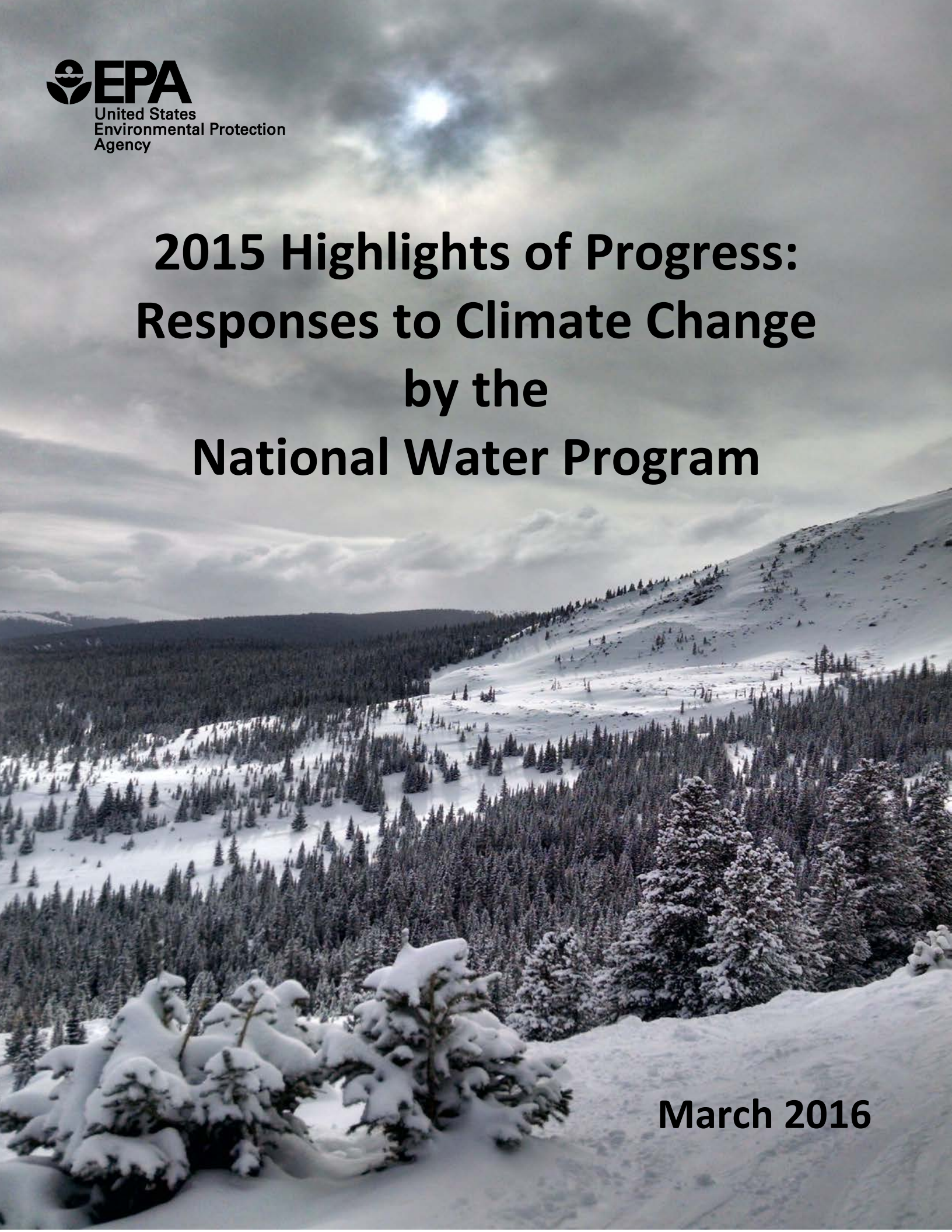
EPA
United States
Environmental Protection
Agency

2015 Highlights of Progress: Responses to Climate Change by the National Water Program



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Office of Water
U.S. Environmental Protection Agency
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Cover photo taken by Brent Truskowski, EPA Region 8
From Peak 10, Breckenridge, Colorado

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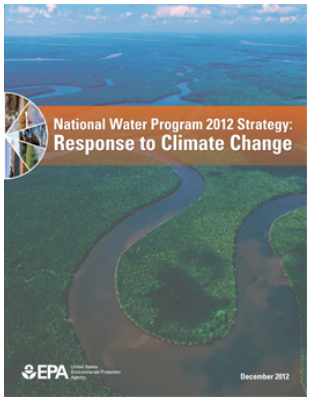
Introduction



The National Water Program at the U.S. Environmental Protection Agency (EPA) released the "National Water Program 2012 Strategy: Response to Climate Change" (2012 Strategy) in December 2012 as an update to an initial climate change and water strategy released in 2008.

The *2012 Strategy* describes long-term goals for the management of sustainable water resources for future generations in light of climate change and is intended to be a roadmap to guide future programmatic planning and inform decision makers during the Agency's annual planning process. The Strategy is available at http://www.epa.gov/climate-change-water-sector.

This "2015 Highlights of Progress Report" provides a summary of the major accomplishments of national water programs and EPA regional water programs in 2015. In addition, major research projects addressing climate change and water that were completed in 2015 by the EPA Office of Research and Development (ORD) are described.

This is the seventh climate change progress report for the National Water Program and is modeled after the 2012, 2013, and 2014 Highlights of Progress report released in March 2013, April 2014, and February 2015 respectively. Like the previous Highlights of Progress Reports, the report is organized around the six long-term programmatic vision areas described in the *2012 Strategy:*

- water infrastructure;
- watersheds and wetlands;
- coastal and ocean waters;
- water quality;
- working with Tribes; and
- cross-cutting program support.

Part I of this report presents key "highlight" projects and products implemented by the National Water Program and Office of Research and Development in 2015 in each of these six vision areas. Part II of this report includes descriptions of key 2015 "highlights" of climate change and water work in each of the 10 EPA regional offices.

In addition to the major accomplishments highlighted in each of these vision areas and for each EPA Region, other important projects and activities were accomplished in 2015. A detailed compendium of 2015 activities and accomplishments related to climate change and water programs underway in EPA national water program offices and regional offices is provided in Appendix A.

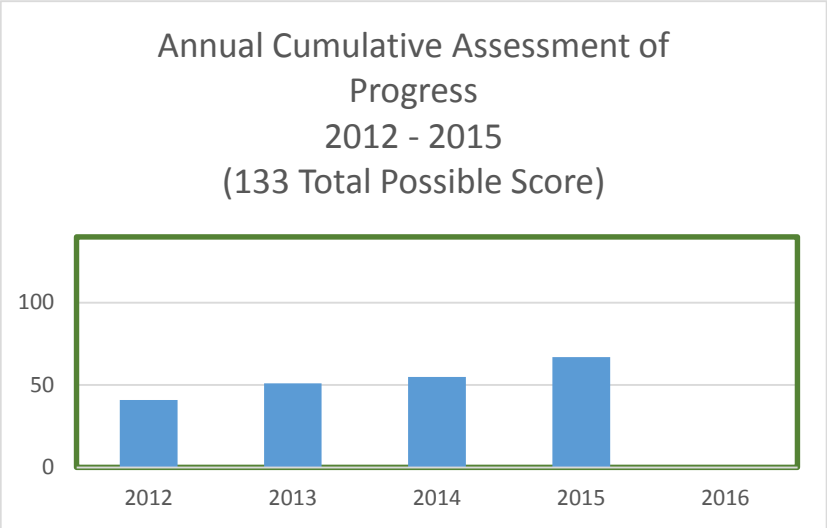
In addition to reporting on highlights of progress for 2015, the National Water Program is continuing past work to assess progress in the overall implementation of the *2012 Strategy* in the context of the stage or phase of development of climate response programs. This assessment effort is described in Part III of this report. The assessment effort tracks program implementation progress through seven developmental phases:

1. initiation;
2. assessment;
3. response development;
4. initial implementation;
5. robust implementation;
6. mainstreaming; and
7. monitor outcomes and adaptive management.

Each of these phases is described in greater detail in the *2012 Strategy* and in this report.

In addition, Part III includes an assessment of the status of progress toward each of the 19 goals described in the *2012 Strategy* with respect to the developmental phases. This assessment builds on the first baseline assessment of the developmental status of climate change adaptation programs and projects across the National Water Program that was provided in the "2012 Highlights of Progress Report." The numerical scores (1-7) representing progress under each of the 19 goals in the *2012 Strategy* have a total possible score of 133. The 2012-2015 scores are:

- 2012: 42
- 2013: 51
- 2014: 55
- 2015: 67



OVERVIEW OF
2015 NATIONAL HIGHLIGHTS

National Water Programs/Research Products

Vision Area 1: Water Infrastructure

1. Provide Training on Use of Climate Resilience Evaluation and Awareness Tool (CREAT)
2. Publish Integrated Storm Surge/Floodplain Maps for Gulf and Atlantic Coasts
3. Strengthen WaterSense Program by Increasing Program Partners and Publishing New Label for Commercial Toilets

Vision Area 2: Watersheds and Wetlands

4. Launch Healthy Watersheds Consortium Grant Program
5. Develop Drinking Water Mapping Application for Protecting Source Waters (DWMAPS) Tool
6. Create Technical Framework for Assessing Wetland Vulnerability to Climate Change (ORD/Office of Water (OW) Product)

Vision Area 3: Coastal and Ocean Waters

7. Add Climate Change to National Estuary Program Funding Guidance
8. Make Climate Change Project Grants to National Estuary Programs
9. Publish User's Guide for the Coastal Biodiversity Risk Analysis Tool (CBRAT) (ORD Product)

Vision Area 4: Water Quality

10. Improve Critical Streamflow Statistics
11. Strengthen Total Maximum Daily Loads (TMDLs) with Robust Decision-Making (ORD Product)
12. Develop EPA/U.S. Geological Survey (USGS) Report on Protecting Aquatic Life from Altered Hydrologic Conditions

Vision Area 5: Working with Tribes

13. Launch Mobile App for Local Environmental Observer (LEO) Network (ORD Product)

Vision Area 6: Cross-cutting Program Support

14. Identify and Describe State Water Agency Climate Adaptation Practices
15. Develop Climate Change and Water Training Module for EPA Watershed Academy

OVERVIEW OF 2015 HIGHLIGHTS

EPA Regional Programs

Region 1: Released a publicly available version of Region's new Resilience and Adaptation in New England (RAINE) data base, an on-line tool showcasing communities that have conducted vulnerability assessments and climate adaptation planning.

Region 2: **Developed and distributed a flood CD-ROM** which contains "before a flood" and "after a flood" navigation, 25 topic areas, and over 300 emergency and flood- related regulatory and voluntary resources including materials in Spanish and funding information.

Region 3: Supported the Hampton Roads Sea Level Rise Adaptation Pilot, a "whole government" initiative aimed at bringing the full force of coordinated government and the community efforts together to address sea level rise and other climate-induced changes.

Region 4: Continued implementation of the Energy Management Initiative in Tennessee, Alabama, and Mississippi with **over 40 wastewater treatment plants that have received energy assessments.** Results include energy savings of over 20 million kilowatt hours per year (kWh/yr); cost savings of over $1.6 million/yr; carbon dioxide (CO_2) reduction of over 30,000,000 pounds/year (lbs/yr); and significant nitrogen reductions.

Region 5: Worked with States and Tribes on the development and implementation of a regional monitoring network for streams to **design sampling protocols that will provide the best chance for detecting a climate change signal** apart from other stressors.

Region 6: **Rrecruited 11 new WaterSense Partners to further water conservation efforts.** Region 6 has a total of 162 WaterSense Partners and 194 Irrigation Partners.

Region 7: Worked with the EPA Office of Research and Development, Office of Air, and Office of Water to **pilot the 2015 U.S EPA Green Infrastructure Technical Assistance Program.** The goal was to estimate changes in air quality and emissions reductions due to trees, green streets, and green roofs in the Kansas City region.

Region 8: Met with Executive Directors of the Rural Water Systems in the Region to discuss EPA and other federal agency tools and resources related climate change mitigation, adaptation, and resiliency.

Region 9: With the Indian Health Service and federal and state partners, **created the "Drought Planning Handbook - Emergency Drinking Water Supply for California Indian Tribes.**"

Region 10: Hosted a two-day workshop to **assist the three National Estuary Programs (NEPs) in the Region to meet the national requirement that all NEPs conduct a broad, risk-based climate change vulnerability assessment** and integrate climate change considerations into their revised or updated Comprehensive Conservation and Management Plans by Fiscal Year (FY) 2020.

PART I
NATIONAL PROGRAM HIGHLIGHTS

Vision Area 1: Water Infrastructure

Vision: *In the face of a changing climate, resilient and adaptable drinking water, wastewater and stormwater utilities (water sector) ensure clean and safe water to protect the nation's public health and environment by making smart investment decisions to improve the sustainability of their infrastructure and operations and the communities they serve, while reducing greenhouse gas emissions through greater energy efficiency.*

1. **Provide Technical Assistant in Use of Climate Resilience Evaluation and Awareness Tool (CREAT):** Under the Climate Ready Water Utilities (CRWU) initiative, EPA provided direct technical assistance to 23 communities for conducting comprehensive climate-related risk assessments and identifying practical, local adaptation strategies, and provided general training to a further 260 water and wastewater utilities in the use of CRWU tools to assess and adapt to climate change.

2. **Publish Integrated Storm Surge/Floodplain Maps for Gulf and Atlantic Coasts:** EPA partnered with the National Oceanic and Atmospheric Administration (NOAA) to develop the Storm Surge Inundation and Hurricane Strike Frequency Map to provide water sector utilities with easy access to critical flood-related information, including data related to historical hurricane strike frequency, 100- and 500-year storm Federal Emergency Management Agency (FEMA) flood plains, and worst-case storm surge inundation. The maps illustrate hurricane strike frequency and worst-case coastal storm surge or inundation scenarios derived from the:

   - National Hurricane Center's hurricane strike dataset;
   - FEMA's 100-year and 500-year flood plains; and
   - NOAA's Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model.

   The maps are available at: http://www.epa.gov/crwu/see-coastal-storm-surge-scenarios-water-utilities.

3. **Strengthen WaterSense Program by Increasing Program Partners and Publishing New Label for Commercial Toilets:** In 2015, the WaterSense program announced that it had exceeded the 1 trillion gallon mark in water savings and $21.7 billion in water and energy bills through December 2014. The program also added more than 120 new partners, for a total of 1,740. In addition, WaterSense released a final specification for flushometer-valve commercial toilets. EPA estimates that there are more than 7 million toilets in use that have flush volumes greater than 3 gallons per flush. If commercial facilities replaced all of these inefficient models with WaterSense labeled models, it could save an estimated 39 billion gallons per year.

Vision Area 2: Watersheds and Wetlands

Vision: *Watersheds are protected, maintained and restored to ensure climate resilience and to preserve the social and economic benefits they provide; and the nation's wetlands are maintained and improved using integrated approaches that recognize their inherent value as well as their role in reducing the impacts of climate change.*

4. **Launch Healthy Watersheds Consortium Grant Program:** The Healthy Watersheds Consortium Grant Program was launched to accelerate and expand the strategic protection of healthy freshwater ecosystems and their watersheds across the country. The grant will leverage a moderate federal investment with other partners and resources to grow state healthy watersheds programs and to sponsor local projects to protect and maintain intact watersheds. The grantee will administer a sub-award program to support either healthy watershed program development projects or local demonstration/training projects.

5. **Develop Drinking Water Mapping Application for Protecting Source Waters (DWMAPS) Tool:** EPA developed a Drinking Water Mapping Application to Protect Source Waters (DWMAP) tool to assist States and public water systems in planning for climate change effects on their water resources. DWMAPS brings together a suite of resources that can provide users with information to update source water assessments and prioritize source water protection measures in any location or watershed in the country. DWMAPS provides water systems, state programs, federal agencies and other interested stakeholders with data critical to drinking water source protection and allows users to easily inventory potential sources of contamination to water supplies. EPA plans to release the public version of DWMAPS in early 2016.

6. **Create Technical Framework for Assessing Wetland Vulnerability to Climate Change:** OW and ORD are collaborating on a project to identify wetland types and functions vulnerable to climate change impacts and assessing approaches for integrating climate science into OW programs (e.g., Clean Water Act Section 404 Program, Healthy Watersheds Initiative, and National Wetlands Condition Assessment). Accomplishments to date include a technical framework for assessing relative wetland vulnerabilities, demonstration of a vulnerability inventory for a pilot region in the Mid-Atlantic, and a stakeholder workshop to obtain feedback on utility of the results for informing program adaptations. A draft journal article on the framework and inventory has been completed.

Vision Area 3: Coastal and Ocean Waters

Vision: *Adverse effects of climate change and unintended adverse consequences of responses to climate change have been successfully prevented or reduced in the ocean and coastal environment. Federal, tribal, state, and local agencies, organizations, and institutions are working cooperatively; and information necessary to integrate climate change considerations into ocean and coastal management is produced, readily available, and used.*

7. **National Estuary Program Adds Climate Change to Funding Guidance:** New funding guidance for 28 National Estuary Programs (NEPs) published in December of 2014 provides that by 2020 the Comprehensive Conservation and Management Plan (CCMP) for each NEP has to include a broad, risk-based climate change vulnerability assessment. Goals that are at high risk from climate change need to be modified or dropped, or the risks need to be mitigated. Second, once CCMPs are revised for climate change considerations, annual workplans are to be "climate resilient investments" that will provide their intended benefits through time, even as the climate changes.

8. **Climate Ready Estuaries Program Makes Project Grants for Change Climate**. In addition to base grant funding, the National Estuary Program made grants to individual estuary programs for projects in several key areas related to climate change:

   - Seven NEPs received grants to create risk-based climate change vulnerability assessments, and a contract work assignment was awarded to assist the six NEPs in New England with climate change vulnerability assessments;
   - The Casco Bay Estuary Partnership and the Barnegat Bay Partnership received grants to evaluate how rising sea level will affect their salt marshes;
   - The Lower Columbia River Estuary Partnership received grant assistance to examine water temperature dynamics to assist in habitat restoration projects;
   - Five grants were provided to NEPs to study "blue carbon" and related carbon sequestration issues including: the eelgrass–blue carbon connection; carbon in living shoreline projects; estuarine carbon budgets; carbon fluxes in restored wetlands; and carbon/sediment accounting at a tidal restoration project; and

- Five NEPs received funding for high-frequency and high-precision measurement of ocean acidification parameters to better understand how nutrients can exacerbate acidification.

9. **Publish User's Guide for the Coastal Biodiversity Risk Analysis Tool (CBRAT):** EPA ORD published a user's guide for the Coastal Biodiversity Risk Analysis Tool (CBRAT) to expand the ability of public users to use the web-based CBRAT program. The user's guide moves the tool toward its objective to provide a risk-assessment tool that automatically calculates the relative vulnerability of species to individual and multiple climate change drivers based on traits that make species vulnerable or resilient to climate change. Additional capabilities are expected to be incorporated into the tool over the coming year and made available on the interagency website: www.cbrat.org

Vision Area 4: Water Quality

Vision: *The Nation's surface water, drinking water, and ground water quality are protected, and the risks of climate change to human health and the environment are diminished, through a variety of adaptation and mitigation strategies.*

10. **Improve Critical Streamflow Statistics:** EPA partnered with the U.S. Geological Survey (USGS) to develop and refine the "SW Toolbox," a tool for estimating critical streamflow statistics, such as 7Q10, at gaged and ungaged stream sites. The tool calculates a wide array of flow statistics and features a batch run option and automated testing for trends, serial correlation, outliers, and unusually large skew. The tool will undergo additional beta testing in early 2016 and is scheduled for formal release in summer 2016. In addition to being important for NPDES (National Permit Discharge Elimination System) permit writers, the SW Toolbox may help identify trends in stream flow resulting from climate change and other factors.

11. **Strengthen TMDLs (Total Maximum Daily Loads) with Robust Decision-Making:** In 2015, the EPA Office of Research and Development project on Robust Decision Making (RDM) culminated in the release of a report by the RAND Corporation describing how RDM methods were applied in two pilot studies of the development of TMDL implementation plans: one focused on the Patuxent River in the Chesapeake Bay watershed and one focused on the North Farm Creek Tributary of the Illinois River. Key findings included demonstrating how water quality planners can:

    - test TMDL implementation plans over a range of futures, including changing climate;
    - use vulnerability analysis to facilitate the development of flexible plans; and
    - identify trade-offs among improvements intended to make the plans more robust.

    Overall, the report suggests that RDM-based analyses can help EPA and its partners manage uncertainty by developing flexible and robust plans within a process designed to facilitate stakeholder input. Follow-on work based on these pilot efforts is now underway to expand RDM methods to a broader set of OW needs.

12. **Develop EPA/USGS Report on Protecting Aquatic Life from Altered Hydrologic Conditions:** EPA and the U.S. Geological Survey **developed a draft technical report that provides information on aquatic life use protection in flowing waters for interested water quality managers and other stakeholders**. The report discusses the natural hydrologic flow regime and potential effects of flow alteration on aquatic life, Clean Water Act programs that can be used to support the natural flow regime and maintain healthy aquatic biota, and the **potential effects of climate change on hydrologic flow.** The report provides a flexible, non-

prescriptive framework that could be considered by water quality managers and other stakeholders to establish targets for flow that are protective of aquatic life.

Vision Area 5: Working with Tribes

Vision: *Tribes are able to preserve, adapt, and maintain the viability of their culture, traditions, natural resources, and economies in the face of a changing climate.*

13. **Launch Mobile App for Local Environmental Observer (LEO) Network:** ORD and the Alaska Native Tribal Health Consortium launched a mobile app for handheld devices called the LEO Viewer, designed to display environmental observations by the Local Environmental Observer (LEO) Network. The LEO Network, focused on the circumpolar north, recognizes the value of local and traditional knowledge and was developed to increase awareness about vulnerabilities and impacts from climate change, and to connect community members with technical experts. The LEO Viewer allows viewers to experience through text, audio, and images the observations and technical consults posted by network members, including information regarding conditions of rivers, streams, wetlands, and coasts. This successful collaboration with EPA was highlighted by Alaskan tribal leaders at the September 30, 2015 White House Citizen Science event.

In addition, water programs in EPA's regional offices are working with Tribes to assist them in responding to climate change-related issues. These activities are summarized below:

- Region 2 worked with the Peconic Estuary Program and the Climate Ready Estuaries Program to conduct a **Climate Vulnerability Assessment in cooperation with the Shinnicock Nation**. These assessments are prepared in accordance with EPA's "Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans". In addition, the Peconic Estuary Program was featured in a series of informational videos produced to promote the "Workbook."

- Region 4 worked with the Water Security Division in the EPA Office of Groundwater and Drinking Water (OGWDW) to provide technical assistance in a pilot effort with the **Climate Resilience Evaluation and Awareness Tool** at the five water systems operated by **the Seminole Tribe of Indians in Florida.**

- Region 4 **expanded its Energy Management Initiative (EMI) to tribal facilities operated by the Mississippi Band of Choctaw Indians and the Poarch Band of Creek Indians**. Tribal utility and technical assistance representatives attended Tennessee EMI Workshops and EPA conducted energy assessments at the two Tribes' facilities. Identified energy savings were 400,000 kWh/year and cost savings are $39,000/year. Region 4 EMI identified carbon

reduction potential at over 300 tons CO_2/year and nitrogen discharge reduction at over 18,000 lbs of nitrogen per year, all at very low cost to the utilities involved.

- The Region 4 Energy Management Initiative team is **collaborating with United South and Eastern Tribes (USET)** -- the support organization for 26 Tribes from Texas to Maine -- and Region 4 tribal program in several areas:
    - Capacity Development support at the USET Annual Tribal Utility Summit in 2014 and 2015.
    - Provide onsite energy assessments for the Choctaw tribal wastewater treatment plants and drinking water facilities in Philadelphia, Mississippi and for the Poarch Band of the Creek tribal wastewater treatment plant in Atmore, Alabama – 25% energy savings identified – over 400,000 kWh/yr , approximately $40,000/year cost savings.
- Region 5 implemented a project, to **assist Tribes in integrating climate resiliency and water facility asset management.** The project, "Integrating Climate Resiliency into Comprehensive Asset Management with the **Menominee Tribe of Wisconsin**," applied two EPA tools - CREAT and CUPSS - at a small tribal wastewater utility. CUPSS provides an asset management framework for the facility, and CREAT helps forecast effects of climate change in the locale.

- Region 7's Environmental Sciences and Technology Division **hosted a Workshop on Central Plains Climate Change Monitoring Network** in partnership to develop a climate change regional monitoring network in April 2015. Environmental staff of the **Winnebago Tribe** attended, and at least three Tribes have expressed interested in participating in the monitoring network. The second day of the workshop included a hands-on session at a local stream installing temperature/flow transducers, gages, performing a cross section survey, measuring air temperature, and measuring stream discharge.

- With the Indian Health Service, Region 9 convened federal and state partners to coordinate information on infrastructure needs and funding, technical assistance, and emergency drought relief opportunities for Tribes. In 2015, these **partners created the "Drought Planning Handbook - Emergency Drinking Water Supply for California Indian Tribes."**

- Region 9 is an active member of the California Landscape Conservation Cooperative's (LCC) Tribal Committee that works with Tribes, the California Department of Water Resources, the Bureau of Indian Affairs, and other agencies to **bring technical and financial assistance to California Tribes for building climate change resilience**. Region 9 provided two presentations to Tribes on potential funding for climate adaptation planning and action.

- Region 9 is **prioritizing drought-resilience projects for EPA tribal drinking water infrastructure funding based on revised project selection criteria developed in 2014 in consultation with Tribes**. In 2015, EPA re-directed a portion of funds for the tribal clean water infrastructure and border infrastructure programs to support two additional drought-

related drinking water projects. A total of almost $1.7 million was authorized to fund five drought-related drinking water infrastructure projects in 2015.

- Region 10 and EPA ORD worked with partners including the **Nooksack Indian Tribe, Lummi Nation,** and Washington Department of Ecology on a **project to use a temperature load allocation for the South Fork Nooksack River as a pilot for integrating climate change into a watershed-specific plan for improving water quality.**

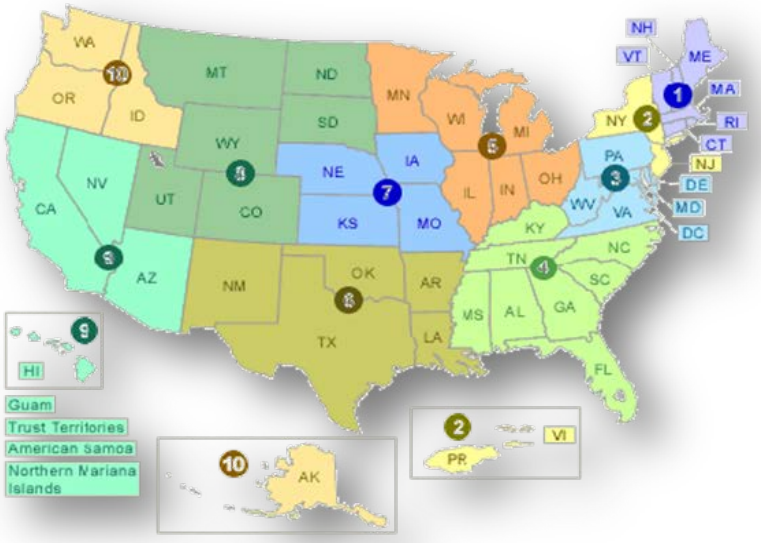
Vision Area 6:
Cross-cutting Program Support

14. Identify and Describe State Water Agency Climate Adaptation Practices: EPA worked with state water agency organizations to identify and describe climate change practices related to the clean water and safe drinking water programs they administer. These select state practices can serve as useful models for other state agencies seeking to make water programs more resilient to climate change. In addition, water resource planners and decision makers from local and tribal governments and other entities may find these practices to be helpful. The practices are the result of a collaborative effort among EPA and the Association of Clean Water Administrators (ACWA), Association of State Drinking Water Administrators (ASDWA), and Association of State Wetland Managers (ASWM). Practices are posted online at: http://www.epa.gov/climate-change-water-sector/state-water-agency-practices-climate-adaptation.

15. Develop Climate Change and Water Training Module for EPA Watershed Academy: In 2015, EPA developed a new online training module, "Understanding Climate Change Impacts on Water Resources." This training is intended to increase water resource professionals' understanding of the causes of climate change and its potential impacts on water resources. The module describes how federal, state, tribal, and local governments and communities are working to make the United States more resilient to the impacts of climate. The 45-minute training was posted online in early 2016 as a part of the EPA Watershed Academy Web certificate program at: www.epa.gov/watershedacademy.

PART II
HIGHLIGHTS FROM EPA REGIONAL PROGRAMS

A major highlight of work in each of the ten EPA regional offices (see map of EPA Regions) to implement the *2012 Strategy* is described below. Additional accomplishments by EPA Regions are described in the Compendium in Appendix C.



Region 1

Region 1 released a publicly available version of the Region's **new Resilience and Adaptation in New England (RAINE) data base**, http://www.epa.gov/raine, an on-line tool showcasing communities that have conducted vulnerability assessments and climate adaptation planning.

Region 2

Region 2 developed and distributed a **flood CD-ROM** which contains "before a flood" and "after a flood" easy navigation buttons, 25 topic areas, and over 300 emergency and flood related regulatory and voluntary resources including over 90 documents, Spanish language materials, and funding resources.

Region 3

Region 3 continued **support of the Hampton Roads (Virginia) Sea Level Rise Adaptation Pilot**, which is currently in phase 2 of its two-year "whole government" initiative aimed at bringing the full force of coordinated government and community efforts together to address sea level rise and other climate-induced changes expected in the Hampton Roads region. In support of this work, which also includes two of Region 3's Making a Visible Difference communities (see https://www.epa.gov/smartgrowth/making-visible-difference-communities for more information) (Norfolk and Newport News, Virginia), the Region:

- secured a $25,000 grant for a workshop for the city of Norfolk, to be held in early 2016 addressing green streets as a way to incorporate green infrastructure;
- secured a $25,000 grant to add to an existing Targeted Brownfields Assessment of the Harbor Park Waterfront area along the Elizabeth River in Hampton Roads; and

- produced GIS (geographic information system) mapping of Superfund sites in the Norfolk area that provided an overlay of sea level rise scenarios and guidance on remedial strategies, adapted to climate change, for the cleanup sites within this community**.**

Region 4

In 2015, Region 4 **continued implementation of the Energy Management Initiative**. This work, began in 2012 as a partnership with the State of Tennessee has expanded to Alabama and Mississippi with over 40 wastewater treatment plants that have received energy assessments (including two tribal utilities). The results include:

- energy savings identified of approximately 20 million kWh/year;
- cost savings identified – over $1.6 million/year;
- CO_2 reduction identified – over 30,000,000 lbs/year; and
- total nitrogen discharge reduction – over 1,000,000 lbs/year

To date, almost 50% of these identified savings have been implemented, all at little to no cost. Region 4 and state partners are continuing to work with these utilities to implement and document all of these savings. Over the next two years, Region 4 will be working with another 20 to 30 WWTPs (wastewater treatment plants) in Tennessee and Alabama supported by a 2015 Department of Energy State Energy Program Grant to those States to continue this work.

Region 5

Region 5 **began working with States and Tribes on the development and implementation of a regional monitoring network (RMN) for streams.** The goal is to pool resources at the regional level in order to efficiently collect consistent, high-quality water quality data that can enable tracking of long-term trends due to climate change and other factors. Thus far, a standardized monitoring protocol for fish and aquatic macroinvertebrates has been developed and candidate sites have been screened in collaboration with the participating agencies. Region 5 is also exploring the development of a RMN for inland lakes in the region. The approach being taken to develop the RMNs is to take advantage of the strengths of existing monitoring programs, while **designing sampling protocols that will provide the best chance for detecting a climate change signal apart from other stressors**.

Region 6

Region 6 **recruited 11 new WaterSense Partners to further water efficiency and conservation efforts.** These partners include 7 promotional partners (The Woodlands Township; North Central Texas Council of Governments; Milligan Water Supply Corp; City of Murphy, Texas; Village of Angel Fire, New Mexico; The Woodlands Joint Powers Agency; and City of Oklahoma City, Oklahama), 2 builder partners (Northwest Regional Housing Authority and Crawford/Sebastian Community Development Council), 1 retail/distributor (Longhorn Inc.), and

1 manufacturer partner (ThermaSol Steambath Company). Region 6 has 162 WaterSense Partners and 194 Irrigation Partners total.

Region 7

In a cross EPA effort, Region 7 worked with the Office of Research and Development, Office of Air, and Office of Water to **pilot the 2015 U.S EPA Green Infrastructure Technical Assistance Program in the region.** The goal of the project is to estimate changes in air quality and/or emissions reductions due to trees, green streets and green roofs in the Kansas City region.

Region 8

Region 8 staff **met with Executive Directors of the Rural Water Systems in the region to discuss EPA and other federal agency tools and resources related climate change** mitigation, adaptation, and resiliency.

Region 9

With the Indian Health Service, Region 9 convened federal and state partners to coordinate information on infrastructure needs and funding, technical assistance, and emergency drought relief opportunities for Tribes. In 2015 these partners **created the "Drought Planning Handbook - Emergency Drinking Water Supply for California Indian Tribes."**

Region 10

Region 10 hosted a **two-day workshop in July 2015 to assist the three EPA Region 10 National Estuary Programs (NEPs) to meet the national EPA requirement that all NEPs conduct a broad, risk-based climate change vulnerability assessment and integrate climate change considerations** into their revised or updated Comprehensive Conservation and Management Plans by FY 2020. The workshop provided the NEPs with the latest science on observed and projected changes in temperature, precipitation, hydrology, ocean acidification, and sea-level rise for their NEPs. EPA staff helped the NEPs begin the process of developing a vulnerability assessment and adaptation plan.

Part III
2014 Assessment of Progress

The "2012 Highlights of Progress Report" included the initial step in tracking progress in implementing climate change response programs based on assessing the stage or phase of development of efforts to implement the 19 Goals and each of the 54 specific "Supporting Actions" identified in the *2012 Strategy*.

The seven developmental phases for climate change related work identified in the 2012 Report are:

1. **Initiation**; conduct a screening assessment of potential implications of climate change to mission, programs, and operations;

2. **Assessment**; conduct a broader review to understand how climate change affects the resources in question;

3. **Response Development**; identify changes necessary to continue to reach program mission and goals and develop initial action plan;

4. **Initial Implementation**; initiate actions in selected priority programs or projects

5. **Robust Implementation**; programs are underway and lessons learned are being applied to additional programs and projects;

6. **Mainstreaming;** climate is an embedded, component of the program; and

7. **Monitor Outcomes and Adaptive Management;** continue to monitor and integrate performance, new information, and lessons learned into programs and plans.

More detailed descriptions of each of these phases of assessment are included in Table I.

Recognizing the long-term nature of work to address climate change, the National Water Program has identified the current (i.e. December 2015) status of work on each of the Goals in Table II below. The 2012 baseline assessment has a total numeric value of 42 out of a total possible score of 133 (i.e., 19 goals times a score of 7 for each goal equals a score of 133). This combined score indicates that many actions are in the early stages of implementation.

This "2015 Highlights of Progress Report" includes a 2015 update of the initial 2012 assessment. The 2015 scores are provided in Table II after the 2012, 2013, and 2014 scores. Collectively, the total score increases from 42 to 51 to 55 to 67 between 2012 and 2015.

Table I - Description of Implementation Phases

Program Implementation Phases	Explanation	Examples of Evidence of Achievement
1. Initiation	Conduct a screening assessment of potential implications of climate change to mission, programs, and operations	o 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 o Responsibilities are assigned at appropriate levels within the organization and resources are available to develop more in-depth assessments
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	o Review science literature and assessments to understand how climate change affects the resources being protected (threat to mission); o Engage internal staff and external stakeholders in evaluation o Identify climate change issues and concerns and communicate with internal and external stakeholders and partners. o Identify which specific programs are threatened and what specific information or tools need to be developed o 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	o Develop initial program vision and goals for responding to climate change. o Identify needed response actions or changes that will allow the organization to begin to address climate impacts on its mission o Initiate strategies and actions in a few key areas to begin to build organizational ability to use climate information in decision processes o Identify program partners' needs for building adaptive capacity o Begin working with an external 'community of practice' to engage in tool and program development o Rudimentary methods are put in place to track progress and options for more formal measures are identified and evaluated o Develop a strategy and partnerships to obtain additional needed research

4. Initial Implementation	Initiate actions in selected priority programs or projects	o Make it clear within the organization that incorporating climate change into programs is critical o Initiate actions and plans identified in Step 3 o Initiate projects with partners o Develop needed information and tools o Initial implementation of measures capable of documenting the extent of implementation of needed actions by partners/stakeholders o 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	o Lessons learned are evaluated and strategies are refined o Efforts are initiated to consider climate change in additional program elements o Continue to institute institutional changes to include climate change in core programs, including refinement of measures o External communities of practice are in place to support ongoing capacity development
6. Mainstreaming	Climate is an embedded, component of the program	o The organization's culture and policies are aligned with responding to climate change o All staff have a basic understanding of climate change causes and impacts o All relevant programs, activities, and decisions processes intrinsically incorporate climate change o Measures for documenting progress among partners/stakeholders are well established and support program evaluation
7. Monitor Outcomes and Adaptive Management	Continue to monitor and integrate performance, new information, and lessons learned into programs and plans	o Progress is evaluated and needed changes are implemented o As impacts of climate change unfold, climate change impacts and organizational responses are reassessed

TABLE II - Climate Goals with 2012 Baseline and 2013, 2014, and 2015 Assessment Scores

Visions and Goals	*Strategic Actions (SA)*	*2012 Baseline and 2013, 2014, and 2015 Assessment Scores*
<u>Infrastructure:</u> In the face of a changing climate, resilient and adaptable drinking water, wastewater and stormwater utilities (water sector) ensure clean and safe water to protect the nation's public health and environment by making smart investment decisions to improve the sustainability of their infrastructure and operations and the communities they serve, while reducing greenhouse gas emissions through greater energy efficiency.		
Goal 1: Build the body of information and tools needed to incorporate climate change into planning and decision making.	SA1: Improve access to vetted climate and hydrological science, modeling, and assessment tools through the Climate Ready Water Utilities program.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 4 2015 Assessment: 5
	SA2: Assist wastewater and water utilities to reduce greenhouse gas emissions and increase long-term sustainability with a combination of energy efficiency, co-generation, and increased use of renewable energy resources.	
	SA3: Work with the States and public water systems, particularly small water systems, to identify and plan for climate change challenges to drinking water safety and to assist in meeting health based drinking water standards.	
	SA4: Promote sustainable design approaches to provide for the long-term sustainability of infrastructure and operations.	
Goal 2: Support Integrated Water Resources Management (IWRM) to sustainably manage water resources.	SA5: Understand and promote through technical assistance the use of water supply management strategies.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 2 2014 Assessment: 3 2015 Assessment: 4
	SA6: Evaluate and provide technical assistance on the use of water demand management strategies.	
	SA7: Increase cross-sector knowledge of water supply climate challenges and develop watershed specific information to inform decision making.	

Visions and Goals	*Strategic Actions*	*2012 Baseline and 2013 & 2014 Assessment Scores*
<u>Watersheds & Wetlands</u>: Watersheds are protected, maintained and restored to ensure climate resilience and to preserve the social and economic benefits they provide; and the nation's wetlands are maintained and improved using integrated approaches that recognize their inherent value as well as their role in reducing the impacts of climate change.		
Goal 3: Identify, protect, and maintain a network of healthy watersheds and supportive habitat corridor networks.	SA8: Develop a national framework and support efforts to protect remaining healthy watersheds and aquatic ecosystems.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 4 2015 Assessment: 5
	SA9: Collaborate with partners on terrestrial ecosystems and hydrology so that effects on water quality and aquatic ecosystems are considered.	
	SA10: Integrate protection of healthy watersheds throughout the National Water Program (NWP) core programs.	
	SA11: Increase public awareness of the role and importance of healthy watersheds in reducing the impacts of climate change.	
Goal 4: Incorporate climate resilience into watershed restoration and floodplain management.	SA12: Consider a means of accounting for climate change in EPA funded and other watershed restoration projects.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 4
	SA13: Work with federal, state, interstate, tribal, and local partners to protect and restore the natural resources and functions of riverine and coastal floodplains as a means of building resiliency and protecting water quality.	
Goal 5: Watershed protection practices incorporate Source Water Protection to protect drinking water supplies.	SA14: Encourage States to update their source water delineations, assessments or protection plans to address anticipated climate change impacts.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 2 2014 Assessment: 2 2015 Assessment: 3
	SA15: Continue to support collaborative efforts to increase state and local awareness of source water protection needs and opportunities, and encourage inclusion of source water protection areas in local climate change adaptation initiatives.	

Visions and Goals	*Strategic Actions*	*Assessment*
Goal 6: Incorporate climate change considerations into the Clean Water Act (CWA) 404 regulatory program as they relate to permit reviews and compensatory mitigation.	SA16: Consider the effects of climate change, as appropriate, when making significant degradation determinations in the CWA Section 404 wetlands permitting and enforcement program. SA17: Evaluate, in conjunction with the U.S. Army Corps of Engineers, how wetland and stream compensation projects could be selected, designed, and sited to aid in reducing the effects of climate change.	**Phase Response Assessment:** 2012 Baseline: 1 2013 Assessment: 1 2014 Assessment: 1 2015 Assessment: 1
Goal 7: Improve baseline information on wetland extent, condition and performance to inform effective adaptation to climate change.	SA18: Expand wetland mapping by supporting wetland mapping coalitions and training on use of the new Federal Wetland Mapping Standard. SA19: Produce a statistically valid, ecological condition assessment of the nation's wetlands. SA20: Work with partners and stakeholders to develop information and tools to support long term planning and priority setting for wetland restoration projects.	**Phase Response Assessment:** 2012 Baseline: 1 2013 Assessment: 2 2014 Assessment: 2 2015 Assessment: 3
<u>Coastal and Ocean Waters</u>: Adverse effects of climate change and unintended adverse consequences of responses to climate change have been successfully prevented or reduced in the ocean and coastal environment. Federal, tribal, state, and local agencies, organizations, and institutions are working cooperatively; and information necessary to integrate climate change considerations into ocean and coastal management is produced, readily available, and used.		
Goal 8: Collaborate to ensure information and methodologies for ocean and coastal areas are collected, produced, analyzed, and easily available.	SA21: Collaborate to ensure that synergy occurs, lessons learned are transferred, federal efforts effectively help local communities, and efforts are not duplicative or at cross-purposes. SA22: Work within EPA and with the U.S. Global Change Research Program and other federal, tribal, and state agencies to collect, produce, analyze, and format knowledge and information needed to protect ocean and coastal areas and make it easily available.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 4

Visions and Goals	*Strategic Actions*	*Assessment*
Goal 9: EPA geographically targeted programs support and build networks of local, tribal, state, regional and federal collaborators to take effective adaptation measures for coastal and ocean environments.	SA23: Work with the NWP's larger geographic programs to incorporate climate change considerations, focusing on both the natural and built environments. SA24: Address climate change adaptation and build stakeholder capacity when implementing NEP Comprehensive Conservation and Management Plans and through the Climate Ready Estuaries Program. SA25: Conduct outreach and education, and provide technical assistance to state and local watershed organizations and communities to build adaptive capacity in coastal areas outside the NEP and Large Aquatic Ecosystem programs.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 2 2014 Assessment: 3 2015 Assessment: 4
Goal 10: Address climate driven environmental changes in coastal areas and ensure that mitigation and adaptation are conducted in an environmentally responsible manner.	SA26: Support coastal wastewater, stormwater, and drinking water infrastructure owners and operators in reducing climate risks and encourage adaptation in coastal areas. SA27: Support climate readiness of coastal communities, including hazard mitigation, pre-disaster planning, preparedness, and recovery efforts. SA28: Support preparation and response planning for diverse impacts to coastal aquatic environments.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 3

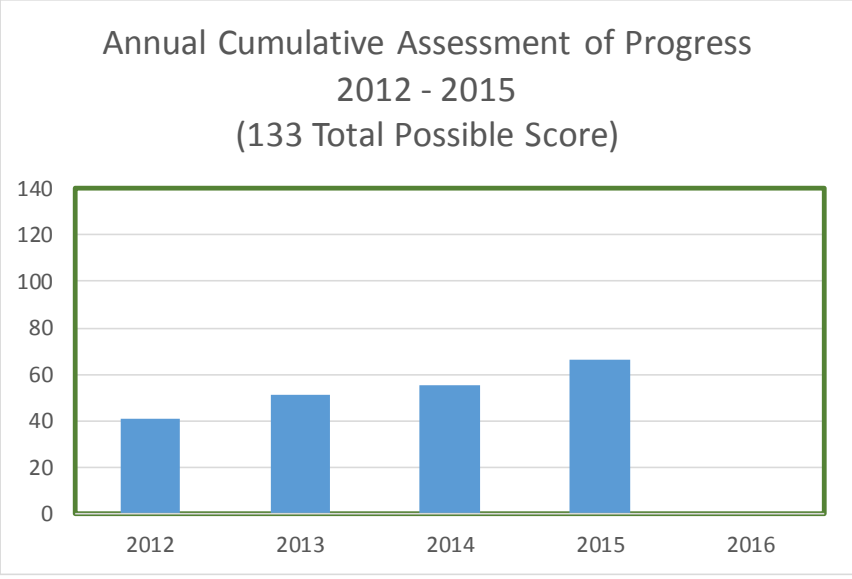
Visions and Goals	*Strategic Actions*	*Assessment*
Goal 11: Ocean environments are protected by EPA programs that incorporate shifting environmental conditions, and other emerging threats.	SA29: Consider climate change impacts on marine water quality in NWP ocean management authorities, policies, and programs.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 3
	SA30: Use available authorities and work with the regional Ocean Organizations and other federal and state agencies through regional ocean groups and other networks so that offshore renewable energy production does not adversely affect the marine environment.	
	SA31: Support the evaluation of sub-seabed sequestration of CO_2 and any proposals for ocean fertilization.	
	SA32: Participate in interagency development and implementation of federal strategies through the National Ocean Council (NOC) and the NOC Strategic Action Plans.	
<u>Water Quality:</u> Our Nation's surface water, drinking water, and ground water quality are protected, and the risks of climate change to human health and the environment are diminished, through a variety of adaptation and mitigation strategies.		
Goal 12: Protect waters of the United States and promote management of sustainable surface water resources.	SA33: Encourage States and communities to incorporate climate change considerations into their water quality planning.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 3
	SA34: Encourage green infrastructure and low-impact development to protect water quality and make watersheds more resilient.	
	SA35: Promote consideration of climate change impacts by National Pollutant Discharge Elimination System permitting authorities.	
	SA36: Encourage water quality authorities to consider climate change impacts when developing wasteload and load allocations in TMDLs where appropriate.	
	SA37: Identify and protect designated uses that are at risk from climate change impacts.	

Visions and Goals	*Strategic Actions*	*Assessment*
Goal 13: As the nation makes decisions to reduce its greenhouse gas emissions and develop alternative sources of energy and fuel, the NWP will work to protect water resources from unintended adverse consequences.	SA38: Clarify how to re-evaluate aquatic life water quality criteria on more regular intervals; and develop information to assist States and Tribes who are developing criteria that incorporate climate change considerations for hydrologic condition.	**Phase Response Assessment:** 2012 Baseline: 1 2013 Assessment: 2 2014 Assessment: 3 2015 Assessment: 4
	SA39: Continue to provide perspective on the water resource implications of new energy technologies.	
	SA40: Provide assistance to States and permittees to assure that geologic sequestration of CO_2 is responsibly managed.	
	SA41: Continue to work with States to help them identify polluted waters, including those affected by biofuels production, and help them develop and implement TMDLs for those waters.	
	SA42: Provide informational materials for stakeholders to encourage the consideration of alternative sources of energy and fuels that are water efficient and maintain water quality.	
	SA43: As climate change affects the operation or placement of reservoirs, EPA will work with other federal agencies and EPA programs to understand the combined effects of climate change and hydropower on flows, water temperature, and water quality.	
Goal 14: Collaborate to make hydrological and climate data and projections available.	SA44: Monitor climate change impacts to surface waters and ground water.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 4
	SA45: Collaborate with other federal agencies to develop new methods for use of updated precipitation, storm frequency, and observational streamflow data, as well as methods for evaluating projected changes in low flow conditions.	

Visions and Goals	*Strategic Actions*	*Assessment*
<u>Working With Tribes:</u> Tribes are able to preserve, adapt, and maintain the viability of their culture, traditions, natural resources, and economies in the face of a changing climate.		
Goal 15: Incorporate climate change considerations in the implementation of core programs, and collaborate with other EPA Offices and federal agencies to work with Tribes on climate change issues on a multi-media basis.	SA47: Through formal consultation and other mechanisms, incorporate climate change as a key consideration in the revised NWP Tribal Strategy and subsequent implementation of CWA, Safe Drinking Water Act (SDWA), and other core programs. SA48: Incorporate adaptation into tribal funding mechanisms, and collaborate with other EPA and federal funding programs to support sustainability and adaptation in tribal communities.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 3
Goal 16: Tribes have access to information on climate change for decision making.	SA49: Collaborate to explore and develop climate change science, information, and tools for Tribes, and incorporate local knowledge. SA50: Collaborate to develop communication materials relevant for tribal uses and tribal audiences.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 3
<u>Cross-Cutting Program Support</u>		
Goal 17: Communication, Collaboration, and Training	SA51: Continue building the communication, collaboration, and training mechanisms needed to effectively increase adaptive capacity at the federal, tribal, state, and local levels.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 4 2014 Assessment: 4 2015 Assessment: 5

Visions and Goals	*Strategic Actions*	*Assessment*
Goal 18: Tracking Progress And Measuring Outcomes	SA52: Adopt a phased approach to track programmatic progress towards Strategic Actions; achieve commitments reflected in the Agency Strategic Plan; work with the EPA Work Group to develop outcome measures.	**Phase Response Assessment:** 2012 Baseline: 3 2013 Assessment: 4 2014 Assessment: 4 2015 Assessment: 4
Goal 19: Climate Change and Water Research Needs	SA53: Work with ORD, 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 this 2012 Strategy, including to provide the decision support tools needed by water resource managers.	**Phase Response Assessment:** 2012 Baseline: 2 2013 Assessment: 3 2014 Assessment: 3 2015 Assessment: 4

TOTAL Implementation Phase Assessment Score: 2012 = 42
TOTAL Implementation Phase Assessment Score: 2013 = 51
TOTAL Implementation Phase Assessment Score: 2014 = 55
TOTAL Implementation Phase Assessment Score: 2015 = 67
TOTAL Possible = 133



Appendices

In addition to the accomplishments highlighted for each of the vision areas and EPA Regions, other important projects are in development and a number of supporting activities are being implemented. A complete summary of activities related to climate change and water programs is provided below for:

- National Water Program Offices;
- EPA Office of Research and Development; and
- EPA Regions.

NOTE that accomplishments described in the highlights portion of this report are not repeated in this Appendix.

Appendix A
National Water Program 2015 Climate Change Accomplishments

Office of Wetlands, Oceans and Watersheds

- The Healthy Watersheds Program **completed three projects to further assess and identify healthy watersheds:**

  - a Montana Prairie Pothole Assessment;
  - a Report on the Aquatic Ecological Health of the Clinch and Powell River System; and
  - a Tennessee Integrated Assessment of Watershed Health report, including an onsite workshop.

- In addition to continuing its general communications with States, the Healthy Watershed Program maintained ongoing efforts to reach out to States through participation in the national state TMDL programs meeting in April 2015, and through **completion of an updated Healthy Watersheds website in November 2015.** Assessment of healthy watershed vulnerability to climate change was specifically featured on the "Vulnerability Index" area of the website.

- In partnership with USGS, EPA is implementing the **Hydrology Futures Project. This project is based on the USGS Water Balance Model and is designed to help watershed managers evaluate the impacts of climate change on future hydrologic parameters for rivers and streams covering the entire coterminous U.S.** Initial products focus on monthly time steps from 2020-2100 for each of over 110,000 Hydrologic Response Units (landscape "pixels"). The model has been initialized with precipitation and atmospheric temperature projections from approximately 230 climate model/greenhouse gas emission scenario combinations. In FY 2015, USGS gave a webinar to EPA Office of Water and regional partners on the project,

and two related peer reviewed journal articles were submitted. Further, FY 2015 saw the development and peer review of a web portal USGS developed to disseminate project results. The web portal and initial underlying data are scheduled for launch in 2016, pending final clearance from USGS.

- In the fall of 2015, EPA **released the results of the first National Wetland Condition Assessment for public comment**. The NWCA is a statistical survey of the quality of our Nation's wetlands. This assessment data will help provide a baseline of wetland condition that will help in understanding changes in wetland condition over time as a result of climate change and other factors.

- Wetland Program Development Grants and targeted technical assistance **supported various projects for developing information and tools related to climate change and long-term planning/priority setting for wetland restoration projects.** To increase coastal resiliency, EPA supported several key projects on enhancing the appropriate use and understanding of living shorelines, for example:

  - the Living Shorelines Academy, which includes a web-based national data repository, regional training workshops, and a national technology transfer meeting; and
  - marine contractor trainings on the proper use and installation of living shorelines as an alternative to traditional erosion control structures such as bulkheads and seawalls.

- EPA is currently supporting a number of regional Wetland Program Development Grants related to **updating the National Wetlands Inventory to ensure that mapping efforts are current.**

- EPA's Ocean and Coastal Protection Division (OCPD) and Region 10 have a cooperative agreement with the Washington Department of Ecology to **examine how various regional land-based sources of carbon and nutrients exacerbate acidification in the Salish Sea**. The model will also help identify when and where portions of the Salish Sea are most influenced by regional sources.

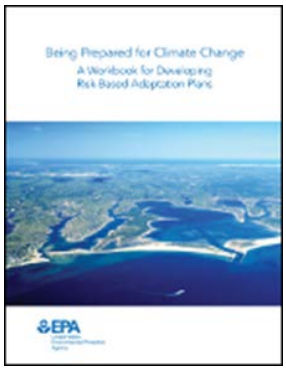
- OCPD is collaborating with the National Center for Environmental Economics to develop **ecosystem services valuation methodologies that will quantify the economic impacts of coastal acidification on shellfisheries in the Gulf of Maine and Puget Sound**. The methodology will use existing surrogates of ecosystem productivity (e.g., biomineralization rates, population models) to estimate impacts on commercial and recreational fishing industry, and project economic impacts in terms of lost revenues.

- OCPD is working in partnership with EPA's ORD to **develop a monitoring standard operating procedure (SOP) for acidification indicators (e.g., alkalinity, dissolved inorganic carbon and pH)** that are appropriate for estuarine environments. This work will aid ocean acidification monitoring by National Estuary Programs and citizen science groups.

- In partnership with other EPA offices, OCPD **is evaluating how existing Clean Water Act regulatory programs (e.g.; water quality standards, impaired water listing, TMDLs) and voluntary programs (e.g.; 319) could help assess and control land-based sources of pollution in areas where these pollutants contribute to ocean and coastal acidification.**

- In collaboration with the Northeast Coastal Acidification Network, **OCPD co-sponsored four regional stakeholder engagement workshops in New England.** The objective was to share and get input from stakeholders to inform development of education and outreach tools, as well as mitigation and adaptation strategies for addressing ocean acidification.

- Following the September 2014 publication of the "Being Prepared for Climate Change" workbook, **outreach efforts in 2015 included in-person trainings, webinars, and conference presentations**. Two videos featuring the vulnerability assessment projects of the San Juan Bay Estuary Program and the Peconic Estuary Program were created and released.



- EPA **continued to work with the international community to support the effective regulation of sequestration of carbon dioxide in sub-seabed geological formations (i.e., offshore carbon capture and storage (CCS) and marine geoengineering** (e.g., fertilization of the ocean) under the London Convention and London Protocol. The London Convention and London Protocol are the principal global regimes for the protection of the marine environment from pollution caused by dumping. In recent years, parties have taken steps to address climate change, including the potential harm to the marine environment from new experimental technologies designed to reduce carbon dioxide in the atmosphere.

- In November 2014, at the 36th Meeting of London Convention Contracting Parties and 9th Meeting of London Protocol Contracting Parties, parties adopted two technical guidance documents related to marine climate geoengineering and ocean fertilization. Under the auspices of the London Convention and Protocol, **the U.S. led development of a web-based ocean fertilization scientific repository.** The repository was published on the International Maritime Organization's website in April 2015. Also, in April 2015, during their annual joint meeting, the London Convention and London Protocol Scientific Groups convened a one-day symposium on marine geoengineering. EPA participated in an offshore CCS meeting co-sponsored by International Energy Agency Greenhouse Gas Research and Development Programme and the United Kingdom's National Oceanography Centre in September 2015.

Office of Ground Water and Drinking Water

- Under the Climate Ready Water Utilities Initiative (CRWU), **EPA became the first federal agency to provide on its website easy to access downscaled climate projection data.** This data will inform the water sector and others about projected annual total precipitation,

annual average temperature, precipitation intensity for the 100-year storm, number of days per year with temperatures above 100ºF, and sea-level rise for coastal locations for the years 2035 and 2060.

- EPA developed the web-based, **interactive Flood Resilience Guide to help drinking water and wastewater utilities, particularly medium and small utilities**, become more resilient to flooding by providing easy-to-use worksheets and instructional videos, and provided training on the guide to over 100 water and wastewater systems in flood prone regions.

- EPA completed the **Water Utility Response On-the-Go mobile website that provides water and wastewater utilities with critical, real-time information on impending severe weather events** including weather tracking, contact details for local and state response partners, rip-and-run action lists specific to several types of extreme weather events, a field-based means for documenting damage, and key Incident Command System response forms.

- EPA staff from Headquarters and Regions **worked with state officials to revise the Sanitary Survey Learners' Guide to assist States in developing a training regimen for staff in conducting sanitary surveys.** This trainers' guide has recently been updated to include numerous examples of climate change adaptation measures that States could pass along to drinking water utilities in the course of conducting sanitary surveys. (http://www.asdwa.org/index.cfm?fuseaction=Page.viewPage&pageId=606)

- The Office of Water encouraged federal agencies, States, and public water systems to **include climate change adaptation in state or local source water protection initiatives, and to include source water protection in climate adaptation initiatives.** For example:

  - Region 8 worked with Headquarters water program offices to co-sponsor a Regional / State Workshop in Sioux Falls, South Dakota on Harmful Algae Blooms.
  - The Association of State Drinking Water Administrators maintains an ongoing dialogue with its members through a Climate Change Committee and its website has posted links to state examples of climate adaptation and resources for hydraulic fracturing.
  - The Groundwater Protection Council website includes 19 pages of information about Aquifer Storage & Recovery, Climate Change Adaptation and Water Availability & Sustainability.

- To ensure protection of underground sources of drinking water (USDWs), EPA worked with co-regulators, industry, and other stakeholders to **develop technical guidance containing recommendations for EPA permit writers to consider in implementing Underground Injection Control (UIC) Class II requirements when conducting hydraulic fracturing using diesel fuels (DFHF).** EPA also released an interpretive memorandum defining the term "diesel fuels" for permitting purposes. After a public comment period on a draft guidance, EPA released the revised guidance on February 12, 2014. Since issuing the revised guidance, EPA has worked with States and regional EPA offices to ensure permit writers are aware of

the information in the guidance and memo and implement their UIC program consistent with Safe Drinking Water Act (SDWA) and UIC regulations.

- In its revised technical guidance for DFHF permitting (see note above), EPA provided permitting recommendations for EPA permit writers that States may also find useful in protecting USDWs. Throughout 2015, **EPA collaborated with States and other stakeholders to share and encourage unconventional oil and gas production practices that are protective of human health and the environment.** For example:

  - EPA participated in the National Governors Association (NGA) State Learning Network on Responsible Shale Energy Development—a program where States share practices to protect public health as shale energy resources are being developed.
  - In March, 2015 EPA supported NGA's Center for Best Practices when they hosted an expert roundtable entitled "A Workshop on State Efforts to Protect Water Resources While Developing Shale Energy." The roundtable brought together States and other stakeholders to discuss a regionally diverse set of protective practices and look at where leading-edge companies and States are headed.
  - In July, 2015 EPA convened a stakeholder forum to explore ways we can ensure that protective practices are being implemented as intended. Representatives with demonstrated expertise from States, Tribes, industry (production companies, service providers, and the insurance and financial sectors), non-governmental organizations and academia, joined to share their experiences.

- EPA worked with permit applicants and permittees on geologic sequestration of carbon dioxide (**CO_2) permits, evaluating applications and issuing Class VI permits for geologic sequestration projects**. For example:

  - EPA provided clarity to the regulated community regarding the relationship between Class II and Class VI wells through a Memorandum to EPA UIC Program Directors (April 2015;
  - EPA continued to work with two Class VI permittees, one permit applicant, and engaged other prospective applicants –providing guidance and support to facilitate efficient and effective permitting that ensures protection of underground sources of drinking water.

Office of Science and Technology

- EPA helped **support Region 3 in an effort to further develop their Regional Monitoring Network (RMN) for detecting and assessing shifting baselines due to climate change in freshwater streams**. The interagency agreement with USGS will provide the technical assistance needed to establish rating curves and collect hydrological data to strengthen their flow monitoring efforts under the RMN. (Office of Science and Technology (OST)/ORD)

- An EPA Headquarters/Regions team conducted a survey to identify regional priorities and key concerns regarding the impacts of climate change on water quality criteria and

standards. In response to regional feedback and interest, **the team is currently finalizing a Frequently Asked Questions (FAQs) document to better address the incorporation of climate change under the Water Quality Standards Program**, with input from various programs across the Office of Water and the Office of Research and Development.

- EPA **provided a climate change module at the spring Water Quality Standards Academy training**. The purpose of the module is to help communicate the National Water Programs latest activities to address climate change, as well as educate public and private sector participants of the importance of considering climate change impacts on water quality management. The climate change module will be revised based on participant feedback so that it can be a fully integrated component of the Academy.

Office of Wastewater Management

- WaterSense continued the **H_2Otel Challenge**, launched in February 2014, to help hotels assess, change, and track (ACT) their water use using the best management practices from "WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities." WaterSense developed a series of technical training webinars, all of which were recorded and made available on the WaterSense website, case studies, and tools for tracking water use and evaluating projects.

- WaterSense developed a series of **webinars to help U.S. Department of Housing and Urban Development (HUD) project officers and HUD grantees incorporate water efficiency into their programs and projects**. The WaterSense/HUD Water Wednesday webinar series, which ran from April through November 2015, provided information about tools and resources that help public, low-income, and multi-family housing managers save water, energy and money. Through November 2015, more than 1,100 had either attended the live webinars or viewed a recording.

- In September, EPA worked with the U.S. Department of Energy (DOE) and state energy offices to initiate energy **training and technical assistance management training programs for drinking water and wastewater utilities** in New Hampshire, Nebraska, Tennessee, Alabama, and New Mexico. **DOE has awarded funds to each of these States for 2-3 year cooperative agreements.** The training programs will focus on helping water and wastewater utilities assess their current energy usage, undertake energy audits, identify energy efficiency projects, and help these utilities identify and apply for federal, state, or local funding, as necessary.

- EPA continued to work with assistance providers like the National Rural Water Association as they **train small systems using the "Rural and Small Systems Guidebook for a Sustainable Utility."**

- In collaboration with utility stakeholders, including the Water Environment Federation, National Association of Clean Water Agencies (NACWA), and others, EPA **continued to promote the use of best practices that highlight a range of sustainable management practices for utilities to consider**, including those that help build climate resilience based on EPA's "Moving Towards Sustainability: Sustainable and Effective Practices for Creating Your Water Utility Roadmap."

- The EPA Headquarters and Regional State Revolving Fund (SRF) climate project team, which was established in early 2014, **continued to meet throughout 2015 to explore ways to further promote the incorporation of climate change considerations at the state level.** The team consists of Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) staff at Headquarters and EPA Regions 6 and 9.

- **Developed an indicator measure for the FY 2016-2017 National Water Program Guidance** concerning the integration of climate resilience considerations into SRF programs. Information will be collected by EPA Regions to report on this measure during the FY 2016 Annual Reviews.

- **Developed a draft of a paper on CWSRF eligibilities**, which includes information on eligible climate and extreme weather resilience projects.

- Convened a CWSRF/DWSRF Outreach Workgroup consisting of 6 EPA regions and several States to explore ways **to promote the CWSRF/DWSRF to a wide range of borrowers and project types, including climate change resiliency projects.**

- In October 2015, EPA and the Environmental Finance Centers of the University of Maryland and Syracuse University **hosted a National Green Infrastructure Learning Lab in College Park, Maryland. The objective of the Learning Lab was to provide a hands-on learning experience for communities interested in implementing green infrastructure**, and an opportunity to engage in dialogue with members of the Green Infrastructure Collaborative. The Learning Lab agenda included sessions on integrating flood mitigation with stormwater management using the Climate Assessment Tool Option of EPA's National Stormwater Calculator, as well as on harvesting rainwater in drought and population stressed regions.

- EPA held **four Green Infrastructure for Climate Resiliency charrettes** in Albuquerque, New Mexico; Grand Rapids, Michigan; Los Angeles, California; and New Orleans, Louisiana in 2015. These charrettes were designed to assist communities in using green infrastructure as a climate change adaptation tool to address issues such as local flooding and drought.

- In 2015, EPA commenced the 4th annual Campus Rainworks Challenge, which invites undergraduate and graduate students to submit green infrastructure designs for on-campus locations and awards prizes for winning submissions. **The 2015 Challenge emphasizes climate resiliency in the selection criteria,** asking applicants to consider the current and/or potential impacts of climate change on their college or university communities and to

demonstrate how their proposed green infrastructure projects would mitigate and build resiliency to those impacts while effectively managing stormwater runoff.

Office of Water Immediate Office

- The Climate Change Team in the Immediate Office of the Assistant Administrator for Water **represented the National Water Program within EPA and among other federal agencies** working to adapt to a changing climate at the:

  - EPA Cross-Agency Climate Change Adaptation Workgroup;
  - Climate Change Workgroup of the Advisory Committee on Water Information (ACWI);
  - Water Resources Workgroup of the Interagency Council on Climate Change Resilience and Preparedness;
  - Interagency Joint Working Group implementing the final "Fish Wildlife and Plants Climate Adaptation Strategy";
  - "National Ocean Policy" Implementation Plan workgroup on climate change;
  - Interagency Working Group on Ocean Acidification; and
  - Coral Reef Task Force.

- During 2015, the National Water Program published Program Guidance for 2016-17 and **established, for the first time, measures of progress related the progress of water programs in adapting to a changing climate and related to reducing release of greenhouse gases** and sequestering carbon. These measures support "Goal 1: Objective 1.1: Address Climate Change" in the "EPA 2014-2018 Strategic Plan."

  Measures relating to adapting clean water programs as the climate changes include:

  - Number of water or wastewater utilities that have registered to use Climate Resilience Evaluation and Awareness Tool (CREAT) tool.
  - Number of CWSRFs and DWSRFs that used financial incentives to promote climate resilience projects in the last year.

  Measures supporting the *Strategic Plan* goal of reducing greenhouse gas releases include:

  - Number of WaterSense partners working to improve water use efficiency.
  - Number of water and wastewater facilities that use the Energy Star Manager to manage energy.

- The National Water Program initiated **development of a white paper summarizing approaches that Tribes have taken to address climate change with a particular focus on water quality/water resources**. The paper seeks to identify:

  - the key impacts of climate change on tribal communities;

- the approaches Tribes have taken to address climate change and water concerns; and
- the resources available to Tribes to perform climate adaptation work.

The paper is intended as a technical informational resource for Tribes. EPA presented an outline of the paper to the National Tribal Water Council and EPA-Tribal Science Council in early Fall of 2015 at their respective meetings. Both partnership groups supported the idea of providing additional tribal climate change activity information and a coordinated review. The Tribal Science Council has recently solicited tribal input through their newsletter. EPA plans to finalize and publish the summary in 2016.

- In 2015, the National Water Program **added features to the beta version of the Hydrologic and Water Quality System (HAWQS) model to enable users to estimate impacts of a changing climate on water resources.** HAWQS is a state-of-the-art total water quantity and quality modeling system with databases, interfaces and models. HAWQS is being developed to evaluate the environmental and economic implications of policy and management alternatives, pollution control scenarios, and climate change scenarios on the quantity and quality of water at a national scale. **New investments in 2015 resulted in improvements to the water temperature and oxygen modeling to make them more user friendly and the addition of the 9 CMIP3 climate emissions scenarios**. With this investment, a user will be able to change key variables or select one of the nine scenarios from a drop down list to model future climate in HAWQS.

- The Office of Water, in cooperation with the Office of Air and Radiation (OAR), **developed a series of upgrades to the wastewater and water elements of the Portfolio Manager** energy management system. These upgrades are designed to make the system more user friendly and encourage wider use of the system by water utilities.

Appendix B
Office of Research and Development (ORD)
2015 Climate Change and Water Accomplishments

Infrastructure and Water Resources Management

- ORD **completed a study of the feasibility of adopting net-zero strategies for water, energy, and waste at Fort Carson, Colorado.** A system dynamics model was developed to analyze data on the base's water, energy, and waste flows to identify connections, dependencies, and trade-offs. The study identified approaches for optimizing Net Zero strategies, and can be applied to other bases and civilian communities.

- ORD **published a report on the development of a digital aquifer permeability map for the Pacific Northwest as a component of research to assess the vulnerability of regional hydrologic landscapes and streamflow to climate change.** The map allows the identification of areas where shallow subsurface versus deep groundwater flows and the loss or gain of water through groundwater export or import may be important. This approach provides a consistent method for creating digital statewide representations of aquifer permeability across the United States which can be used in evaluating regional hydrologic vulnerability due to climate change.

- ORD partnered with USGS and the Army Corps of Engineers (USACE) to **draft a report that identifies potential climate change effects that could be critical to the future management of land and water resources within the Ohio River Basin** (ORB); specifically identifying water resources within the ORB at risk to climate change, such as 'nationally-significant ecosystems, significant wetland complexes, known threatened and endangered species locations, and other natural resources. USACE is in the process of redesigning this infrastructure and realizes most of the original drivers of original design criteria have changed and continue to change. Their goal is to use natural and traditional (gray) infrastructure to improve the sustainability of ORB to promote their mission of flood control, transportation and environmental protection.

Watersheds and Wetlands

- A research from a team of researchers at ORD, U.S. Fish and Wildlife Service (USFS), USGS, and several universities **assessed the impact of nitrogen deposition on plant biodiversity nationwide using field data from over 15,000 plots, and addressed how that impact is influenced by climatic and soil conditions.** Results suggest that herbaceous plant biodiversity declines at levels of nitrogen deposition common across the eastern U.S., and that this sensitivity is increased under more acidic soils, and certain climate conditions. A parallel effort on tree growth and mortality suggests that dozens of tree species are affected negatively by nitrogen deposition. Findings are being disseminated in a series of peer reviewed manuscripts, one of which was accepted by the Proceedings of the National Academy of Sciences.

- ORD scientists **used a dynamic model to study the interactive effects of climate change and nitrogen deposition on ecosystem and ecosystem services.** The research applied the model to simulate the interactive effects on forests understory biodiversity, soil nitrate leaching, and acid neutralizing capacity in the Northeast. The results found that nitrogen deposition has a much larger effect than climate change on most end points considered in this study, and that nitrogen deposition reductions projected by EPA halt further environmental damage, but do not induce a recovery.

- ORD scientists **conducted a review of the published literature on DNA barcoding/ metabarcoding (the use of DNA sequence data from a standardized locus to identify specimens to species) applied to bioassessment and discusses the future direction for DNA barcoding of individual specimens.** Although environmental bioassessments have been an integral tool for monitoring ecosystem condition and health, this tool faces increasing difficulties with issues such as urbanization, climate change, invasive species, eutrophication, and water use practices highlighting the need for more rapid and efficient bioassessment approaches. In the face of current and future challenges, methods like DNA barcoding have the potential to modernize bioassessment methods with decreased cost and effort, quicker results, and more in-depth descriptions of aquatic communities.

- In 2015, ORD and NOAA **released a draft report, for public comment and external review, summarizing the findings of a series of stormwater and climate change workshops held in the Great Lakes and Chesapeake Bay.** The report focuses on lessons learned about the impacts of climate and land-use change on water quality and precipitation-driven flooding, and the implications for stormwater management. The report explores stormwater adaptations, particularly green infrastructure or other low-impact development strategies; and identifies information gaps and other barriers preventing local-level consideration and implementation of these strategies along with some example solutions. The report will incorporate comments and will be published in final form in 2016.

- ORD **published a report that describes a method for developing indicators of the benefits of flood regulation services of freshwater wetlands** and presents a companion case study application to the Woonasquatucket River watershed in northern Rhode Island. The benefits indicators approach developed in this report attempts to provide decision makers with a more accessible alternative to monetary valuation, with an approach that explicitly links functions to benefits. We propose criteria to facilitate comparison of freshwater wetland restoration scenarios based not only on production of ecosystem services, but also on how those services reach and benefit people.

- ORD worked with the U.S. Department of Agriculture (USDA) and several universities to **develop a wetland nutrient model and risk-based watershed management tools.** The wetland nutrient model is a useful for gaining new insights on important biogeochemical and physical processes interactions, and can be used for the assessment of the efficacy of treatment wetlands and to inform management decisions. It can also be used as to predict time series of greenhouse gas emissions, such as methane and nitrogen. For risk-based watershed management, a stand-alone computer code with graphical user interface has

been developed and is being modified for the estimation of a composite measure of watershed health and associated uncertainty. Climate variability on risk-based indices were examined.

Coastal and Ocean Waters

- ORD and Region 2 partnered with the Partnership for the Delaware Estuary **to quantify the role that ribbed mussels play in promoting salt marsh accretion and nutrient removal**. A better understanding of the ecological importance of ribbed mussels to salt marsh health and climate resilience provides more support for efforts to preserve, restore, and adapt vitally important habitats. The Information can be used by managers and restoration practitioners who are focused on protecting water quality and coastal wetlands. Investments in marsh- and mussel-mediated ecosystem services could be justified by future savings in water quality treatment or flood protection for coastal communities. A report was submitted to the Region.

Water Quality

- A brief **summary of results from research grants examining the consequences of global change for water quality was completed**, including research on regional watershed modeling, water quality and nutrients, water supply for ecosystems, predictions in ungauged basins, and biogeochemistry. A bibliography of 45 research articles published by grantees was developed. Example of articles are "Climate change impacts on streamflow and subbasin-scale hydrology in the Upper Colorado River Basin," "Convergence of approaches toward reducing uncertainty in predictions in ungauged basins," and "Predicting thermal reference conditions in USA streams and rivers."

- ORD **is assessing the potential impacts of climate change on stormwater management practices including gray (wet ponds) and green infrastructure (green roofs, swales, bioretention) in different U.S. hydroclimatic and urban settings**. Computer simulations were conducted for 36 characteristic urban "archetypes" representing different development patterns and green infrastructure practices found in typical U.S. cities under a range of mid-21st century climate change scenarios. Results suggest that climate change could alter the performance of these practices for stormwater quantity and quality.

- ORD **published results from a study that examined how electric sector water use is changing as electricity generators change their strategies to meet greenhouse gas (GHG) reduction targets**. The study evaluated scenarios of electricity generation approaches for several levels of GHG reduction targets, which are projected to lead to greater use of renewable energy sources and more water-efficient thermoelectric generation technologies. These changes in electricity generation technology and the resulting change in water use suggest reduced electric sector vulnerability to droughts and heat waves.

- Several research **studies were completed in 2015 to gain a more complete understanding of the associations between extreme weather events and health endpoints using existing health and weather databases.** ORD reported results from studies examining the associations between flooding and emergency room visits for gastrointestinal illness

(including areas with and without combined sewer systems) and evaluated the links between marine phytoplankton and illness among beachgoers. This work provides information that will help decision makers better understand how extreme weather events may lead to increased risk of illness.

- ORD completed a pilot effort to understand the information and approaches needed to incorporate **climate change information into Total Maximum Daily Loads (TMDL) development in the Pacific Northwest.** This project synthesizes, interprets and presents information in a way that informs and promotes capacity building in EPA Regions to incorporate climate change mitigation and adaption into their operating programs.

Appendix C
2015 Climate Change Accomplishments: EPA Regional Water Programs

Climate change accomplishments in 2015 related to water programs by EPA Regional Offices are described below. Accomplishments already noted in the Regional Highlights section of this report, or described in Vision Area 5: Working with Tribes, are not repeated here.

Region 1

- **Continue support for energy efficiency improvements at water utilities.** One drinking water facility has reached Zero Net Energy and **one** other facility is approaching it. **Two** wastewater facilities are near Zero Net Energy, and at least **ten** others are working on plans to reach this goal. Completion dates for proposed Zero Net Energy facilities are mostly unknown, while others have completion dates between 2017 and 2026.

- Worked with EPA Headquarters to **conduct Vulnerability Assessment Tool (VSAT) and Water Health and Economic Analysis Tool (WHEAT) 2-day training for over 50 water utility and association attendees** from the New England area**.**

- **Initiated three Small System Resilience Pilots.** The first two pilots in Hinsdale New Hampshire and Lawrence, Massachusetts are part of the region's Making a Visible Difference community work and were based on tools developed through the national pilot with the Berwick, Maine Water System. The third, Mattapoisett, Massachusetts, is a collaboration with ORD, utilizing Regional Applied Research Effort (RARE) and Regional Sustainable Environmental Science (RESE) funding, to assess drinking water infrastructure vulnerable to flooding.

- Worked with the New England Interstate Water Pollution Control Commission **to develop climate preparedness guidance** for water and wastewater facilities with a focus on preparing for extreme weather events.

- Coordinated with state Emergency Management Assistance Compacts and water sector contacts to discuss ways to **establish an inter-state water mutual aid program for New England**. This was a result of follow up from the New England Hurricane Summit held in 2013, which focused on key issues and lessons learned from Tropical Storm Irene and Hurricane Sandy.

- Completed the RARE (Regional Applied Research Effort) project to **refine the Watershed Management and Optimization Support Tool (WMOST V2) to consider how to meet high and low flows** in the Monponsett Pond watershed in Halifax, Massachusetts using green infrastructure and other water management techniques in the most cost effective manner.

A final report titled: "Watershed Management Optimization Support Tool (WMOST) v2: User Manual and Case Studies" was completed by our EPA ORD partner.

- Worked with Colchester, Vermont and the State of Vermont to discuss the connections between green infrastructure, stormwater and **flood resilience as it relates to FEMA's community rating system.**

- Promoted integration of Clean Water Act/Safe Drinking Water Act (CWA/SDWA) and understanding of climate change impacts through a **regional pilot to map impaired waters against drinking water sources in New Hampshire** and coordination with other water programs (e.g. 319/Nonpoint Source).

- Established a **climate working group with U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the USACE to identify actions that integrate climate change considerations into CWA Section 404** and Section 10 permits. The workgroup is developing information materials for permit applicants and project managers.

- Awarded **priority points in the Wetland Program Development Grants Competition for projects targeting climate change adaptation.** Climate change adaptation is a central focus of several grants awarded in September 2015:

    - Massachusetts - developing a program to monitor and assess long-term impacts of climate change on tidal marshes;
    - Massachusetts Protection - creating maps and policies for coastal resilience;
    - New Hampshire - assisting municipalities in identifying and prioritizing areas that are vulnerable to threats from climate change; and
    - Rhode Island - strengthening wetland monitoring and assessment to support wetland protection and restoration in changing climate conditions.

- Continued to **work with the Maine Department of Conservation's Natural Areas Program to start identifying sites with high resilience to climate change** for targeted protection efforts, based on the results of the "Conservation Planning for Tidal Marsh Migration Due to Sea Level Rise" project. The goal of this project is to minimize net loss of tidal marsh habitat and its incumbent functions and values by identifying and initiating conservation planning for landscapes that will be needed to accommodate marsh migration.

- Continued to work with State of Massachusetts to address the threats of sea level rise to coastal wetlands, including generating site-specific information and **maps to identify vulnerability, risk, and impacts to coastal wetlands under scenarios of sea level rise.**

- As federal co-chair for the Northeast Regional Ocean Council (NROC) in 2015, and co-chair of NROC's Ocean and Coastal Ecosystem Health Committee, EPA Region 1 continued to **participate in a wide range of interagency efforts to collect and disseminate data** on ocean

uses and natural resources that will support climate change vulnerability assessments and adaptation planning (see www.northeastoceandata.org).

- Worked with NROC partners to complete a **marsh migration guidance entitled, "Make Way for Marshes" for coastal managers** based on analysis of various models and a highly successful workshop in December 2014.

- Continued to co-chair steering committee that led a joint effort by NROC and the Northeastern Regional Association of Coastal and Ocean Observing Systems to develop and release a draft **Integrated Sentinel Monitoring Network for Change in Northeastern Marine and Estuarine Ecosystems** Science and Implementation Plan. The plan will be finalized in 2016 and used to help secure additional funding to develop a regional strategy and establish a sentinel monitoring network.

- Worked with the Department of Homeland Security (DHS) on their **Casco Bay Maine Climate Change Adaptation Project as part of their Regional Resiliency Assessment Program** that is focusing on critical infrastructure, including energy, wastewater and drinking water, transportation and telecommunication.

- Worked with EPA ORD and the Buzzards Bay National Estuary Program to **initiate RARE (Regional Applied Research Effort) and RESES (Regional Sustainable Environmental Science) climate change projects for the Mattapoisett Water System** and other watershed communities in Massachusetts.

- Worked with the six New England National Estuary Programs and the EPA Climate Ready Estuaries program to scope out **a joint project to initiate vulnerability assessments for their respective Comprehensive Conservation and Management Plans under a single contract**, as required by new national program guidance.

- The Long Island Sound Study incorporated **actions to address climate change in their newly released revised Comprehensive Conservation Management Plan** (CCMP).

- The Buzzards Bay National Estuary Program worked with state and local partners to **implement its recently completed vulnerability assessment of water infrastructure and environmental justice communities in the New Bedford Harbor** area funded under the Climate Ready Estuaries program.

- Continued to participate on the **Northeast Coastal Acidification Network (NECAN) Steering Committee to help coordinate research and management of coastal acidification issues**, including two publications summarizing findings of the April 2014 "State of the Science" workshop; a series of stakeholder engagement workshops; and working with partners to establish a new ocean acidification monitoring station in Casco Bay.

Region 2

- EPA Region 2 hosted two **CREAT Workshops** in West Babylon, New York and Edison, New Jersey in 2015 which included presentations on climate change and the Storm Surge and Hurricane Strike Frequency Map.

- EPA Region 2 and EPA's Climate Ready Water Utilities **program provided technical assistance to the Passaic Valley Sewerage Commission and United Water Haworth to develop a CREAT project** using webinars, work product review, and in-person workshops.

- **Regional Applied Research Effort** funds were used to support a project entitled the **Evaluation of Renewable Water Treatment and Monitoring Technologies to Support Communities in Puerto Rico with the Operation of Non-PRASA (Puerto Rico Aqueduct and Sewerage Authority) Drinking Water Systems**. This research demonstration project will study the efficacy of sustainable solar powered water delivery and monitoring systems, reduce the economic burden of operating and maintaining Non-PRASA drinking water systems and reduce fossil fuel emissions in Puerto Rico.

- An EPA Sustainable Communities Building Blocks technical assistance **workshop on the subject of Flood Resilience for Riverine and Coastal Communities** was held in New Paltz, New York in September, 2015. EPA is helping the community adapt to climate change and plan for disaster resilience by auditing local plans, policies, and development regulations.

- Region 2 awarded $1.5 million in FY 2015-2016 **Wetland Program Development Grants** which included grants given to:

    - The Meadowlands Environmental Research Institute (of the New Jersey Sports and Exposition Authority) **to examine greenhouse gas exchange and carbon sequestration potential throughout the Meadowlands** to inform wetland preservation and mitigation decisions.
    - The **New York City Department of Parks and Recreation to develop core indicators of wetland vulnerability to storm water disturbance** and prepare preliminary guidelines for storm water management to better protect downstream wetlands.

- The New Jersey Department of Environmental Protection announced the award in November, 2015 of $1.75 million of **Clean Water Act Section 319 funds for projects to improve water quality by using green infrastructure techniques.** Funding was provided to:

    - **Rutgers Cooperative Extension Water Resources Program** to reduce stormwater runoff and the frequency of combined sewer overflow (CSO) discharges in the City of Paterson using green infrastructure.

- **Rutgers Cooperative Extension Water Resources Program** to implement **water quality improvement projects** to address flooding and **phosphorus levels in the Raritan River Watershed** which will use **green infrastructure techniques**.
- **Camden County Municipal Utilities Authority** to **install green infrastructure in Gateway Park**, a 25-acre stretch of mostly grass parkland.

- Region 2 has **issued a series of Administrative Orders which encourage green infrastructure**. For example, the Buffalo Sewer Authority developed their Long Term Control Plan and included significant green infrastructure component as a result of the administrative orders which required them to use green infrastructure whenever feasible to reduce combined sewer overflow (CSO) volumes.

- EPA Region 2 convened the 3rd annual Principals Meeting of the **Caribbean Coral Reef Partnership**. The group discussed the priority watersheds, the proposed marina at Coral Bay, Trash Free Waters, and ocean acidification.

- **Organizations and municipalities that joined the EPA's WaterSense promotional partnership** family in 2015 included the Stony Brook-Millstone Watershed Association, Camden, New Jersey, Sustainable New Jersey, Orange County Water Authority (New York), Rockland County (New York) Water Management Task Force, the Town of Southampton, New York, the Hudson River Watershed Alliance, the New York Water Environment Association, and the New Jersey Water Association. In addition, EPA staff conducted outreach at events and provided technical information and conducted trainings with local municipalities.

- **New York City worked with WaterSense** on several areas of coordination, including incorporating WaterSense into their strategy for climate resiliency and low income housing.

- The **Puerto Rico Tourism Company (PRTC) joined the WaterSense program as a promotional partner.** PRTC is the government-owned corporation in charge of tourism in Puerto Rico. As the agency in charge of educating hotels on how to save water, PRTC is working with the hotels and the Region 2 liaison is assisting by coordinating the national WaterSense 2015 H2Otel Challenge initiative.

- The **Partnership for the Delaware Estuary** (PDE) held its annual **Climate Change Outreach Roundtable** in July, 2015. Topics covered included environmental justice and climate change and PDE's Weathering Change program.

- The Partnership for the Delaware Estuary (PDE) and the New York-New Jersey Harbor & Estuary Program (HEP) began the **revision of their Comprehensive Conservation and Management Plans (CCMP)**. Both programs received **Climate Ready Estuaries (CRE) Vulnerability Assessment Funding** in 2015 to conduct the climate change vulnerability assessment of CCMP goals as they proceed through the revision process.

- With FY 2015 Climate Ready Estuaries funding, **the Partnership for the Delaware Estuary held its Living Shoreline Marine Contractor Training** in June 2015. A subsequent living shoreline site visit was held in July, 2015.

- **The online edition of the scientific journal Ecological Indicators made an article by members of Long Island Sound Study's Sentinel Monitoring for Climate Change program** in 2015. The article describes a novel approach for strategic planning that combines available regional-scale predictions and climate drivers (top down) with local monitoring information (bottom up) to identify candidate sentinels of climate change.

- In November, 2015, a Steering Committee comprised by officials of EPA Region 2 and other federal and state agencies held the **Second Climate Change in the Caribbean 2015: Puerto Rico and U.S. Virgin Islands Conference**.

- The 2015 New York Clean Water State Revolving Fund **(CWSRF) Workshop** was held in October, 2015 at the Environmental Facilities Corporation offices in Albany, New York, and included **content on extreme weather and climate change implications relevant to both the drinking water and clean water programs**.

- EPA Region 2 has been involved in **Superstorm Sandy recovery** efforts by working with Coordination Teams:

    - The **New York-New Jersey Federal Leadership Resiliency Collaborative** holds meetings that covers topics including how federal agencies can coordinate better with the states to help municipalities make appropriate decisions in the face of storms.
    - The **Coastal Hudson County Technical Coordination Team** (TCT) has provided input on the criteria that New Jersey will use to evaluate project concepts for the Rebuild By Design (RBD) Hudson River Project in Hoboken, Weehawken, and Jersey City.
    - The **New York City TCT** is working on the East Side Coastal Resilience Project.
    - **The Water Supply TCT** activities included holding a meeting at the New Jersey American Raritan Millstone Water Treatment Plant in Bridgewater, New Jersey to discuss FEMA flood mapping and flood risk management and New Jersey American's flood wall elevation project funded through the New Jersey SRF.

- EPA Region 2 placed **greater focus on enforcement and inspections of facilities in flood-prone areas** by targeting industries in FEMA 100 year flood zones. A map developed using EPA's GeoPlatform and ECHO (Enforcement and Compliance History Online) and state databases was used by inspectors to identify facility locations in relation to flood zones.

- EPA Region 2 and State and local agencies collaborated in the **Long Island Smart Growth Resiliency Partnership to guide post-Hurricane Sandy redevelopment and recovery on Long Island**. Their efforts focused on three areas:

- **Health Impact Assessments** (HIA) uses scientific data, health expertise and public input to help guide local governments to avoid and resolve impacts on public health that result from their decision-making and actions taken. The Partnership is supporting the State's efforts to develop implementation recommendations for the New York Community Risk and Resiliency Act and implementing a pilot HIA in Suffolk County that is evaluating proposed code changes for onsite sewage disposal systems.
- **Ecosystem Services Valuation** will specifically key on Long Island eco-systems to help guide decisions on infrastructure projects. This project is looking at key communities in both Nassau and Suffolk Counties and is focusing on New York Rising Community Reconstruction Plan projects.
- **Integration of FEMA HAZUS data, EPA Environmental Justice Indicators, NOAA Sea Level Rise Data, and Local Land Use data into GIS a scenario planning tool** to give communities a better understanding of their risks and opportunities when making recovery and future land use decisions.

- The Region worked with the EPA Office of Research and Development to advance a study of im**pacts of climate change and wastewater discharges on human health and environmental endpoints**, in the San Juan Bay Estuary in Puerto Rico. The research will characterize the co-occurring impacts of climate change and wastewater discharges on the sustainable delivery of ecosystem services and health of communities.

Region 3

- In 2015, Region 3 funded $97.5 million in **energy efficiency projects under the Clean Water State Revolving Loan Fund (SRF) Green Project Reserve**. The Drinking Water SRF funded 12 projects focused on water efficiency, audits, metering, reuse, and/or leak detection. Examples of SRF-funded projects include:

  - A CWSRF-funded **wind turbine project at the Crisfield, Maryland wastewater treatment plant** is expected to save the plant $200,000 each year in energy costs and will **reduce greenhouse gas emissions by an estimated 765 metric tons per year**. Construction continued on this project throughout 2015.
  - Energy efficiency improvements at the **Harrisonburg Rockingham Regional Sewer Authority.** In February 2015, **Virginia closed a $4 million CWSRF loan** for improvements to aeration, mixing, and anaerobic digestion systems, and more, which will offset additional energy usage from the Authority's 2010 enhanced nutrient removal project.

  The Region's water sector energy team held 10 wastewater operator training events and provided technical assistance to utilities in Delaware, Maryland, and Pennsylvania. In total, full implementation of EPA's technical assistance will result in savings of an estimated 1,506 tons of CO_2 emissions annually.

- Through emails to the 40 largest water systems in the region and via presentations to state drinking water programs and the water industry, Region 3 continues to **provide outreach on tools available through the Climate Ready Water Utilities initiative**. A training session was held at the Water Works Operators Association of Pennsylvania's annual conference on the Flood Resiliency Guide and Tabletop exercise tools for 25 utility managers and operators.

    - The Region worked with EPA Headquarters to **conduct Vulnerability Assessment Tool (VSAT) and Water Health and Economic Analysis Tool (WHEAT) 2-day training for 30 water utility and association attendees** from the Reading, Pennsylvania area**. Reading is one of Region 3's Making a Visible Difference Communities.**

- Region 3 encouraged **States to consider climate change, resiliency, and sustainability projects in their SRF funding decisions**, resulting in 40 CWSRF projects and 20 DWSRF projects that funded green infrastructure, energy efficiency, water efficiency, and innovative green projects.

- Region 3 participated in 20 activities which **promoted the WaterSense program,** including: a Fix-a-Leak Week event with a local Home Depot, a WaterSense partner, that was covered by a local network news station; teaching an Earth Day water conservation class with the Region's Green Schools team; and contributing to EPA's Healthy Waters in the Mid-Atlantic blog.

- Regions 2 and 3 have **continued to support the Partnership for the Delaware Estuary** (PDE) including the following climate related activities:

    - PDE has continued to promote living shorelines, enabling installation of 350 feet of living shorelines to build climate resilience;
    - PDE continued to hold Climate Outreach Roundtable meetings which foster collaboration and aid in resource sharing, providing a sounding board for new climate change outreach initiatives and efforts in the estuary watershed;
    - PDE capitalized on the initial Weathering Change outreach effort by fostering engagement with communities in resilience planning efforts.

- The benefits of the Watershed Resources Registry (WRR) are being recognized around Region 3 and across the country. The WRR helps **preserve wetlands, which are under threat from climate-related changes, for their floodwater storage, storm buffering abilities, carbon sequestration, and other ecosystem services.** More than 14 states outside of Region 3 have expressed interest in this tool and a national WRR webinar was held in December 2015. The Maryland State Highway Administration and the Maryland Department of the Environment are using the WRR. The tool is also used in targeting mitigation sites for Clean Water Act Section 404 wetlands-related projects.

- The Maryland Coastal Bays Program is part of the Climate Ready Estuaries Program and **updated its CCMP to incorporate climate change actions**.

- Region 3 continues to assist the Chesapeake Bay Program Office (CBPO) develop and implement a workplan that will assist Goal Implementation Teams (GITs) **integrate climate considerations into Chesapeake Bay restoration.** During 2015, Region 3 assisted CBPO in development of a Climate Resiliency Workplan.

- In June 2015, EPA and the Chesapeake Bay Trust, in partnership with Maryland's Department of Natural Resources, the Region announced $727,500 in **grants to be awarded to 15 organizations through the Green Streets, Green Towns, Green Jobs Grant Initiative (G3).** This program encourages local jurisdictions to use "green" techniques that help communities adapt to the challenges of climate change.

- The Region's drinking water program communicated energy efficiency priorities to the States, encouraged consideration of adding related components to their workplans. The **connection between climate change and water system resiliency was also a featured topic at this year's national Capacity Development/Operator Certification biannual workshop** for the States and Regions.

- Region 3 provided **leadership among federal agencies on climate change adaptation**. In 2015, the Region:

    - became the lead for EPA on the Mid-Atlantic Regional Planning Body (RPB) that is working on the Regional Ocean Action Plan to set forth clear goals and objectives associated with sound decision making regarding ocean planning, including response to the impacts of climate change;
    - convened four conference calls were held with 13 federal agencies that comprise the Mid-Atlantic Federal Climate Partners;
    - collaborated with the General Services Administration to draft frameworks to implement Executive Order 13693, Planning for Federal Sustainability in the Next Decade, that addresses climate adaptation, water efficiency, and drought.

- Region 3 developed a plan to support post-disaster community recovery in support of the **National Disaster Recovery Framework emphasizing climate adaptation, environmental restoration and sustainability as integral parts of community recovery**. Region 3 also worked with the Federal Emergency Management Agency (FEMA) to establish an EPA-staffed Sustainability Advisor position to serve on FEMA's Recovery Coordination Team to help local, state, and federal agencies incorporate sustainability and climate change adaptation into recovery efforts.

- Region 3, working with EPA ORD, has developed a **partnership with communities on the Delmarva Peninsula to move the Sustainability Triple Value System** (3VS) Project forward on the peninsula. The 3VS process aims to capture decision options, potential benefits, and trade-offs associated with various sustainability strategies on the Delmarva Peninsula especially in light of climate and land-use change.

- Region 3 scientists are working with EPA ORD to **assess implications of climate change on wetland ecosystems.** The Wetland and Climate Change Vulnerability Assessment Project has completed a phase 1 report, detailing hydrologic modeling concepts for detecting water budget changes in wetlands and watersheds. A second phase of the project will specifically work with CWA 404 or healthy watershed programs to evaluate methods in pilot watersheds in Region 3 that would help practitioners and mangers take into account climate change considerations in state and regional programs.

Region 4

- Region 4 is working with the National Rural Water Association state organizations in Georgia, Tennessee, Alabama to build their capacity to **provide wastewater treatment plan (WWTP) energy/nutrient optimization support to their stakeholders.**

- Region 4 is supporting the State of Kentucky in **development of an optimization program for WWTPs for energy and nutrient management.**

- The City of Dania Beach, Florida has problems with infiltration and inflow in the waste water system during seasonal storms, along with city-wide street flooding expected to grow worse as a result of climate change. In order to mitigate the negative impacts of storm water runoff, the construction and maintenance of a city-wide drainage system is necessary for Dania Beach. **The Clean Water State Revolving Fund in Florida provided an $8,150,490 loan to Dania Beach.** The project includes rehabilitation of the existing storm water system including the replacement of existing pump stations along with three needed new pump stations. System facilities include instillation of porous pavement, infiltration basins and trenches, bioretention and sand/organic filters.

- All of the Region 4 National Estuary Programs have participated in the Climate Ready Estuary Program. Region 4 NEPs are continuing to develop projects for consideration for available Climate Ready Estuary program funding. For example:

    - The Mobile Bay NEP is completing a **watershed management plan for the 3 Mile Creek area that incorporates consideration of sea level rise and storm surge related to climate change.**

    - The Charlotte Harbor NEP has completed vulnerability assessments for their study area and in support of local authorities. **The Charlotte Harbor NEP has added an element to their CCMP addressing climate change.**

- Region 4 is working with six Urban Waters Small Grants grantees, two green infrastructure technical assistance communities, and many environmental justice communities to **increase the use of green infrastructure principles and construct green infrastructure assets.**

Region 5

- Region 5 continues to **promote implementation of green infrastructure and asset management** through a variety of means. By engaging with several communities Region 5 promoted the use of green infrastructure on vacant parcels. Several Consent Decrees were modified to require green infrastructure among strategies to control or mitigate combined sewer overflows. Additionally, a green infrastructure/climate charrette was held in Grand Rapids, Michigan in partnership with the Office of Wastewater Management.

- **Region 5 is also working with state partners to encourage the inclusion of asset management and green infrastructure requirements in permits.** Notably, the Michigan Department of Environmental Quality is incorporating asset management into all major NPDES permits. Asset management is an NPDES permit requirement for Tribal wastewater dischargers.

- During 2015, a Region 5 project explored the integration of climate resiliency and asset management. **The project, "Integrating Climate Resiliency into Comprehensive Asset Management with the Menominee Tribe of Wisconsin," applied two EPA Tools - CREAT and CUPSS - at a small tribal wastewater utility**. CUPSS provides an asset management framework for the facility and CREAT helps forecast effects of climate change in the locale. The project demonstrated that by integrating a more robust approach to long term facility planning can be developed.

- Region 5 collaborated with outside agencies and associations to **inform water and wastewater utilities about energy efficiency and renewable energy (EERE) practices.** Presentations at the Illinois Water Environment Association and Indiana State Bar Association described EPA informational tools, and highlighted the central importance of energy efficiency in the public water sector. Planning assistance to the Northern Illinois Mayors Caucus helped develop carry out a unique forum on solar energy at wastewater treatment plants.

- Region 5 leadership in the Ohio Water & Energy Pilot **leveraged resources for contracted energy audits at five wastewater utilities in Ohio.** Additionally, Region 5 worked with the Indiana Industrial Assessment Center to identify Indiana wastewater treatment facilities interested in energy assessments.

Region 6

- The Housing and Urban Development **Resiliency Competition announced a grant awarded to the City of New Orleans of $141 million** for a variety of activities that include coastal restoration and supporting the Gently Neighborhood in planning, development and implementation of a more resilient community. Region 6, through the Urban Waters Federal Partnership, will support the local co-leads (City of New Orleans and Sewage and

Water Board) in planning for up-coming community meetings/workshops as needed. EPA will support any project work that can incorporate Green Infrastructure into new revitalization or redevelopment scoped in storm water management.

- Region 6 sponsored a **CREAT (Climate Resilience Evaluating and Assessment Tool) workshop** in the Pueblo of Santa Ana in June 2015. Also, in depth training and technical assistance on the use of CREAT was provided to the Cities of Austin and Houston, Texas.

- Region 6 developed and maintains a **website to inform the public on drought issues**: http://www.epa.gov/natural-disasters/drought. The website provides general information on drought, how to prepare for a drought, what to do during a drought, and ways to conserve water.

- EPA Region 6 organized and **facilitated one webinar and one energy management workshop** with 35 participants representing 8 water and wastewater utilities in Dallas and Fort Worth, Texas. These discussions highlighted the energy management practices at the Tarrant Regional Water District. An energy assessment, in partnership with the Texas Manufacturing Assistance Center at The University of Texas at Arlington, was conducted at the Lakeview Regional Water Reclamation Plant.

- EPA Region 6 **supported the Central New Mexico Climate Change Scenario Planning Project** (CCSP), a Department of Transportation - and Federal Highway Administration - led federal, state, and local agency initiative geared to integrate an analysis of strategies to reduce greenhouse gas (GHG) emissions and improve resilience to climate change impacts. The project report is available at: http://www.fhwa.dot.gov/environment/climate_change/adaptation/publications_and_tools/scenario/fhwa1510.pdf

- Region 6 supported the Coastal Bend Bays and Estuaries Program in their collaboration with The Nature Conservancy and the Mission-Aransas National Estuarine Research Reserve to **expand a long-term relative sea level rise monitoring and analysis program**. In this phase of the work, the focus is on assessing the vulnerability and resilience of the environmental, cultural, economic and human health sectors of the Texas Coastal Bend.

- Region 6 staff participated on the **Program Planning Committee for the 2016 State of the (Louisiana) Coast Conference,** which is expected to include an emphasis on the science of coastal climate change, sea level rise modeling and monitoring, blue carbon, enhancing resilient coastal natural areas, and building resilient coastal communities.

- The Regional Administrator participated in a ribbon cutting ceremony on September 14, 2015, in Little Rock, **celebrating completion of green infrastructure projects in Little Rock, Arkansas as part of the Greening America's Capitals program**. This is a federal program that helps state capitals develop and implement innovative green building and green

infrastructure strategies. The City of Little Rock was selected in 2010 as one of the first five state capitals to receive financial assistance. EPA committed $1.2 million to implement the plan's low impact development streetscapes with $900,000 of Clean Water Act and Brownfields funds. The Arkansas Natural Resources Commission worked with the City of Little Rock to demonstrate the benefits of rain gardens, curb extensions, pervious paving, infiltration trenches, bioswales, tree meanders, and other water filtrations through the use of clean water initiatives.

Region 7

- Through Region 7 funding, the Wichita State University Environmental Finance Center (EFC) provided **three one day training sessions to 27 attendees on energy efficiency at water and wastewater utilities**. The EFC also performed energy assessments at nine small to mid-sized drinking water and wastewater treatment plants.

- A Net Zero project in Region 7 is geared toward helping the military installation or community become more sustainable and resilient with an emphasis on taking a systems approach. **One of these projects is focused on green infrastructure demonstration and education in Fort Riley, Kansas**. For more information, see https://www.epa.gov/water-research/net-zero-projects.

- Region 7 had **three communities pilot the Climate Resiliency Evaluation and Awareness Tool (CREAT)** through a Headquarters contract. Blair Nebraska, Fredericktown, Missouri and Hillsboro, Kansas learned the level of risk and options to reduce that risk for their respective drinking water utilities. Additionally, Region 7 participated in the CREAT training in Des Moines, Iowa where 20 utilities from three Region 7 States in the Region attended. The Fredericktown, Missouri community drinking water and wastewater utilities were featured in the following EPA video for how they are responding to extreme events and planning for their climate futures: https://youtu.be/acVgr7qdkMU.

- In April 2015, Region 7 partnered with Missouri to **host the Vulnerability Self-Assessment Tool (VSAT) and the Water Health and Economic Analysis Tool (WHEAT) training workshop** held at the Missouri Department of Natural Resources' regional office. Thirty-four participants from 25 water systems and two rural water associations participated.

- Region 7 worked with USACE, Section 404 programs to **incorporate climate change impacts in permits, compensation plans and draft EIS documents.** In Missouri, Region7 has included climate change implications and how to address climate change in National Environmental Policy Act (NEPA) documents for two proposed reservoir projects: Little Otter Creek Reservoir and East Locust Creek Reservoir. The Region also recommended alternatives be considered that do not cut off flood plain or upstream habitat from downstream habitat. This would include consideration of increased flows and decreased low flows due to increasingly varied climate precipitation patterns.

- The Region supported the Nebraska Game and Parks Commission in implementing a project called: "Potential of Restoration and Conservation Efforts to Ameliorate Greenhouse Gas Emissions in Nebraska Wetlands." The project, funded by an EPA wetland program grant, was designed to **understand how land use influences greenhouse gas fluxes in playa wetlands as well as gain a better understanding of how playa restoration practices such as sediment removal affect soil carbon and nitrogen concentrations and carbon sequestration services**. Paired with sediment removal within basins, playa watershed restoration can increase upland carbon storage by establishing permanent vegetation and concomitantly protecting wetland services from future degradation by preventing volume loss from watershed soil erosion.

- Region 7 is a core work group member of the water quality standards and climate change national workgroup. The EPA Office of water, Region 7, and Region 4 are **developing a Frequently Asked Questions Water Quality Standards document on the inclusion of climate change impacts in protecting designated uses and development of water quality criteria.**

- Region 7 worked with federal and state partners to **address Climate Change in the Public Water System Supervision (PWSS) program Capacity Development Program.** Quarterly Region 7 Asset Management calls included discussion about the risk of climate change and incorporating that into the asset management process. In addition, climate change and CREAT were discussed at the annual capacity development and operator certification meeting in the regional Office.

Region 8

- Region 8 hosted **an in-person training session on the recently updated Vulnerability Self-Assessment Tool** (VSAT) and Water Health and Economic Analysis Tool (WHEAT) in June 2015 in Helena, Montana.

- Region 8 **selected two communities to participate in a pilot project using EPA's Climate Resilience Evaluation and Awareness Tool (CREAT)** in 2016: 1) the Evergreen Metropolitan District/Bear Creek Watershed Association (Aurora, Colorado), and 2) the City of Fort Collins, Colorado. The communities will receive training and technical assistance in using the CREAT software that helps users identify assets, threats, and adaptation options to build climate resilience. Challenges to be addressed include drought, more intense and frequent storms, flooding, and water quality changes.

- Region 8 emphasized the importance of preservation and restoration of wetlands and riparian resources as a tool for responding to climate change by **focusing the Enhancing State and Tribal Program on pilot communities receptive to using the wetlands grants program to increase understanding of the value of the resource and its vulnerability to climate change impacts**. Specific projects included wetland monitoring and assessment for

Huerfano County, Colorado, the City and County of Denver, Colorado, and the development of a grant proposal with Lake County, Colorado.

- In 2014, Montana Department of Natural Resources and Conservation (DNRC) identified the Missouri Basin above the Fort Peck Reservoir as a demonstration project for the National Drought Resiliency Partnership**. In March 2015, DNRC and the federal partners hosted a drought planning workshop for the Big Sky Watershed Corps members to initiate their locally-led drought planning efforts.** In September, the federal, state and non-governmental organization (NGO) partners reconvened to finalize a project workplan and meet directly with the watershed groups working on the project. Moving into 2016, the project is poised to assist local groups with developing drought plans; facilitating communication regarding drought conditions; and implementing on-the-ground projects that build resiliency.

- Region 8 continued to participate in the **Geological Sequestration workgroup to develop guidances, share permitting experiences, resources, and technical information, to facilitate implementation of CO_2 geological sequestration final rules designed to protect drinking water resources,** while encouraging successful deployment of commercial scale sequestration projects. Region 8 worked with States (notably Montana, Wyoming and North Dakota) to help them obtain primacy for the Class VI UIC program, and issue permits for projects where state primacy had yet to be established.

- The State of Colorado released its Climate Action Plan in 2015, which contained several water quality related goals. **Region 8 initiated discussions with the Colorado Department of Public Health and the Environment to explore how climate change could be considered in future TMDLs and Nonpoint Source Management Plans.**

- All of the Region 8 States have experienced an increased frequency of large storm events exceeding the 100-year storm in the past five years. The Region **worked with federal facilities to ensure construction projects were designed to manage storm water through low-impact procedures and vegetation to reduce pollutant loading and flow-related impacts.** Increased use of technologies to treat stormwater on site and reduce directly connected impervious areas will lead to more resilient stormwater infrastructure that is better equipped to handle storms outside the historic rainfall norms.

- **Statewide design manuals for low-impact development were created for Montana and North Dakota** in 2015 as part of a partnership with EPA, municipal planners in the States, TetraTech, and the Urban Drainage and Flood Control District. These design standards create a level playing field for all developers in the two States to budget for, plan, execute, and maintain low impact development technologies state-wide.

- Region 8 **continued education and outreach on the use of green infrastructure and provided technical assistance** on a number of projects, including: the City of Pierre, South

Dakota Greening America's Capitals project, Fort Peck, Montana's Making a Visible Difference green infrastructure project, and a Valley City, North Dakota green infrastructure project.

- Region 8 also **worked to integrate green infrastructure into the work of the regional office,** including the following efforts: developed a stormwater design criteria manuals for North Dakota and Montana, completed a stream restoration design for an affordable transit-oriented development (funded with Brownfields revitalization funding), and held discussions with Region 8's State Revolving Fund Program on how to use green infrastructure in their work.

- Region 8 **worked with other federal agencies to leverage collective knowledge about climate adaptation planning and initiate on-the-ground projects**. This included participating in the North Central Climate Science Center Stakeholder Advisory Committee, the Missouri River Basin Federal Climate Collaborative, a workshop conducted by the National Exercise Program focusing on climate change resilience in the State of Colorado, a pilot project under the National Drought Resilience Partnership (NDRP) to support long-term drought resilience in the Upper Missouri River Basin, and cooperation with FEMA to incorporate climate resilience into Colorado flood recovery efforts.

Region 9

- In February, 2015, the publication **"Food Waste to Energy"** was publicly released. This document was prepared by Region 9 and EPA ORD's National Risk Management Research Lab, and **documents how co-digestion at Wastewater Treatment Plants is increasing on-site renewable energy production to reduce greenhouse gas emissions**. In March, 2015, Region 9 organized two well-attended webinars to discuss the findings of this paper.

- Region 9 consulted with California legislative staff and representatives from California regulatory agencies on the development of new legislation, which was ultimately passed as SB 555, and signed into law after the 2015 legislative session. The new state law will **improve water loss control by requiring third party validation of audits, annual submission of updated audits, and the preparation of water loss performance metrics by 2020.** Between 200-300 billion gallons of drinking water are lost each in year from California's urban water distribution systems and reducing these losses should be viewed as a new water supply in the context of California's historic drought.

- Region 9 provided training to a range of relevant stakeholders on water loss control. This included **training for State Revolving Fund (SRF) program staff** from across Region 9 on the use of the American Water Works Association's (AWWA's) water audit software. Region 9 also collaborated with the California Department of Water Resources in the development and presentation in a series of water loss control workshops for urban water systems.

- In December, 2015, Region 9 participated in the National Drought Resiliency Partnership's **Drought Resiliency Recovery Workshops in Merced, California and Tulare, California**. These workshops focused on lessons learned for small to medium-sized utilities and involved representatives from the California State Water Board, FEMA, USDA, and the U.S. Bureau of Reclamation (USBR). The workshops incorporated an overview of the EPA's "Drought Response and Recovery Guide", which includes strategies used by the Tuolumne (CA) Utility District to reduce water use by 50%.

- Region 9 worked with the regional office of the U.S. Department of Housing and Urban Development (HUD) and the EPA's national WaterSense program to organize the 2015 **Water Wednesday webinar series**. These webinars aimed to help HUD project officers and grantees incorporate water efficiency into their programs and projects. The series provided information about tools and resources that can help housing managers save water, energy and money. Through November 2015, more than 1,100 had either attended the live webinars or viewed a recording.

- Region 9's promotion of the national **WaterSense program in 2015 included participation in over a dozen events and the recruitment of 31 additional partners.**

- The Region worked with StopWaste.org and the national WaterSense program to **add WaterSense certified products to the online bulk purchasing website, QuantityQuotes** (QQ). Since WaterSense products were added to the Quantity Quotes bulk purchasing platform, nearly 5,000 products have been requested. Using these new products, QQ shoppers will save over 15 million gallons of water annually.

- Region 9 initiated a partnership with the Pacific Islands Climate Change Cooperative (PICCC) and NOAA on the **Resilient Lands and Waters Initiative** (RLW) in Hawai'i. The project involves community members, private landowners, others in conserving and restoring key lands and waters and addressing multiple stressors on landscapes. At West Maui, Region 9 advanced the Corals and Climate Adaptation Planning Project which will provide a more in-depth review of watershed planning efforts from a climate change adaptation perspective.

- Region 9 **continued to work with the Coral Reef Task Force** and on coral reef protection in the Pacific Islands. Watershed protection projects and local coral management combine to reduce stressors and increase protection of coral reefs in the Pacific.

- With Office of Water contract support, Region 9 organized and participated in a September 24, 2015, **Green Infrastructure Climate Resiliency Charrette** with the City of Los Angeles. This involved a diverse range of local stakeholders focusing on how to use green infrastructure tools to address specific climate vulnerabilities (including water supply shortfalls, heat-island effects) in three different Los Angeles transportation corridors.

- In September, 2015, Region 9 awarded $1.7 million in San Francisco Bay Water Quality Improvement Funds for the **Urban Greening Bay Area** project to increase the use of green infrastructure to protect Bay water quality and promote climate resiliency. This grant will support GIS tools for green infrastructure planning and development of design standards.

- As a Making a Visible Difference community**, American Samoa identified climate change prevention and adaptation as top priorities**. In 2015, Region 9 helped initiate a **Sustainable Groundwater Plan** in conjunction with the American Samoa EPA and the University of Hawaii. The Plan will identify and prioritize sources of drinking water which are free of contaminants and upstream of climate change impacts. Potential climate change impacts on drinking water include salt water intrusion as a result of sea level rise, extreme weather, and groundwater depletion.

- EPA Region 9 co-sponsored and participated in the development of **the Southwest Climate Summit held in Sacramento, California in November, 2015.** Speakers and participants were representatives of Tribes, state agencies, federal agencies, universities, and others interested in using climate science for on-the-ground climate adaptation action.

- During 2015, Region 9 provided **training on drought resiliency** at two tribal conferences. These training sessions covered water loss control (including the American Water Works Association Water Audit Software), WaterSense program resources, and other tools.

- Region 9 provided **training on climate change issues for Region 9 staff**. In January and February, 2015, presentations were offered on how king tides illustrate future sea levels. The presentations included a field trip to the San Francisco Bay shoreline to experience the tide, first hand; as well as presentations from local government representatives. Region 9 also hosted a climate change speaker series for staff that included presentations on sustainable residential water use and the use of climate vulnerability assessments.

Region 10

- Region 10 **promoted the use of the CREAT tool to utilities across the Region**. Homer, Alaska and Sandpoint, Idaho participated in the national effort to assist water utilities to better understand the threats to their systems and what they can do to make their systems more resilient. The Region also sponsored a two-day workshop in June 2015 in Portland, Oregon for over 20 drinking water and wastewater utilities using the CREAT tool.

- Region 10 worked with **Habitat for Humanity to build 10 WaterSense and Built Green certified homes** and participated in several classes for real estate agents and appraisers on the regional Water Sense Program. The WaterSense program presented to the sustainability directors for the major hospitals/medical facilities in Puget Sound on the benefits of using WaterSense certified products and doing assessments to look at water use to find opportunities to be more efficient.

- Region 10 worked with EPA Headquarters, EPA Region 9, and the Department of Housing and Urban Development to **develop a series of webinars called "Water Wednesdays" which explains regional and national water use, what drought conditions mean for public housing, the WaterSense certification, and other resources to improve water efficiency.**

- The latest requests for proposals to support the **Puget Sound Partnership Action Agenda requested applicants discuss how they will prepare for the impacts of climate change on Puget Sound ecosystem** protection activities; and build ecosystem resiliency. Climate change is also included as one of the EPA evaluation criteria for each proposal.

- Region 10 is working on **two projects to examine how various regional land-based sources of carbon and nutrients, such as local air emissions, wastewater treatment plants, and nonpoint discharges exacerbate acidification** in the Salish Sea, including Puget Sound, and the relative contribution of these regional sources to acidification:

    - working with the Washington Department of Ecology to develop a model that will help identify when and where portions of the Salish Sea are most influenced by regional sources; and
    - working with the EPA Office of Research and Development to investigate the role of nutrients from fertilizer and wastewater sources in accelerating the resultant changes in carbonate chemistry parameters in a nearshore environment of Puget Sound.

- Region 10 **completed a report summarizing a workshop of federal, state, and tribal partners on observed and projected impacts of climate change on stream temperature in coldwater fisheries** in the Pacific Northwest and existing and future management and adaptation efforts. The key theme from the workshop is the need to develop a coordinated regional strategy for addressing increasing stream temperature across agencies.

- In order to help Alaska Native Villages, EPA in collaboration with the Institute for Tribal Environmental Professionals (ITEP) **hosted quarterly webinars that provided information to Alaska Native Villages on different issues related to climate change** and provides training on a variety of issues including developing climate adaptation plans.

- As part of the Administrator's Making a Visible Difference Initiative, EPA Region 10 worked with three Alaska Native communities to **identify projects to help make their drinking water and wastewater infrastructure more resilient from climate change.**

- Region 10 **initiated a Greener Grants Policy that builds on work already underway to incorporate sustainability and climate considerations into grants.** The purpose of the greener grant policy is to work with our partners to ensure they are considering sustainability and climate in their work including water related grants. The policy is phased in with the first year focusing on tribal grants and competitive grants.

- The Region **incorporated climate change as a regional priority for the Wetland Program Development Grants Competition.** Points were given to grantees for incorporating climate change into their proposals. Three grants were awarded that addressed climate change adaptation.

- Region 10 **served on the steering committees for the USFWS North Pacific Landscape Conservation Cooperative and the USGS Pacific Northwest Climate Science Center**. Also, staff participated in the Great Northern Landscape Conservation Cooperative and the four Cooperative and Science Center in Alaska. Chair a Regional-Federal Interagency Climate Change Collaboration workgroup that meets monthly to share information and increase collaboration across agencies.

- Region 10 staff **participated on the Arctic Executive Steering Committees Coastal Erosion Workgroup** and worked with several other federal agencies to develop a resources guide for Alaska Native Villages on funding sources to increase resilience of their water infrastructure to climate change impacts.

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