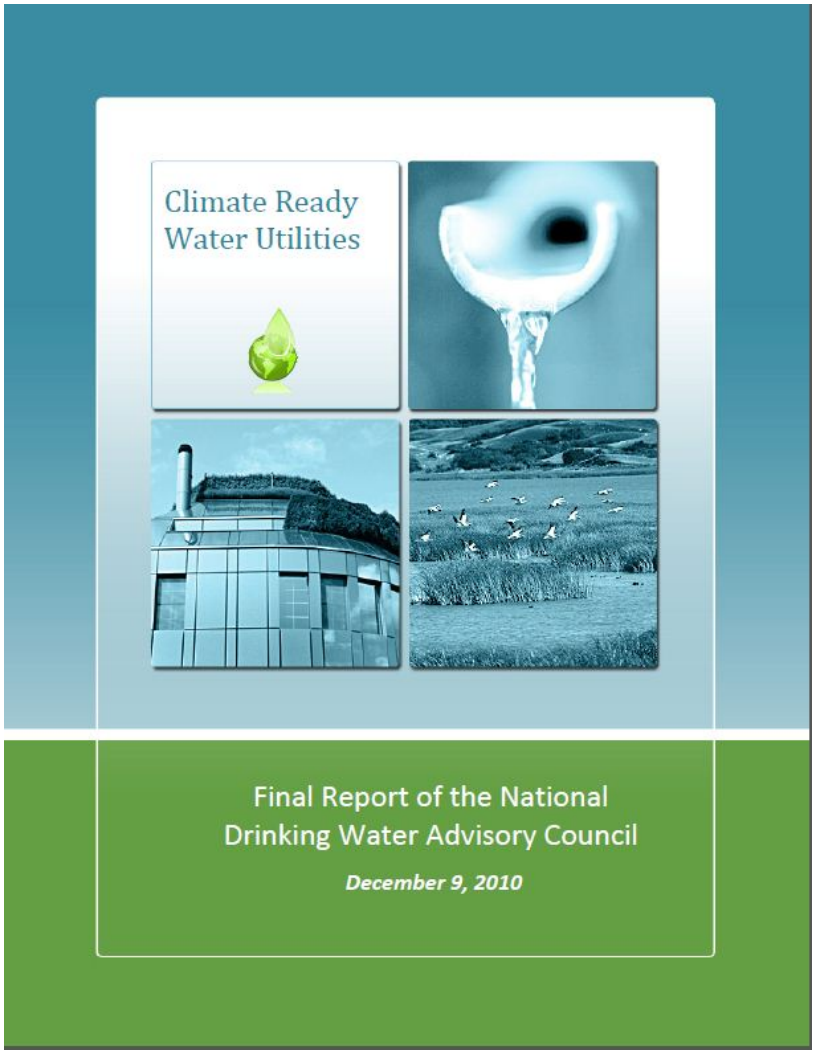
# National Drinking Water Advisory Council Report




- Released January 2011
- 11 findings of barriers to mitigation and adaptation actions by utilities
- 12 recommendations to help EPA and utilities move forward
- Result: EPA started CRWU initiative

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# *Adaptive Response Framework*

Explore elements of climate readiness

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# *Elements of Climate Readiness*

## Adaptive Response Framework

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# Planning & Climate Change

- Incorporate climate change into existing planning practices
- Range of activities can build "climate readiness" at your utility
- Use of adaptive management may be critical component of becoming and staying a climate ready water utility

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# Framework Document

- Reference guide for using Framework
- Key concepts and actions for each element
- Resources that support pursuing actions

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Adaptive Response Framework

Awareness | Adaptation | Mitigation | Policies | Community | Partnership | Climate Ready

MITIGATION STRATEGIES

Return to Framework

OVERVIEW

Mitigation strategies are actions that reduce the carbon footprint of a utility, including reducing greenhouse gas (GHG) emissions from operations (e.g., on-site electrical generation from recovered sludge digest emissions), helping to reduce a community's water footprint (reducing the amount of energy-intensive water treatment your utility must conduct), or even altering practices to account for a carbon budget beyond emissions reductions (e.g., carbon offsets on property through land use planning).

Energy management is a straightforward strategy for your utility to pursue mitigation. By lowering the amount of energy used, through conservation, energy efficiency, or on-site alternative power generation, you can reduce emissions and costs. Integrating GHG management into overall utility planning and monitoring can help promote utility initiatives across the community and generate environmental, economic and social benefits.

KEY CONCEPTS

- ***Activities that reduce the amount or rate of GHG emissions*** from a utility are generally described as mitigation.
- ***Mitigation efforts can provide other benefits,*** including reduced energy costs, increased resilience to climate change, and public health co-benefits.

ACTIONS

- Identify where your energy comes from (e.g., different utility processes), how it is used, fuel sources, and how it is measured.
- Estimate your energy use along with direct and indirect GHG emissions.
- Identify energy management strategies and set reduction targets for your utility.
- Monitor performance against established indicators and metrics and compare to measurable goals.
- Link strategy to broader community plans, such as reforestation, conservation partnerships and equipment rebates.
- Incentivize mitigation on the part of the community (i.e., energy and water conservation).
- Research energy conservation programs in your community and identify collaboration opportunities.
- Implement and evaluate energy management, measuring energy savings, cost savings, and pollution reduction; publicize success.

RESOURCES

- Sustainable Infrastructure Resources
- Utility Professionals Quick Links
- EPA State and Local Climate and Energy Program
- EPA Energy Use Assessment Tool
- Benchmarking Your Energy Performance with Portfolio Manager
- EPA Greenhouse Gas Equivalencies Calculator

ADAPTIVE RESPONSE FRAMEWORK • MITIGATION Page 6

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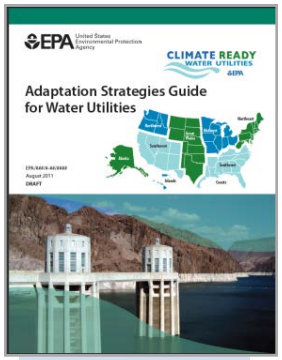
# Climate Ready Tools & Resources

## Climate Ready Process

### Adaptive Response Framework


*Explore Elements of Climate Readiness*

### Adaptation Strategies Guide




*Learn Climate and Adaptation Basics*

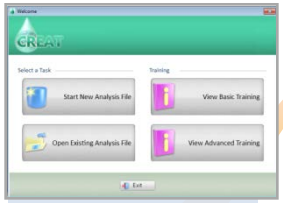
### Toolbox


*Research and Gather Information*

### Extreme Events Workshop Planner


*Collaborate with Partners*

### Climate Resilience Evaluation and Awareness Tool




*Assess Risks and Evaluate Opportunities*

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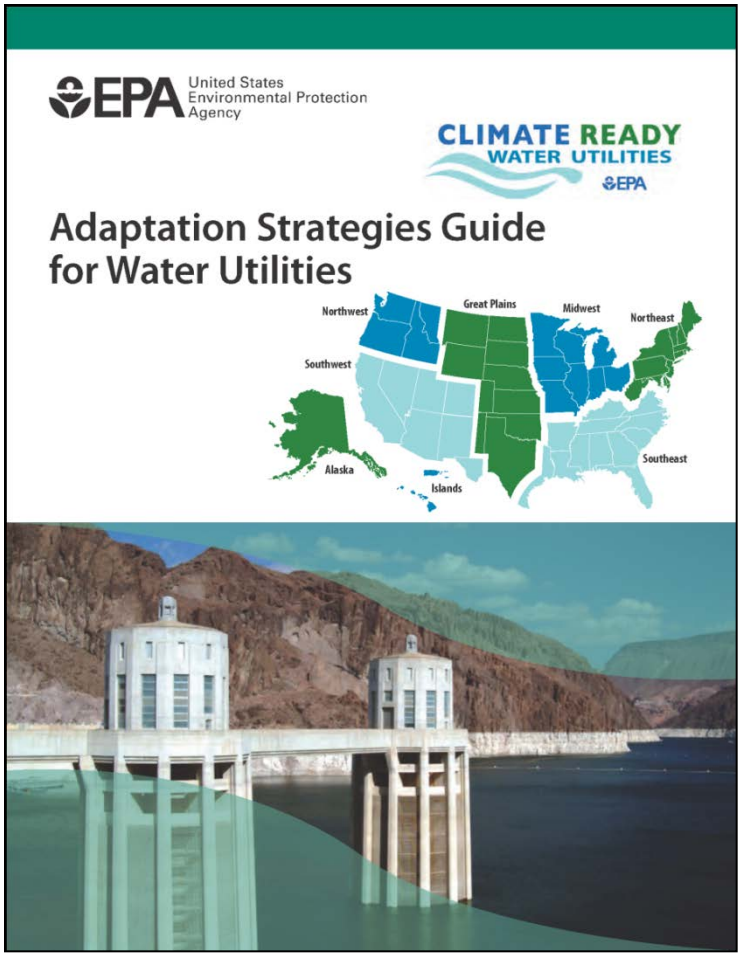
# *Adaptation Strategies Guide*

Learn climate and adaptation basics

# Adaptation Strategies Guide

- Reference guide for adaptation planning
- Easy-to-navigate briefs
  - Regional climate impacts
  - Utility-specific challenges
  - Sustainable strategies
- Adaptation options to consider
- Glossary and planning worksheet



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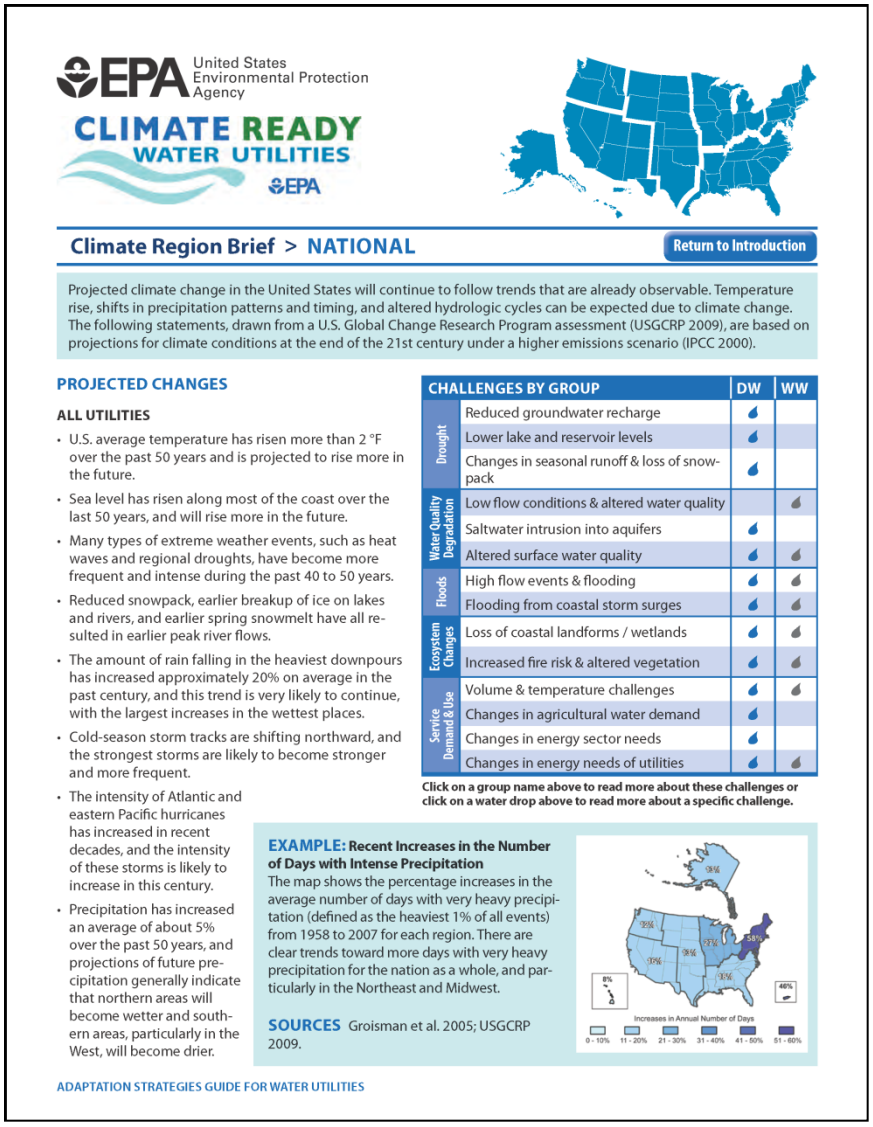
# Regional Climate Briefs



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## Climate Region Brief > NATIONAL

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Projected climate change in the United States will continue to follow trends that are already observable. Temperature rise, shifts in precipitation patterns and timing, and altered hydrologic cycles can be expected due to climate change. The following statements, drawn from a U.S. Global Change Research Program assessment (USGCRP 2009), are based on projections for climate conditions at the end of the 21st century under a higher emissions scenario (IPCC 2000).

### PROJECTED CHANGES

**ALL UTILITIES**

- U.S. average temperature has risen more than 2 °F over the past 50 years and is projected to rise more in the future.
- Sea level has risen along most of the coast over the last 50 years, and will rise more in the future.
- Many types of extreme weather events, such as heat waves and regional droughts, have become more frequent and intense during the past 40 to 50 years.
- Reduced snowpack, earlier breakup of ice on lakes and rivers, and earlier spring snowmelt have all resulted in earlier peak river flows.
- The amount of rain falling in the heaviest downpours has increased approximately 20% on average in the past century, and this trend is very likely to continue, with the largest increases in the wettest places.
- Cold-season storm tracks are shifting northward, and the strongest storms are likely to become stronger and more frequent.
- The intensity of Atlantic and eastern Pacific hurricanes has increased in recent decades, and the intensity of these storms is likely to increase in this century.
- Precipitation has increased an average of about 5% over the past 50 years, and projections of future precipitation generally indicate that northern areas will become wetter and southern areas, particularly in the West, will become drier.

| CHALLENGES BY GROUP | | DW | WW |
|---|---|---|---|
| Drought | Reduced groundwater recharge | 💧 | |
| | Lower lake and reservoir levels | 💧 | |
| | Changes in seasonal runoff & loss of snowpack | 💧 | |
| Water Quality Degradation | Low flow conditions & altered water quality | | 💧 |
| | Saltwater intrusion into aquifers | 💧 | |
| | Altered surface water quality | 💧 | 💧 |
| Floods | High flow events & flooding | 💧 | 💧 |
| | Flooding from coastal storm surges | 💧 | 💧 |
| Ecosystem Changes | Loss of coastal landforms / wetlands | 💧 | 💧 |
| | Increased fire risk & altered vegetation | 💧 | 💧 |
| Service Demand & Use | Volume & temperature challenges | 💧 | 💧 |
| | Changes in agricultural water demand | 💧 | |
| | Changes in energy sector needs | 💧 | |
| | Changes in energy needs of utilities | 💧 | 💧 |

Click on a group name above to read more about these challenges or click on a water drop above to read more about a specific challenge.

**EXAMPLE: Recent Increases in the Number of Days with Intense Precipitation**

The map shows the percentage increases in the average number of days with very heavy precipitation (defined as the heaviest 1% of all events) from 1958 to 2007 for each region. There are clear trends toward more days with very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest.

**SOURCES** Groisman et al. 2005; USGCRP 2009.



ADAPTATION STRATEGIES GUIDE FOR WATER UTILITIES

- Browse regional climate data
  - Projected changes
  - Anticipated challenges
- Jump to specific challenge briefs
- Review example data and related challenges

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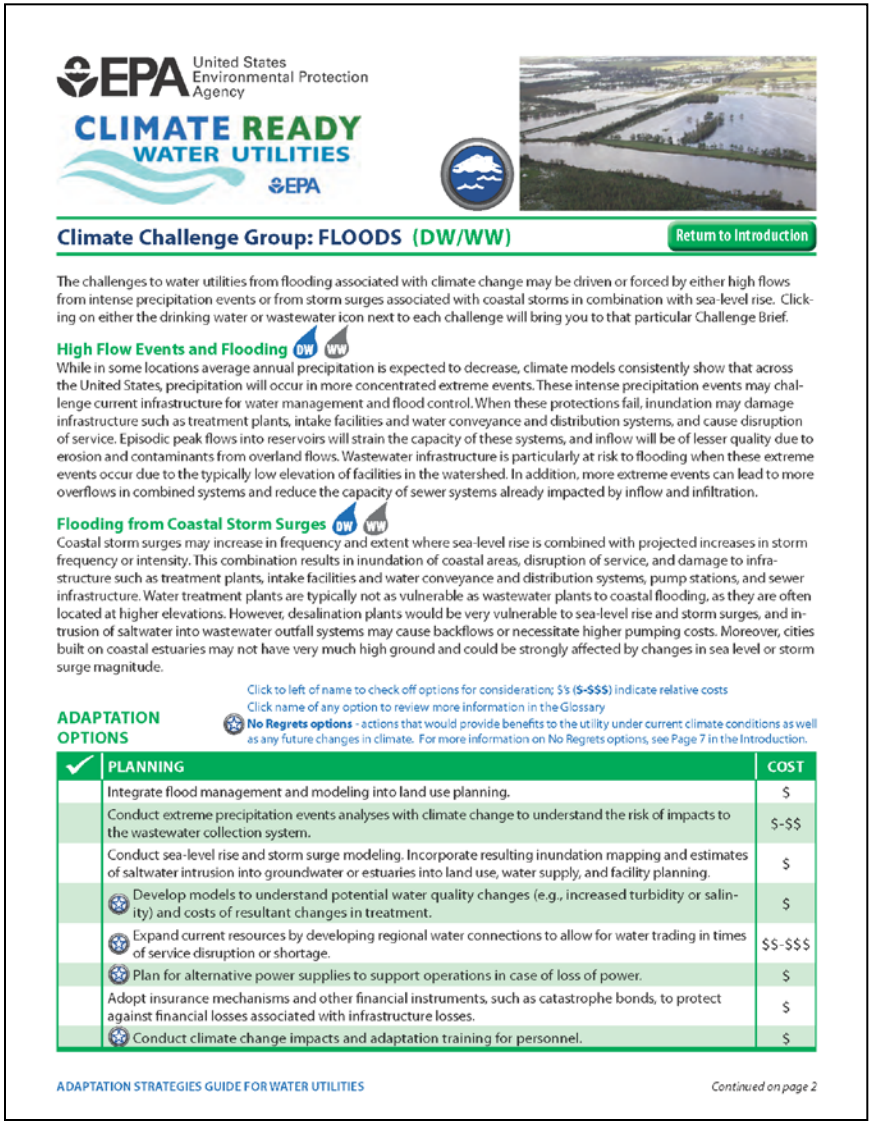
# *Challenge Briefs*



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## Climate Challenge Group: FLOODS (DW/WW)

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The challenges to water utilities from flooding associated with climate change may be driven or forced by either high flows from intense precipitation events or from storm surges associated with coastal storms in combination with sea-level rise. Clicking on either the drinking water or wastewater icon next to each challenge will bring you to that particular Challenge Brief.

### High Flow Events and Flooding DW WW

While in some locations average annual precipitation is expected to decrease, climate models consistently show that across the United States, precipitation will occur in more concentrated extreme events. These intense precipitation events may challenge current infrastructure for water management and flood control. When these protections fail, inundation may damage infrastructure such as treatment plants, intake facilities and water conveyance and distribution systems, and cause disruption of service. Episodic peak flows into reservoirs will strain the capacity of these systems, and inflow will be of lesser quality due to erosion and contaminants from overland flows. Wastewater infrastructure is particularly at risk to flooding when these extreme events occur due to the typically low elevation of facilities in the watershed. In addition, more extreme events can lead to more overflows in combined systems and reduce the capacity of sewer systems already impacted by inflow and infiltration.

### Flooding from Coastal Storm Surges DW WW

Coastal storm surges may increase in frequency and extent where sea-level rise is combined with projected increases in storm frequency or intensity. This combination results in inundation of coastal areas, disruption of service, and damage to infrastructure such as treatment plants, intake facilities and water conveyance and distribution systems, pump stations, and sewer infrastructure. Water treatment plants are typically not as vulnerable as wastewater plants to coastal flooding, as they are often located at higher elevations. However, desalination plants would be very vulnerable to sea-level rise and storm surges, and intrusion of saltwater into wastewater outfall systems may cause backflows or necessitate higher pumping costs. Moreover, cities built on coastal estuaries may not have very much high ground and could be strongly affected by changes in sea level or storm surge magnitude.

Click to left of name to check off options for consideration; $'s ($-$$$) indicate relative costs
Click name of any option to review more information in the Glossary

**ADAPTATION OPTIONS**

**No Regrets options** - actions that would provide benefits to the utility under current climate conditions as well as any future changes in climate. For more information on No Regrets options, see Page 7 in the Introduction.

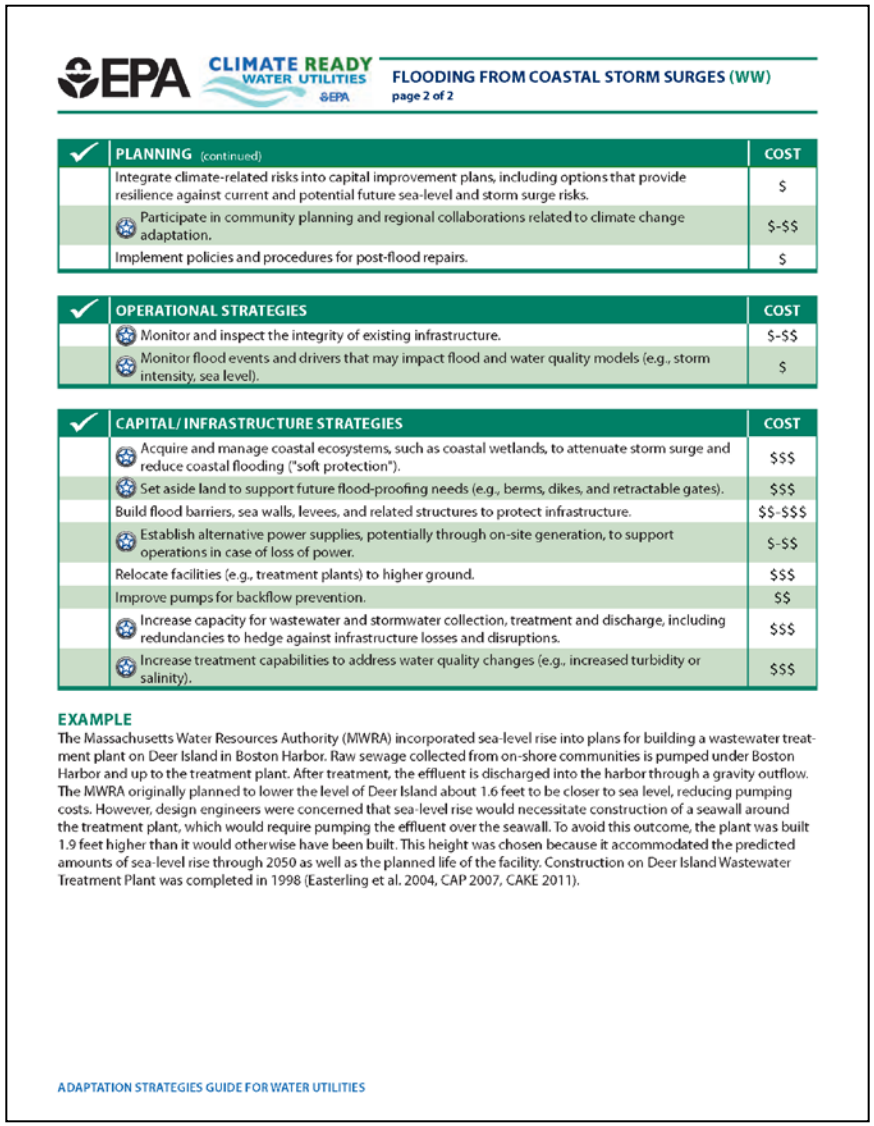
| ✓ | PLANNING | COST |
|---|---|---|
| | Integrate flood management and modeling into land use planning. | $ |
| | Conduct extreme precipitation events analyses with climate change to understand the risk of impacts to the wastewater collection system. | $-$$ |
| | Conduct sea-level rise and storm surge modeling. Incorporate resulting inundation mapping and estimates of saltwater intrusion into groundwater or estuaries into land use, water supply, and facility planning. | $ |
| | Develop models to understand potential water quality changes (e.g., increased turbidity or salinity) and costs of resultant changes in treatment. | $ |
| | Expand current resources by developing regional water connections to allow for water trading in times of service disruption or shortage. | $$-$$$ |
| | Plan for alternative power supplies to support operations in case of loss of power. | $ |
| | Adopt insurance mechanisms and other financial instruments, such as catastrophe bonds, to protect against financial losses associated with infrastructure losses. | $ |
| | Conduct climate change impacts and adaptation training for personnel. | $ |

ADAPTATION STRATEGIES GUIDE FOR WATER UTILITIES

*Continued on page 2*

- Translating climate data into utility-relevant challenges
- Adaptation options relevant to this challenge

# Adaptation Options



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FLOODING FROM COASTAL STORM SURGES (WW)

page 2 of 2

| ✓ | PLANNING (continued) | COST |
|---|---|---|
| | Integrate climate-related risks into capital improvement plans, including options that provide resilience against current and potential future sea-level and storm surge risks. | $ |
| | Participate in community planning and regional collaborations related to climate change adaptation. | $-$$ |
| | Implement policies and procedures for post-flood repairs. | $ |

| ✓ | OPERATIONAL STRATEGIES | COST |
|---|---|---|
| | Monitor and inspect the integrity of existing infrastructure. | $-$$ |
| | Monitor flood events and drivers that may impact flood and water quality models (e.g., storm intensity, sea level). | $ |

| ✓ | CAPITAL/INFRASTRUCTURE STRATEGIES | COST |
|---|---|---|
| | Acquire and manage coastal ecosystems, such as coastal wetlands, to attenuate storm surge and reduce coastal flooding ("soft protection"). | $$$ |
| | Set aside land to support future flood-proofing needs (e.g., berms, dikes, and retractable gates). | $$$ |
| | Build flood barriers, sea walls, levees, and related structures to protect infrastructure. | $$-$$$ |
| | Establish alternative power supplies, potentially through on-site generation, to support operations in case of loss of power. | $-$$ |
| | Relocate facilities (e.g., treatment plants) to higher ground. | $$$ |
| | Improve pumps for backflow prevention. | $$ |
| | Increase capacity for wastewater and stormwater collection, treatment and discharge, including redundancies to hedge against infrastructure losses and disruptions. | $$$ |
| | Increase treatment capabilities to address water quality changes (e.g., increased turbidity or salinity). | $$$ |

**EXAMPLE**

The Massachusetts Water Resources Authority (MWRA) incorporated sea-level rise into plans for building a wastewater treatment plant on Deer Island in Boston Harbor. Raw sewage collected from on-shore communities is pumped under Boston Harbor and up to the treatment plant. After treatment, the effluent is discharged into the harbor through a gravity outflow. The MWRA originally planned to lower the level of Deer Island about 1.6 feet to be closer to sea level, reducing pumping costs. However, design engineers were concerned that sea-level rise would necessitate construction of a seawall around the treatment plant, which would require pumping the effluent over the seawall. To avoid this outcome, the plant was built 1.9 feet higher than it would otherwise have been built. This height was chosen because it accommodated the predicted amounts of sea-level rise through 2050 as well as the planned life of the facility. Construction on Deer Island Wastewater Treatment Plant was completed in 1998 (Easterling et al. 2004, CAP 2007, CAKE 2011).

ADAPTATION STRATEGIES GUIDE FOR WATER UTILITIES

- Options provided in three categories
  - Planning
  - Operational
  - Capital/ Infrastructure
- Relative cost ($-$$$)
- No Regrets
- Utility Examples

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# *Toolbox*

Research and gather information

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# *Toolbox*

- Interactive online database geared towards the water sector
- Current toolbox contains approximately 600 resources
  - Publications
  - Current activities
  - Funding opportunities
  - Events
  - Tools and models

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# Highlights

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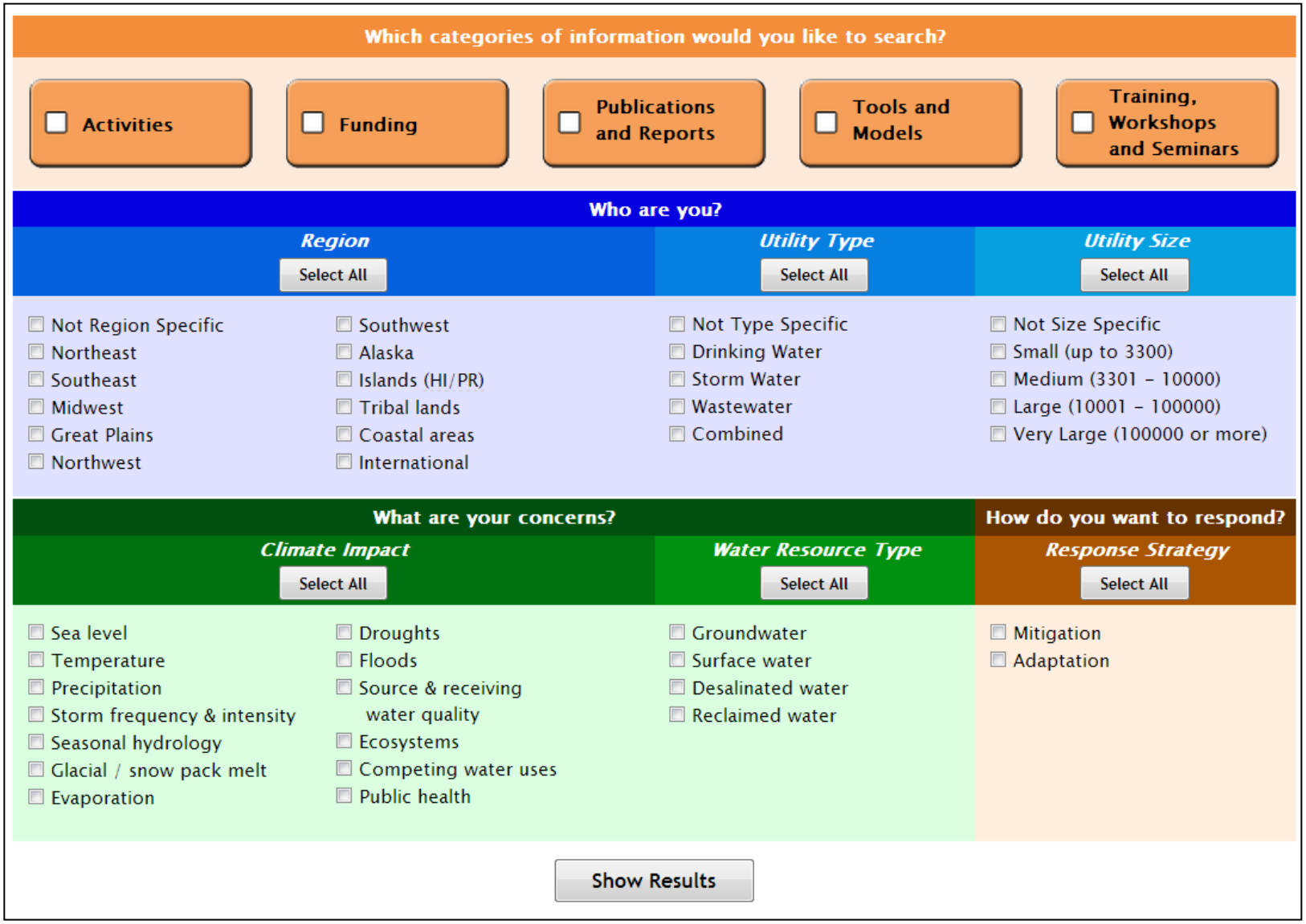
# Search



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# *Preparing for Extreme Weather Events: Workshop Planner for the Water Sector*

Collaborate with partners

# Extreme Weather Events Workshop Planner

- Workshop planner contains materials needed to plan and conduct a workshop on how extreme weather events could impact your utility and watershed
- Users are encouraged to work with partners and stakeholders outside of the utility to open lines of communication and ensure a comprehensive discussion
- Workshops allow participants to gain a better understanding of the impacts and identify what steps can be taken now to provide greater resilience in the long-term

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# *Workshop Planner Scenarios*

- Five scenarios are included:
  - Flooding
  - Drought
  - Sea-level rise
  - Wildfire
  - Reduced snowpack

- Available on CRWU website
  http://www.epa.gov/climatereadyutilities

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

Assess risks and evaluate opportunities

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# 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

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# CREAT Process

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# Climate Data in CREAT

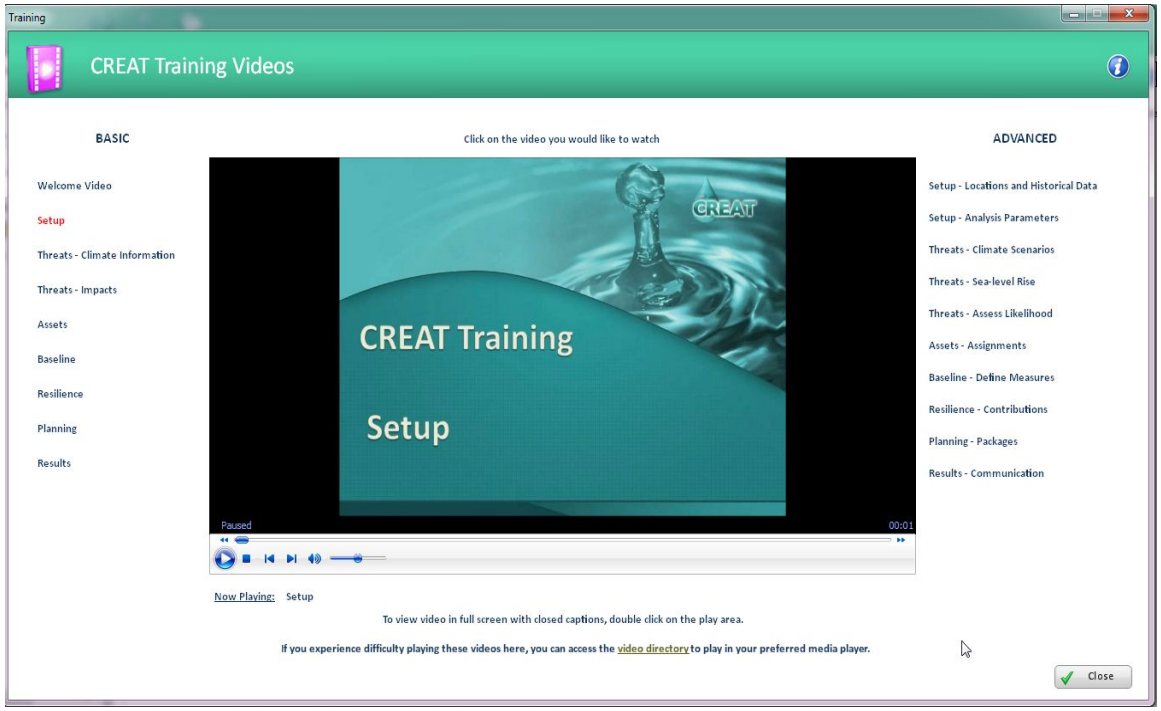

View data from multiple climate stations, scenarios, and time periods

Annual and monthly temperature and precipitation

Intense precipitation events and sea-level rise

# CREAT Training

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



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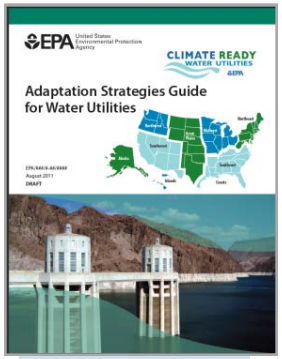
# Climate Ready Tools & Resources

Climate Ready Process

## Adaptive Response Framework

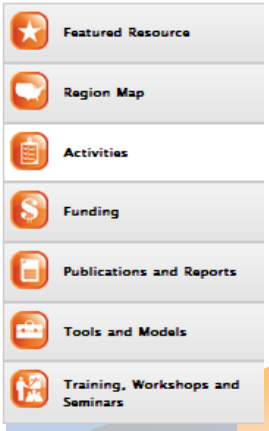

*Explore Elements of Climate Readiness*

## Adaptation Strategies Guide




*Learn Climate and Adaptation Basics*

## Toolbox

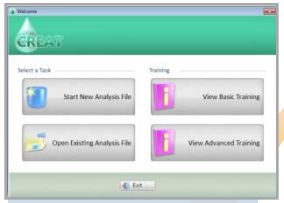



*Research and Gather Information*

## Extreme Events Workshop Planner


*Collaborate with Partners*

## Climate Resilience Evaluation and Awareness Tool




*Assess Risks and Evaluate Opportunities*

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# *CRWU Implementation*

*Working collaboratively with utilities and partners*

# CRWU-CRE Exercises

- North Hudson Sewerage Authority, NY/NJ Harbor NEP, EPA Region 2
  - Joint risk assessment
  - Explored collaborative adaptation strategies
  - Fostered relationship between wastewater utility and NEP
  - Documented methodology and lessons learned

# CRWU-CRE Exercises

- Morro Bay Water Purveyors, Morro Bay NEP
  - Climate projections integrated into groundwater basin management plan
  - Sustainable yield calculations used to support CREAT assessment
- Albemarle-Pamlico NEP
  - Coastal utilities from Manteo and Columbia, North Carolina
  - Joint risk assessment with focus on sea-level rise

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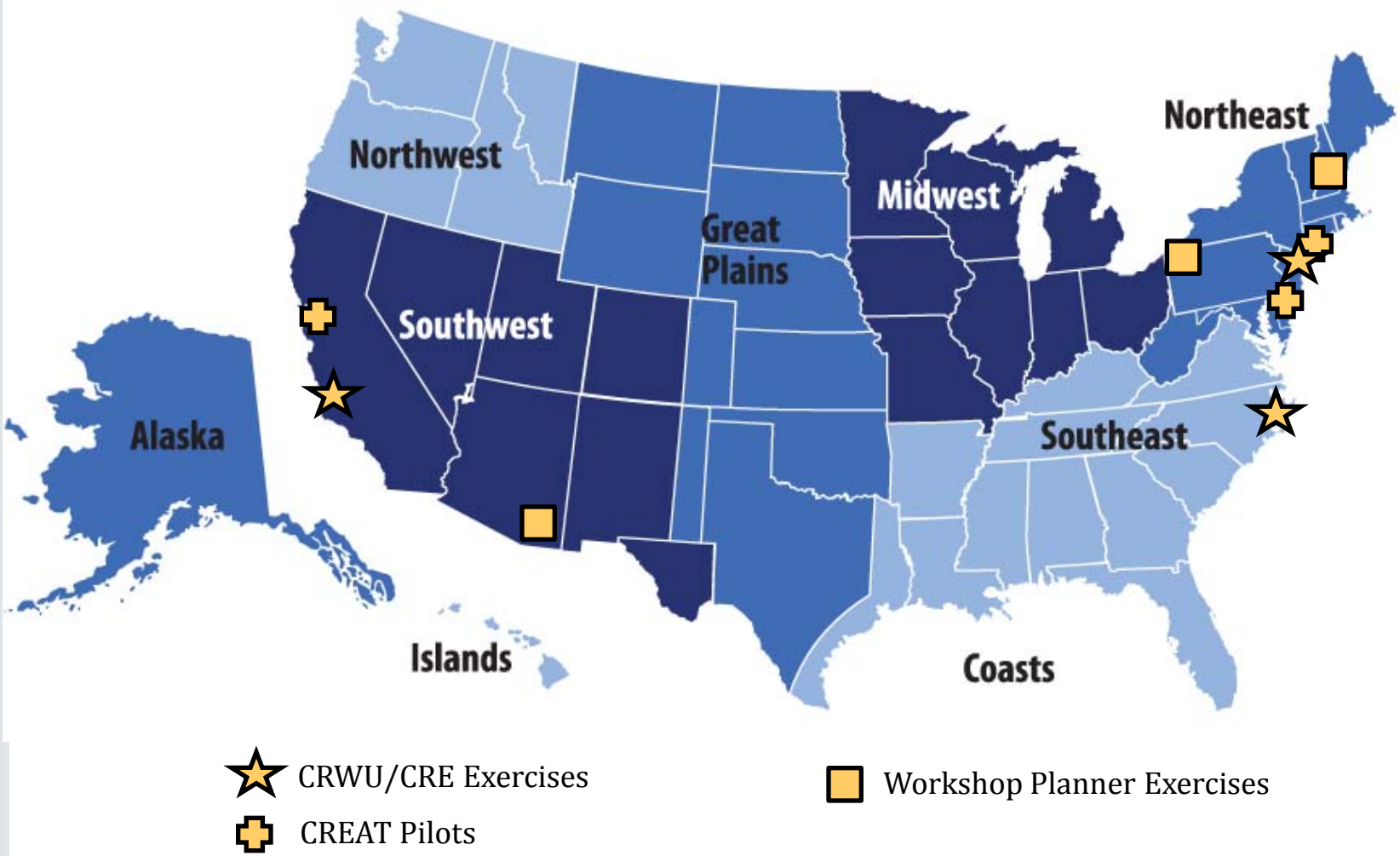
# *Implementation – Pilots and Exercises*



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# *Connect with CRWU*

We always appreciate feedback and collaboration when it comes to climate resiliency at utilities.

- Send questions to 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

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# *Upcoming Events*

| Next Event | Date |
|---|---|
| **Climate Change and the Water Sector** | *February 13, 2013* |

| Coming soon | Date |
|---|---|
| **Introduction to CREAT** | *February 27, 2013* |
| **Extreme Events Workshop Planner** | *March 6, 2013* |
| **Adaptation Strategies Guide** | *March 13, 2013* |

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

www.epa.gov/climatereadyutilities

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# *Thank you*

# *Any questions?*


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