

# Adaptive Response Framework for Drinking Water and Wastewater Utilities



# **Adaptive Response Framework for Drinking Water and Wastewater Utilities**

## DISCLAIMER

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# Adaptive Response Framework

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## Adaptive Response Framework

# GETTING STARTED WITH THE FRAMEWORK

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The **Adaptive Response Framework** describes approaches for water utilities seeking to become more “climate ready.” This Framework supports and guides utilities as they learn about and pursue management techniques and adaptive actions that can be implemented to build climate readiness. The Framework is described in the [Climate Ready Water Utilities report](#), developed by the National Drinking Water Advisory Council and submitted to the EPA Administrator in January 2011.

The diagram below is a version of the Adaptive Response Framework, which highlights six elements of becoming more Climate Ready: Climate Impact Awareness, Adaptation Strategies, Federal and State Policies and Programs, Mitigation Strategies, Community Interest and Support, and Partnerships Outside of the Utility. Each of these elements is important for any utility that is considering taking action in response to climate change. This Framework document includes a section for each of the six elements, explaining the relevance and importance to the water sector, suggesting specific actions utilities can begin to take today, and offering resources to access for further information.

To begin, click on any of the six elements in this diagram to view more detailed information. For new users, the Climate Impact Awareness section is a good starting point. For an overall description of climate readiness and the adaptive management process, click on the central element.



## Adaptive Response Framework

Awareness

Adaptation

Mitigation

Policies

Community

Partnership

Climate Ready

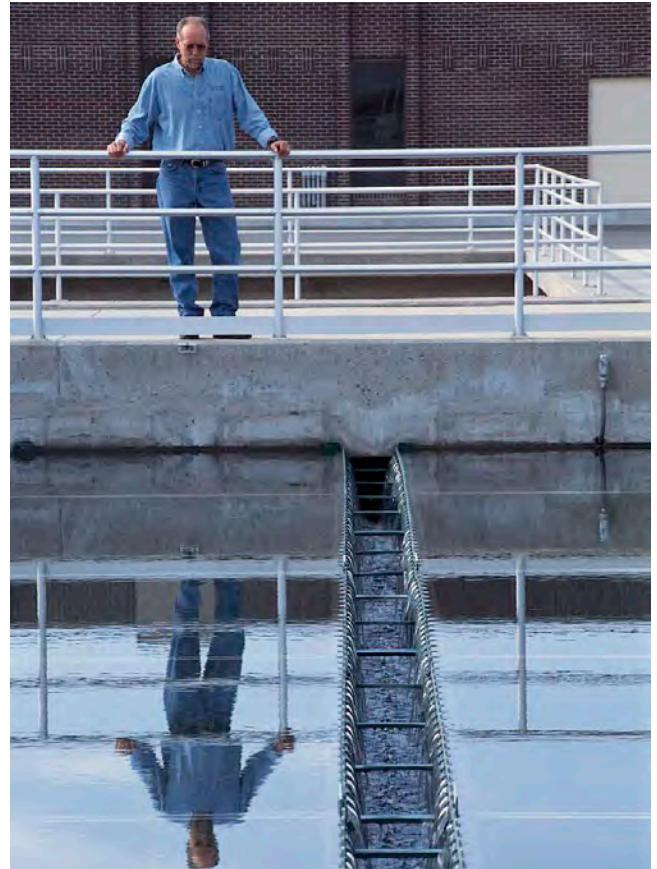
### WHAT DOES IT MEAN TO BE CLIMATE READY?

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#### OVERVIEW

Climate change impacts pose challenges to the water sector's ability to fulfill its public health and environmental missions. Extreme weather events, sea-level rise, temperature changes, and shifting precipitation and runoff patterns may result in changes to water quality and availability. Uncertainty in climate change projections and difficulty in connecting these changes to local impacts poses a complex set of challenges to utilities. Increased understanding of these factors has significant implications for the resilience of the water sector.

EPA's Climate Ready Water Utilities (CRWU) initiative provides resources for the water sector to adapt to climate change by promoting a clear understanding of climate science and adaptation options and by promoting consideration of integrated water resources management planning in the water sector. If you have not yet incorporated climate change into your utility's decision-making processes, it may seem daunting. But climate change can be integrated into existing practices such as asset management, effective utility management, water supply and demand planning, capacity building, security, and emergency preparedness. Capitalizing on these connections makes climate planning more manageable and approachable.



#### KEY CONCEPTS

- **Climate ready water utilities** are those drinking water, wastewater and stormwater utilities that are actively preparing for the challenges associated with climate change.
- This preparation involves developing an understanding of the risks that result from changes in climate, planning to address these impacts, and implementing adaptive actions to reduce the consequences of climate change.
- Becoming climate ready is an **iterative process**, with goals within each Framework element marking progress towards a state of readiness. Revisiting and updating actions as new climate data and tools become available provides utilities with a better understanding of climate change and a more robust adaptive management process.

## What is adaptive management?

Due to the evolving nature of climate change, the water sector should consider managing water resources using an adaptive management approach. The National Research Council<sup>1</sup> defines adaptive management as “promoting flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.” It incorporates the main principles and ideals of integrated management, such as a holistic and participatory approach, especially through meaningful collaboration with stakeholders.

Adaptive management proves useful in the context of climate change planning because it is an iterative process, emphasizing learning and structured experimentation, while simultaneously adapting to what is learned (**Figure 1**). It is a knowledge-building system that involves: increased understanding and assessment of challenges and associated risk, development of policies or plans, implementation of these plans and most importantly, monitoring of performance and reconsideration of assessments and updated priorities. Simply put, adaptive management facilitates a process of ‘learning by doing.’ Utilities can continually evaluate their ability to manage and adapt to climate change impacts, and build resiliency.



**Figure 1: Adaptive Management Process**

As part of the adaptive management concept, remember that it is important to re-evaluate climate planning decisions periodically. This will ensure that up-to-date information is used, while also accounting for evolving utility resources and priorities. Re-evaluating progress towards climate readiness can help to identify where planning adjustments are needed and show how to implement them based on the utility’s experiences and lessons learned. To help in this process, bookmark and revisit the [CRWU website](#) to consider additional actions and review new resources and tools.

<sup>1</sup> National Research Council. 2004. Adaptive Management for Water Resources Planning, The National Academies Press. Washington, DC.

## Adaptive Response Framework



### CLIMATE IMPACT AWARENESS

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#### OVERVIEW

Understanding how climate change impacts your drinking water, wastewater, or stormwater utility is the first step in climate-related planning. Historically, utilities have assumed that while observed climate conditions (e.g., temperature, precipitation, and extreme weather events such as drought, wildfire, flooding, and loss of snowpack) may exhibit large variations in annual and decadal time scales, the observed variability and average conditions will remain consistent into the future. This assumption, often referred to as *stationarity*, will be challenged as the climate changes. Many models project that future climate conditions will exceed the variability of levels seen in the past; therefore, historical data and trends may no longer be adequate for long-term planning.

Climate change can negatively impact basic efforts such as delivering adequate, reliable and sustainable water supplies, providing effective flood management, ensuring the quality and quantity of in-stream flows for health and environmental purposes, maintaining rates at affordable levels, and preparing emergency response programs. Secondary effects of climate change may also impact utilities, such as changes in customer demands, greater use of water for energy production and agriculture, and even shifts in population and economic activity. Other factors, not related to climate change, compound these challenges and complicate planning by presenting utilities with competing priorities to address with a finite budget. Climate readiness can provide utilities a hedge against climate impacts, while performing well under a variety of environmental conditions.

#### KEY CONCEPTS

- For many utilities, **climate change poses serious challenges** to operations and infrastructure across their service area.
- Increasing temperature, altered precipitation patterns and changing frequencies and durations of extreme weather events could have significant impacts on water utilities.
- Given the uncertainty in climate change projections, it is important for utilities to examine their long-range plans and **prepare for a range of possible climate change impacts**.

#### ACTIONS

- Engage the local scientific community (e.g., government and academia) to exchange information regarding climate science and consequences of change on water resources.
- Identify potential impacts to your utility due to climate change and how those impacts will challenge your system.
- Identify assets that would be particularly vulnerable to those projected impacts.
- Train personnel on how climate change may impact utility operations.
- Research how to integrate climate change into utility planning and decision-making efforts.
- Conduct a workshop with your utility and local stakeholders to discuss information related to your utility's specific concerns and possible adaptation plans.

#### RESOURCES

- [EPA CRWU Adaptation Strategies Guide](#)
- [EPA CRWU Toolbox](#)
- [National Oceanic and Atmospheric Administrative Climate Portal](#)
- [U.S. Global Change Research Program Report: Global Climate Change Impacts in the U.S. \(2009\)](#)
- [American Association of State Climatologists](#)



## Adaptive Response Framework



### ADAPTATION STRATEGIES

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#### OVERVIEW

It is important to explore the actions your utility can take to prepare for and adapt to projected climate change impacts. Adaptation refers to changes in operations and investments at the utility to account for projected changes in environmental conditions. Adaptation options range from small- to large-scale actions, each of which can be performed alone or in combination with other options to build climate resiliency.

When planning for adaptation, you will need to consider the specific needs, priorities, and climate challenges of your utility. Adaptation planning is not necessarily distinct from other utility planning and practices. Since adaptation strategies often provide multiple benefits, planning can be most effective when integrated with overall strategies related to emergency response, capacity development, capital investment, water supply and demand, conservation practices, and infrastructure maintenance. Planning related to large and long-term investments, in particular, should consider potential consequences from climate impacts. If possible, investment strategies that leverage incremental improvements to infrastructure (e.g., upgrades in lieu of replacements) towards a long-term goal will provide more flexibility to account for uncertainty in climate projections. By incorporating climate adaptation into existing utility activities and encouraging stakeholder support, future adaptations can be streamlined.

#### KEY CONCEPTS

- Adapting to climate change may be a **critical component of long-term planning and water resource management** strategies.
- Utility planning should allow for uncertainty in climate projections through periodic evaluation and adjustment where possible.
- Where possible, identify opportunities to **incorporate adaptation into existing plans and investments**, even if climate change has not been a priority in the past.

#### ACTIONS

- Leverage current awareness of climate change to identify short- and long-term challenges.
- Conduct a climate change risk assessment for your utility and gauge projected capacity to provide service under changing climate conditions.
- Examine actions undertaken by similar utilities to better understand how adaptation can be incorporated into on-going planning and operations.
- Determine adaptation options to reduce system vulnerability.
- Discuss options with stakeholders and the community to inform decision-making processes.
- Implement and monitor performance of adaptation options to inform periodic evaluations and adjustments.

#### RESOURCES

- [EPA CRWU Adaptation Strategies Guide](#)
- [EPA CRWU Climate Resilience Evaluation and Awareness Tool \(CREAT\) 2.0](#)
- [National Association of Clean Water Agencies/Association of Metropolitan Water Agencies - Confronting Climate Change: An Early Analysis of Water and Wastewater Adaptation Costs](#)
- [Climate Adaptation Knowledge Exchange](#)
- [Water Utility Climate Alliance](#)

## Adaptive Response Framework



### MITIGATION STRATEGIES

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#### 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



### FEDERAL & STATE POLICIES AND PROGRAMS

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#### OVERVIEW

A basic awareness of policies at the federal and state level is a critical component of adjustments to operations, changes in infrastructure, and other responses to climate change. Compliance with regulations could be compromised by climate change impacts and the prioritization of actions that address these potential challenges is important to recognize and implement. Local experts and current partners, including town planners, legal advisors, environmental experts, and climate scientists, are valuable collaborators in identifying potential issues and proposing potential solutions. New challenges and opportunities may also emerge as a result of updated policy developments, such as greenhouse gas offsets and reduction policies and incentives.

The coordination of the current regulatory landscape with projected climate change and possible regulatory changes in response to this change is a large challenge. While there are few water sector design standards that explicitly consider climate change, there are recommendations that consider specific threats related to climate change, such as technical standards for treatment processes, construction guidelines for new facilities, and association standards on other relevant topics. Combined, they can solidify adaptation planning and increase sector resiliency.

#### KEY CONCEPTS

- Ensure that federal, state and local **policies and regulations are considered in light of projected climate changes**.
- Government and association recommendations can inform planning that **balances utility priorities to maintain regulatory compliance** with their response to climate change.

#### ACTIONS

- Review your state and local regulations and policies to ensure compliance with regulations that must be met and can be maintained as climate changes. Proactively plan for and communicate any potential future issues to regulators, as appropriate.
- Maintain awareness of current and future greenhouse-gas reduction incentives or policies that may impact operations and compliance with regulations that must be met.
- Identify and communicate with regulators and local officials who can advise or be notified of regulatory implications and opportunities related to changing climate conditions.
- Research the legal and applicable aspects of the laws: contact local association chapters to discuss what recommendations they can make for utilities planning for certain threats.

#### RESOURCES

- [Water Environment Federation manuals: Complete list includes manuals on energy management, urban runoff, and other climate-relevant topics](#)
- [American Water Works Association manuals](#)
- [American Water Works Association standards](#)
- [Local Government Environmental Assistance Network](#)
- [EPA Clean Water and Drinking Water Infrastructure Sustainability Policy](#)
- [EPA State & Regional Climate Policy Tracking](#)
- [Water Resource Foundation/American Water Works Association - Building a climate-ready regulatory system](#)

## Adaptive Response Framework

Awareness

Adaptation

Mitigation

Policies

**Community**

Partnership

Climate  
Ready

### COMMUNITY INTEREST & SUPPORT

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#### OVERVIEW

Both climate change and any actions pursued in response to climate will affect entire communities. For this reason, you can benefit from engaging with the community during development and planning your climate-related strategy. This engagement is an essential foundation for integrated and adaptive water resources management, and contributes towards the goal of building both utility and community resilience together. Community engagement should be an open process, where possible, providing opportunities for both groups to learn, participate, collaborate and contribute in real and meaningful ways. Community could be defined based on the rate-paying population, those within the boundaries of your watershed or any party who would benefit from potential adaptation plans.

Education is an important component of any community outreach to ensure that everyone not only understands how climate change can affect local water resources, but also how the utility can respond to those challenges. Providing this information creates an opportunity to gauge community interests and perspectives on climate change while building a support network. Based on community response, the utility can tailor public communications and messaging consistent with the identified interests (e.g., websites, surveys and bill inserts). With this type of outreach, the utility should consistently acknowledge the importance of climate adaptation action, especially in relation to planned operational changes.

#### KEY CONCEPTS

- Climate change impacts, and responses to change implemented by water utilities, both **affect the community**.
- Collaboration with your community will result in **new ideas, public support, and possible partnerships** for adaptation plans.



#### ACTIONS

- Identify key players within your watershed, with a focus on diverse representation.
- Develop an outreach strategy.
- Contact stakeholders and use outreach tools to ascertain interest and support in climate change plans.
- Continue outreach and solicit participation in planning processes.
- Coordinate actions with the community to better improve water management and increase community resiliency.

#### RESOURCES

- [EPA CRWU Preparing for Extreme Weather Events Workshop Planner for the Water Sector](#)
- [ICLEI-Local Governments for Sustainability](#)
- [EPA Surf Your Watershed](#)
- [Delaware River Basin Commission](#)
- [Community-Based Watershed Management \(Ohio State University Fact Sheet\)](#)

## Adaptive Response Framework



### PARTNERSHIPS OUTSIDE OF THE UTILITY

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#### OVERVIEW

In addition to building partnerships within the community, strategic partnerships with key stakeholders (e.g., watershed and environmental organizations, land use planners, other utilities and water associations) provide opportunities to leverage your mutual efforts to accomplish larger and longer-term goals. Partnerships are very important when a climate change threat poses a shared risk: groups and even different utilities can advise one another and share resources for critical situations, such as extreme event preparedness and emergency response procedures.

These efforts can help create an environment in which local utility managers will encounter informed and welcoming partners as they undertake efforts to engage interdependent sectors and ask for their assistance in building shared responsibility. Through partnerships you may find greater flexibility to start projects across the watershed, and increase the reach of project benefits to improve local economic vitality and community well-being. For example, a utility and a watershed organization can form a partnership to restore the riparian borders along a river to not only decrease flooding, erosion and sedimentation, but to increase green spaces, public access to water and public engagement in protecting source water quality.

#### RESOURCES

- [EPA Region 9 and California Department of Water Resources – Climate Change Handbook for Regional Water Planning](#)
- [EPA Climate Ready Estuaries \(CRE\)](#)
- [EPA CRWU/CRE – Climate Resilience Evaluation and Awareness Tool Exercise with North Hudson Sewerage Authority and New York-New Jersey Harbor Estuary Program](#)
- [EPA CRWU Preparing for Extreme Weather Events Workshop Planner for the Water Sector](#)

#### KEY CONCEPT

- Partnerships are a critical strategy to **coordinate actions and exchange resources and knowledge when responding to shared risks** posed by climate change.



#### ACTIONS

- Identify and open a dialogue with possible partners outside of your utility to ensure compatibility in goals and challenges related to climate change.
- Establish formal partnerships.
- Coordinate plans to address shared climate risks and set goals and a plan of action.
- Implement, evaluate and publicize coordinated actions.
- Continue outreach to community and other stakeholders to demonstrate mutually beneficial results and maintain an integrated and adaptive approach.

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