VI. Cross-Cutting Program Support

A. Goal 17: Communication, Collaboration, and Training

Strategic Action 51: Continue building the communication, collaboration, and training mechanisms needed to effectively increase adaptive capacity at the federal, tribal, state, and local levels.

The NWP intends to continue building the communication, collaboration, and training mechanisms needed to effectively increase adaptive capacity at the federal, tribal, state, and local levels, including nongovernmental and private sector stakeholders.

Communicating Effectively

Communication involves three elements: the audience, the message, and the medium. This *2012 Strategy* describes the messages, including:

- Climate change poses threats to water resources and the NWP's mission.
- Ecosystem services associated with water are valuable resources for modulating climate impacts.
- Water management strategies can reduce greenhouse gas emissions and increase resilience to climate change.
- Programmatic actions are being taken to address climate change.
- Information and tools are needed to inform action.
- Collaboration is essential for shared learning and problem solving.

As described earlier, there are many stakeholders with interests and responsibilities for protecting the nation's water resources. Some of the audiences the NWP intends to communicate with include:

- State and tribal co-regulators who need information and tools to adapt their programs.

Examples of Collaborative Partnership Programs

Infrastructure:

- Source Water Collaborative
- Rural Community Assistance Partnership
- Capacity Development Program
- Effective Utility Management

Ocean and Coastal Waters:

- National Ocean Council
- National Estuary Programs

Watersheds and Wetlands:

- Healthy Watersheds Initiative

Water Quality:

- Green Infrastructure Initiative

- The water utility operators who need tools to calibrate their design and management practices for protecting infrastructure from climate change impacts.
- Natural resource professionals who protect water quality and ecological integrity from compounding stressors, including climate change.
- Tribal communities that have geographically and culturally specific challenges for protecting and preserving their freshwater resources and communities.

Examples of Regional Collaboration Goals:

- **Region 1 Federal Partners Group**
  http://www.epa.gov/region1/eco/energy/adaptation-efforts-epane.html.
- **Region 4 Southeast Natural Resources Leadership Group**
  http://www.epa.gov/region4/topics/envmanagement/senrlg/index.htm.
- **Region 9 Water-Energy Team of the California Climate Action Team (WET-CAT)**
  http://www.climatechange.ca.gov/wetcat/index.html.
- **Great Lakes Statement of Common Purpose**
  http://collaborate.csc.noaa.gov/nroc/default.aspx.
- **Gulf of Mexico Alliance Action Plan II for Healthy and Resilient Coasts, 2009-2014**
  http://www.gulfofmexicoalliance.org/pdfs/ap2_final2.pdf?#Page=8.

- Economically disadvantaged communities that may already have a deficit in the ability to respond to impacts.
- Communities that are at risk from sea level rise, flood, and drought.
- The public and stakeholders who want to know how the federal government is addressing climate change.
- The private sector who are working to protect their investments while responsibly managing natural resources.
- Federal agencies with which EPA collaborates.

In addition to the avenues discussed throughout this document for training and tool development, the NWP intends to provide communication outlets including:

- National Water Program Climate Change & Water Website
- *EPA Climate Change & Water News* E-Newsletter
- Climate Ready Water Utilities website and toolbox
- Webcasts and Webinars – to provide opportunities for targeted training

Examples of Federal Collaborative Forums

- Interagency Climate Change Adaptation Task Force, Freshwater Workgroup
- White House Office of Science & Technology Policy Subcommittee on Water Availability and Quality
- U.S. Global Change Research Program
- Climate Change Adaptation Work Group

- Ongoing dialogue forums with stakeholder groups and co-regulators such as the State-Tribal Climate Change Council (STC3)
- Speaker Series – for EPA employees to hear from experts
- Annual reports and periodic updates

The NWP intends to continue working with partners and stakeholders to develop communication mechanisms to expand access to information and resources for general and targeted audiences.

Working in Collaboration

Existing EPA partnership programs provide ready access to networks of key entities and can be leveraged to address the challenges posed by climate change while minimizing the "overhead" involved in collaboration. Examples of existing programs and initiatives are referenced throughout this document, and some are noted in the text box below.

The NWP intends to work to expand opportunities for dialogue through both formal and informal discussion. For example, ACWI and the National Drinking Water Advisory Committee (NDWAC) are key Federal Advisory Committees (FACAs). The NWP's STC3 is an important discussion forum with state and tribal co-regulators. Collaboration with sector partnerships is a particularly important avenue for promoting research, pilots, and communication, including associations such as the Water Utility Climate Alliance (WUCA), WRF, and the WERF.

Climate impacts are local, as are adaptation strategies; hence, many EPA Regions are building collaborations with state, tribal, and local government agencies as well as with other federal agencies to more effectively deliver services. Information on Regional partnerships can be found in Chapter V, *Geographic Climate Regions*.

Federal partnerships are also essential to leveraging resources and building national capability for adaptation. The NWP intends to continue to strengthen and expand our coordination on climate change adaptation and mitigation with other federal agencies at both the national and regional levels.

Delivering Tools and Training

Many of the Strategic Actions throughout this *2012 Strategy* are driven by the over-riding need to improve

Federal Sources of Climate Change Information

EPA

Water & Climate Change: http://water.epa.gov/scitech/climatechange

Climate Ready Water Utilities: http://www.water.epa.gov/crwu

Climate Ready Estuaries: http://www.epa.gov/cre/

Climate Change: http://www.epa.gov/climatechange/

NOAA

Climate Service: http://www.climate.gov

RISAs: http://www.research.noaa.gov/climate/t_regional.html

Coasts: http://www.csc.noaa.gov/digitalcoast/tools/index.html

Interagency

USGCRP: http://www.globalchange.gov

Smartcoasts: http://stormsmartcoasts.org/ http://www.epa.gov/adr/index.html

the translation of climate impact projections into materials tailored for NWP partners and constituents, including regionally specific information. The NWP intends to work to make information available, including training to help practitioners apply new tools. The NWP intends to collaborate with various forums for delivering the information and training.

National Water Program Implementation

- The core CWA, SDWA, and other statutorily authorized programs within the NWP have training forums such as the NPDES Permit Writers training, the Watershed Academy, the Water Quality Standards Academy, and the Drinking Water Capacity Development Program that reach out to practitioners.
- Partner organizations host and co-sponsor training sessions, such as those based on the *Clean Water and Safe Drinking Water Infrastructure Sustainability Policy* to promote best practices for effective utility management, energy management, and advanced asset management, and related topics such as GI and LID.
- Conflict Resolution is a field that can help to build skills for collaborating and consensus building for working effectively with stakeholders. The NWP intends to work with partners and stakeholders to draw on the expertise and resources of the Conflict Prevention and Resolution Center (CPRC) within EPA's Office of General Counsel as well as the Regional Alternative Dispute Resolution (ADR) Specialists to conduct training.

Decision Support

- The USGCRP delivers science and science translation to inform adaptation planning.
- Federal partners are building regional capabilities, such as NIDIS, NOAA RISAs, and the LCCs and CSCs launched by DOI.
- The interagency CCAWWG, under the leadership of the Bureau of Reclamation, is working to establish a training program for water resource managers.

B. Goal 18: Tracking Progress and Measuring Outcomes

Strategic Action 52: Adopt a phased approach to track programmatic progress towards Strategic Actions; achieve commitments reflected in the Agency *Strategic Plan*; work with an EPA workgroup to develop outcome measures.

Tracking and measuring progress towards a stated goal provides information about the efficacy of the actions taken to inform adaptive management; provides a way to share information and lessons learned with others working toward similar ends; and provides transparency to stakeholders who have an interest in the process or outcome. Devising meaningful and practical indicators for tracking progress, however, is complex. It is preferable to measure *outcomes* rather than *outputs*, but outcomes often take many years to realize and may be hard to quantify. The NWP intends to work to develop and refine these measures, including ways to measure outcomes. Tracking progress for climate change adaptation poses its own challenges, including how to evaluate avoided losses.

NWP Phased Approach for Indicators of Progress

Currently, the most amenable approach for evaluating progress is to assess institutional progress toward becoming a resilient and adaptive program. The NWP is adopting a phased approach that uses indicators of progress and emphasizes peer-to-peer learning rather than a top-down mandate. A similar approach is in use in the United Kingdom (UK DEFRA, 2010).

Initially, the NWP Phased Approach intends to track the NWP's institutional *process* and *progress* in incorporating climate change considerations into EPA programs. *Outputs* will not be counted per se; rather, the collectivity of actions and their products will demonstrate *the weight of evidence* for determining the status of adaptation activities. An annual reporting process will assemble information for evaluating and publicly reporting progress. The elements to be assessed include progress toward achieving the stated Goals and Strategic Actions (Headquarters programs) and progress toward implementing Regional strategies. The NWP intends to work with its State-Tribal Climate Change Council and other partners to refine this approach and develop a model that could be useable by others at their discretion.

Table 5 presents a summary of the seven phases. Recognizing that it may take years or decades to achieve adaptive preparedness and resilience, the NWP designed phases for which progress could be demonstrated within a relatively short time frame (1 to 3 years).

In addition to the process to track progress described in Table 5, EPA's *2011–2015 Strategic Plan* includes measures for climate change adaptation and mitigation actions, listed in Table 6. This *2012 Strategy* reflects the NWP's commitment to achieve these measures. An EPA workgroup has undertaken a process to refine and update the Agency's measures to reflect outcomes toward desired objectives. The NWP intends to work with the above mentioned EPA workgroup to develop outcome measures applicable to the NWP.

Table 5: Phases of Adaptive Management

NWP Phases	Explanation	Examples of Evidence of Achievement	NWP Status
1. Initiation	Conduct a screening assessment of potential implications of climate change to mission, programs, and operations.	■ Preliminary information is developed to evaluate relevance of climate change to the mission or program; a decision is made as to whether to prepare a response to climate change; further exploration of climate change implications has been authorized. ■ Accountabilities and responsibilities are assigned at appropriate levels within the organization and resources are available to develop a more in-depth assessment.	

Table 5: Phases of Adaptive Management

2. Assessment	Conduct a broader review to understand how climate change affects the resources in question. Work with stakeholders to develop an understanding of the implications of climate change to the mission, programs, and operations.	■ Review science literature and assessments to understand how climate change affects the resources being protected (threat to mission); Engage internal staff and external stakeholders in evaluation. ■ Identify climate change issues and concerns and communicate with internal and external stakeholders and partners. ■ Identify which specific programs are threatened and what specific information or tools need to be developed. ■ Communicate findings to partners and stakeholders and engage them in dialogue on building adaptive capacity.	
3. Response Development	Identify changes necessary to continue to reach program mission and goals. Develop initial action plan. Identify and seek the research, information, and tools needed to support actions. Begin to build the body of tools, information, and partnerships needed to build capacity internally and externally.	■ Develop initial program vision and goals for responding to climate change. ■ Identify needed response actions or changes that will allow the organization to begin to address climate impacts on its mission. ■ Initiate strategies and actions in a few key areas to begin to build organizational ability to use climate information in decision processes. ■ Identify program partners' needs for building adaptive capacity. ■ Begin working with an external "community of practice" to engage in tool and program development. ■ Rudimentary methods are put in place to track progress. ■ Develop a research strategy and partnerships to obtain additional needed research.	

Table 5: Phases of Adaptive Management (cont.)

4. Initial Implementation	Initiate actions in selected priority programs or projects.	■ Make it clear within the organization that incorporating climate change into programs is critical. ■ Initiate actions and plans identified in Step 3. ■ Initiate cooperative projects with partners. ■ Develop a range of needed information and tools. ■ Begin to institute changes to incorporate climate change into core programs. ■ Some program partners have begun to implement response actions.	
5. Robust Implementation	Programs are underway and lessons learned are being applied to additional programs and projects.	■ Lessons learned are evaluated and strategies are refined. ■ Efforts are initiated to consider climate change in additional, or more complex, program elements. ■ Continue to institute institutional changes to incorporate climate change into core programs. ■ External communities of practice are in place to support ongoing capacity development.	
6. Mainstreaming	Climate is an embedded, component of the program.	■ The organization's culture and policies are aligned with responding to climate change. ■ All staff have a basic understanding of climate change causes and impacts. ■ All relevant programs, activities, and decision processes intrinsically incorporate climate change. ■ Methods for evaluating outcomes are in place.	
7. Monitoring and Adaptive Management	Continue to monitor and integrate performance, new information, and lessons learned into programs and plans.	■ Progress is evaluated and needed changes are implemented. ■ As impacts of climate change unfold, climate change impacts and organizational responses are reassessed.	

Table 6: *2011–2015 EPA Strategic Plan* National Water Program Commitments

Goal 1: Taking Action on Climate Change and Improving Air Quality. Reduce greenhouse gas emissions and develop adaptation strategies to address climate change, and protect and improve air quality.	
Objective 1.1: Address Climate Change. Reduce the threats posed by climate change by reducing greenhouse gas emissions and taking actions that help communities and ecosystems become more resilient to the effects of climate change.	
Water-Related Strategic Measures:	■ By 2015, additional programs from across EPA will promote practices to ***help Americans save energy and conserve resources***, leading to expected greenhouse gas emissions reductions of 740.1 MMTCO2 Eq. from a baseline without adoption of efficient practices. **The WaterSense Program will contribute to achieving greenhouse gas reduction goals through 2015.**
	■ By 2015, EPA will integrate climate change science trend and scenario information into ***five major scientific models and/or decision-support tools*** used in implementing Agency environmental management programs to further EPA's mission, consistent with existing authorities. **Under the CRWU initiative, the NWP will deploy an upgraded version of the CREAT, as well as a comprehensive toolbox of water-related climate resources by the end of 2012, to better assist water and wastewater utilities in becoming more resilient to climate change.**
	■ By 2015, EPA will account for climate change by integrating climate change science trend and scenario information ***into five rule-making processes*** to further EPA's mission, consistent with existing authorities. **The NWP will incorporate climate change considerations in the development and implementation of a rulemaking by 2015.**
	■ By 2015, EPA will build resilience to climate change by integrating considerations of climate change impacts and adaptive measures ***into five major grant, loan, contract, or technical assistance programs*** to further EPA's mission, consistent with existing authorities. **The NWP will help NEP grantees consider as a potential priority climate adaptation and resilience in their Comprehensive Conservation and Management Plans s and develop climate adaptation plans and implementation strategies where considered a priority.**

C. Goal 19: Climate Change and Water Research Needs

Strategic Action 53: Work with the EPA's Office of Research and Development, other water science agencies, and the water research community to further define needs and develop research opportunities to deliver the information needed to support implementation of the *2012 Strategy*, including providing the decision support tools needed by water resource managers.

This section describes the types of research questions that need to be addressed to support the Strategic Actions in this *2012 Strategy*. In general, research for adaptation should provide decision support to manage risk in an evolving context under ranges of uncertainty. Implementation of this strategy will incorporate new research and tools as they become available.

The NWP collaborates with and relies on the broader research community, including EPA ORD, federal science agencies (e.g., USGS, NOAA, USGCRP), drinking water and water quality research associations (e.g., WRF, WERF), academia, and others. The NWP is also a member of CCAWWG, a "working level" forum for sharing expertise and planning to build climate adaptation tools and methods across federal agencies. These collaborations have already produced a range of reports and inventories on research needs and activities. (See: CCAWWG, 2011; WRF, 2011; EPA-ORD, 2012.) The NWP intends to continue to work with the water research community to further define needs and develop collaborative and coordinated research opportunities to deliver the information needed by water resource managers.

Cross-Cutting Research Needs

A. **Data: Update data for precipitation, storm frequency, and streamflow, and develop new methods for analyzing projected changes, in collaboration with other federal agencies.**
   1. Of particular concern are the storm frequency, duration, and intensity estimates and low-flow conditions in rivers and streams at the HUC 12 watershed level.
   2. Improve methods to address non-stationarity, particularly improving clarity of precipitation data used in wastewater, drinking water, and stormwater management systems design, operation, and planning (e.g., TP40, Atlas 14).
   3. Enhance flow estimation using NHDPlus.

B. **Decision Support: Integrate non-stationarity and recent data into decision support tools for water utilities and water quality managers to use in planning across a range of plausible climate change scenarios.**
   1. Research Translation: Produce annual or biennial synthesis reports of recent research and implications for decision-makers to inform the water resource management community.
   2. Modify climate model outputs that can be used as inputs for hydrologic and management models at the spatial and temporal scales relevant to decision-makers.
   3. Develop regionally specific information (include description of observed and projected impacts, scenarios, etc.) for communicating with communities and tribes.

4. Develop models that integrate hydrology, land cover, air quality, and economics for comprehensive assessment and comparison of climate change mitigation and adaptation policies for local, state, and federal governments.
5. Develop a rapid response protocol to incorporate the results of the ongoing monitoring data into permitting, planning, and resource allocation decisions.
6. Develop tools for prioritizing response actions that take into account potential for both adaptation and GHG mitigation, especially for wetlands protection and restoration.

C. **Metrics: Develop measures and metrics to track and determine progress in climate change adaptation and preparedness.**

Research to Support Infrastructure

A. **Water Demand Management: Design metrics for water and energy efficiency in key sectors (e.g. municipal use; energy production and agriculture). Produce methods and technology transfers in various sectors to reduce water demand.**

B. **Water Supply Management: Develop alternative and nonconventional water supplies that will relieve pressure on freshwater sources and ensure the protection of current and future sources of drinking water.**

C. **Energy-Water Nexus: Develop zero-net energy strategies through life cycle analysis of water/energy consumption and optimization and co-generation.**

D. **Aquifer Storage and Recharge: Research into technologies to minimize mobilization of geologic chemicals/radionuclides and the formation of new drinking water contaminants by injectate that is already treated to national drinking water standards. Consider natural attenuation of microbes in different soil and geologic profiles and disinfectant byproducts from treated injectate. Also identify configurations that minimize adverse effects on surface water/ground water interchange (e.g., that maintain healthy instream flows to support aquatic habitats).**

E. **Economics: Conduct cost-benefit analysis of climate change adaptation strategies. Evaluate the cost of adapting versus the comparative costs of business-as-usual approaches. Calculate the value of built infrastructure at risk from climate change, especially from sea level rise and flooding, and use this information in economic assessments of potential adaptation strategies.**

Research to Support Watersheds and Wetlands

A. **Monitoring: Identify aquatic ecosystem responses to changes in temperature, precipitation, and sea level rise. Identify water chemistry changes including possible acidification effects that may be occurring in freshwater and estuarine systems. Develop water monitoring designs to track parameters relevant to climate change impacts. Identify and measure shifts over time in the condition of water resources attributed to climate change.**

B. **Hydrology: Improve the understanding of climate change on the hydrologic function of wetlands and in providing ecological services. Increase the understanding of the hydrological connections between surface water and ground water to inform IWRM. Model potential changes to flood regulation, ground water recharge, and surface water base flow, given scenarios of wetlands loss, including from increased ground water pumping. Assess different types of wetlands' capacity to adapt to climate change.**

C. **Co-benefits: Characterize co-benefits of healthy watersheds, GI, and site conditions where GI is cost-effective and where it is not:**

1. Identify climate change mitigation and adaptation strategies that lead to water quality improvements, such as increased ground water recharge and stormwater runoff mitigation and reduced cost for stormwater management and green space connectivity.
2. Develop method to measure carbon sequestration potential for aquatic ecosystems (e.g., wetland types, and forested watersheds).

Research to Support Coastal and Ocean Planning

A. **Ocean Acidification: Understand likely impacts of ocean acidification to coastal systems/system components, and identify and fill information gaps. Assess relative vulnerabilities in order to identify sites appropriate for action to increase coral reef resiliency.**

B. **Sea Level Rise: Accurate mapping of relative historic and projected sea level rise and its impacts. Determine which coastal wetlands and ecosystems to protect or restore and those that are "lost."**

C. **Temperature: Investigate potential impacts of climate change, such as warming water temperatures on eutrophication and ecology.**

Research to Support Water Quality

A. **Pathogens: Evaluate potential changes in exposure factors and assessment methods for waterborne pathogens that result from climate change. Develop models to better understand how increased water temperature affects pathogen survival and proliferation, drinking water treatment, and sanitary waste treatment requirements based on water quality based effluent limitations or effluent limitation guidelines. Identify contaminants that may more greatly affect public water system noncompliance by increases or decreases in precipitation or ground water levels.**

B. **Precipitation: Identify impacts from changes such as extreme precipitation events that may increase sediment loading or scouring, nutrient, pathogen, and toxic contaminant loads to water bodies.**

C. **Nitrogen Cycle:** **Assess air-water interactions (i.e., sources and sinks) of nitrogen and develop strategies to reduce impacts to aquatic ecosystems and ground and surface drinking water sources.**

D. **Flow:** **Characterize ecological flow criteria for aquatic species to protect designated uses, given climate change intensifying the competition for finite water resources. The criteria may be useful in developing TMDLs.**

Research to Support Tribes

A. **Traditional Ecological Knowledge:** **Strengthen the ability to incorporate tribal traditional knowledge into adaptation strategies relevant to tribes.**

B. **Overall:** **Include development of tribal-specific elements in overall research strategies to understand climate change impacts and to develop adaptation strategies.**