

U.S. EPA and Environmental Council of the States

Partners for Meeting State Research Needs

The U.S. Environmental Protection Agency’s Office of Research and Development (EPA ORD) has partnered with the Environmental Council of the States (ECOS, the national association of state environmental agency leaders) and its research arm, the Environmental Research Institute of the States (ERIS), to ensure that its research is useful and practical for the states—and has positive impact.

Over the past five years, ERIS and EPA ORD have worked together through a series of meetings and surveys to align EPA ORD scientific and technical capabilities with state research priorities and needs. States identified needs and grouped them into broad topics such as air, energy, drinking water, water pollution and hazardous waste, which EPA ORD scientists then used to inform the design and delivery of their work. This was done so that the tools, methods and research results EPA ORD produces are immediately applicable to the states in meeting the environmental and related public health challenges they face.

The following are some highlights of how EPA resources have helped states meet their environmental challenges and responsibilities.

Partners: State of Connecticut; DC Department of Energy & Environment; Kansas Department of Health and Environment; Oklahoma Department of Environmental Quality; City of Philadelphia, PA

Challenge: Air quality monitoring for community awareness

Resource: Village Green Project



“The Village Green station is a helpful tool in educating the public, and particularly children, about the importance of air quality in our everyday lives,” said Oklahoma Department of Environmental Quality Executive Director Scott Thompson referring to the Village Green Project in Oklahoma City. *“We are thankful to be one of five cities across the country to have such an innovative tool.”*

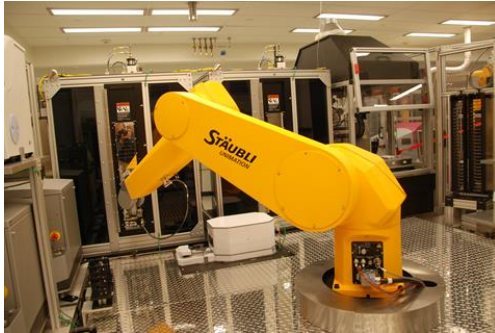
The Village Green Project (VGP) is a novel air and weather measurement station originally developed by EPA ORD scientists. The station is a compact, solar-powered system that incorporates air and weather instrumentation into a park bench. The project builds upon the need to enhance transparency and showcases next-generation air measurement technology by providing quality-assured data to the public on a near real-time basis, updating to a public data website every minute.

The original prototype was field-tested outside a public library in Durham, NC. Following the successful prototype test, EPA created a pilot VGP expansion and engaged with state, local and tribal agencies in placing new park bench stations in various community environments. Currently, five new stations are operating in a variety of environments selected by the agency grant recipients, including high foot traffic tourist areas, a community identified as a “making a visible difference” priority area, and a city center garden. The state and local agencies have used the stations as an opportunity to host public outreach events, including ribbon-cutting ceremonies and informational sessions.

Partners: California Department of Toxic Substances Control; California Office of Environmental Health Hazard Assessment; EPA Region 9; EPA Office of Chemical Safety and Pollution Prevention

Challenge: Evaluating chemicals for health effects

Resource: New technologies, models, tools, data and other chemical information



“California benefits significantly from our partnership with EPA ORD. We use ToxCast data to provide valuable insight into how chemicals may cause toxicity, we use their lifecycle analytic and exposure modeling and monitoring for various state efforts including our work on safer consumer products. EPA ORD resources are helping us to make more informed decisions about the potential health effects of chemicals,” said CalEPA Secretary Matthew Rodriguez.

California's Department of Toxic Substances Control and Office of Environmental Health Hazard Assessment are collaborating with EPA ORD on the following projects: 1) using EPA ORD's new technologies and computational modeling approaches to evaluate the potential health effects of chemicals; 2) improving and using EPA ORD science for evaluating the risk of chemical exposure to threatened and endangered species; and 3) a collaboration which includes EPA Region 9 and EPA Office of Chemical Safety and Pollution Prevention to advance sustainable chemistry practices and activities.

EPA researchers have provided California staff training on the use and interpretation of the high-throughput chemical testing data contained in the iCSS ToxCast dashboard (<http://actor.epa.gov/dashboard/>); planned and participated in a workshop to discuss an endangered species case study in the Sacramento River Basin; and shared database architecture to help the state develop chemical information databases. This collaboration is helping California use scientific advances to make more informed decisions about the potential health effects of chemicals as well as determine safer, more sustainable uses of chemicals found in products consumers buy and use.

Partners: California Energy Commission

Challenge: Population and land use projections to the year 2100 consistent with emissions storylines

Resource: Integrated Climate and Land Use Scenarios (ICLUS) version 2



“It is extraordinarily beneficial to climate planning in California to be able to rely on tools, like ICLUS v2, to provide a federally-vetted baseline for coordinated climate assessment research,” said JR De la Rosa, Special Assistant for Climate Change, California Natural Resources Agency.

EPA researchers developed national population, land use and impervious surface projections that the state of California used in its Third Climate Change Assessment. For the upcoming Fourth Assessment, the state will use EPA's updated climate model, the Integrated Climate and Land Use Scenarios (ICLUS) version 2 (v2), as a basis for land use scenarios in California, with minor modifications as necessary. These scenarios will be used across multi-disciplinary and multi-sectoral research that informs the Fourth Assessment.

ICLUS v2 uses the latest census, land use and land cover datasets to model population growth, residential housing changes, and commercial and industrial development nationally to the year 2100. Projections use information on fertility, mortality and international immigration rates, that are consistent with global storylines (e.g., Shared

Socioeconomic Pathways) used in climate change impacts, vulnerability and adaptation assessments. In addition, ICLUS v2 projections use information on domestic migration, including how future climate may make certain places more desirable. Combined with expanded land use classifications and allocations, the updates represented in ICLUS v2 will help the state of California better assess potential future impacts from climate change and prepare adaptation and mitigation responses.

Partner: Hawaii Department of Land and Natural Resources

Challenge: Restore and enhance the health and resiliency of West Maui coral reefs

Resource: Corals and Climate Adaptation Planning (CCAP) Adaptation Design Tool



“Participating in the development of the CCAP adaptive design tool has given the West Maui watershed planning team an opportunity to engage in in-depth conversations with experts from around the world about how climate change is likely to impact coral reef health and the connecting watersheds. Once the tool is finished, we anticipate incorporating the framework into our decision making to arrive at the most resilient set of watershed management strategies that are relevant into an uncertain future,” said Tova Callender, Watershed Coordinator, Hawaii Department of Land and Natural Resources.

The West Maui Ridge to Reef (R2R) initiative, founded by Hawaii’s Department of Land and Natural Resources, addresses adverse impacts to coral reefs in West Maui. It takes a comprehensive, watershed-based approach to reducing land-based sources of pollution as a critical step toward restoring and building the resiliency of coral reef ecosystems. However, climate change is complicating that effort. Increasing temperatures and ocean acidification directly impact the health of coral reefs, and changing precipitation patterns are altering the frequency and load of nutrient pollution reaching coastal waters through runoff. Managers need tools that incorporate climate change information and scenarios.

EPA ORD has been working with the R2R Initiative on ‘climate-smart’ management planning through the Corals & Climate Adaptation Planning (CCAP) project. The CCAP project is a cooperative effort of the Climate Change Working Group of the Interagency U.S. Coral Reef Task Force, co-chaired by EPA and NOAA. The overall goal is to support the creation of effective, place-based adaptation actions using recent adaptation planning principles and frameworks, tailored specifically for coral reefs. To achieve this, the CCAP and R2R teams collaborated through workshops, webinars and expert consultations to develop, beta-test and refine the CCAP Adaptation Design Tool. The tool guides users through two activities to: 1) systematically analyze a series of ‘design considerations’ for adjusting existing management actions to be more ‘climate-smart’; and 2) brainstorm and tailor additional adaptation actions based on general strategies compiled from the literature. Together these activities aim to make the components of an existing plan ‘climate-smart’ while also expanding the actions under consideration.

Partner: Interstate Technology and Regulatory Council

Challenge: Need for specialized risk assessment training

Resource: Training module, “Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment”



“The experience and knowledge of EPA scientists were essential to the success of this important training used by state risk assessors and others to address complex challenges at contaminated sites,” said Claudio Sorrentino, California Department of Toxic Substances Control (State Co-Chair).

“The Interstate Technology and Regulatory Council risk training is more robust as a result of our partnership with EPA experts on this effort,” added John McVey, South Dakota Department of Environment & Natural Resources (State Co-Chair).

EPA ORD partnered with the Interstate Technology and Regulatory Council (ITRC), a program of the Environmental Research Institute of the States, to develop specialized training for state risk assessors responsible for the cleanup of chemicals released into the environment. Based on feedback from EPA’s Risk Assessment and Training Experience (RATE) program, EPA ORD scientists reached out to ITRC and proposed that ITRC create training modules on the harmonization of risk assessment approaches across state regulators. EPA experts provided materials developed for its RATE program for the ITRC effort. These materials provide up-to-date and comprehensive training for human health risk assessment, ranging from beginner to expert classes.

The ITRC team of approximately 75 representatives from various environmental sectors completed a comprehensive web-based training module entitled, “Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment.” EPA scientists provided expert technical support as needed along the development processes and extensive peer reviews of the final product before release. Currently, all interested risk assessors in the United States and around the globe have free access to this important training material via <http://www.itrcweb.org/risk-3/>. To date, more than 1,500 people have taken the online course, and the associated guidance document is available to download.

Partner: Kansas Department of Health and Environment

Challenge: Understanding trade-offs associated with prairie rangeland burning

Resource: Multi-model framework and decision support tool in support of Kansas Flint Hills Smoke Management



“Kansas Department of Health and Environment is excited and optimistic about the potential uses of this multi-model framework, including predicted spatial and temporal patterns of surface fuel loads, live biomass (forage), and soil moisture information that can be used to supplement our existing Flint Hills Smoke Management Plan modeling tool,” said John Mitchell, Director, Division of Environment, Kansas Department of Health and Environment.

Flint Hills area of eastern Kansas and northern Oklahoma is home to the largest (12,000 square miles) remaining contiguous natural grassland prairie in the U.S. Throughout the region, land managers frequently use controlled burns to sustain the natural prairie ecosystem from the encroachment of eastern Red Cedar and other woody species, and to enhance the quantity and

quality of the grasses for cattle grazing. However, smoke from widespread early spring burning has exceeded air quality limits and impacted urban areas such as Kansas City, Topeka and Wichita.

To assist rangeland managers and local and state officials in better understanding the economic, ecological and human health trade-offs of rangeland burning in Flint Hills, EPA Region 7 and EPA ORD are collaborating with the Kansas Department of Health and Environment and Kansas State University (www.ksfire.org) to establish a user-friendly, multi-model framework for visualizing historical and hypothetical burning scenarios, including changes in the location, timing and frequency of rangeland burning practices. Tangible products of the research include computer-generated spatial and temporal maps of predicted changes in rangeland productivity and air quality. Stakeholders and decision makers can use these resources to identify best case scenarios for land management that strike a balance between the environmental, economic and human health objectives of rural and urban communities.

Partner: Minnesota Pollution Control Agency

Challenge: Delisting the St. Louis River Area of Concern

Resource: Development of monitoring and assessment tools



“EPA ORD’s Mid-Continent Ecology Division has been instrumental in providing data, analytical expertise and guidance to support the Minnesota Pollution Control Agency’s efforts to remove Beneficial Use Impairments (BUI’s) in the St. Louis River Area of Concern (AOC) in Duluth, MN and Superior, WI. This AOC is the largest and most complex of the 43 legacy pollution sites surrounding the Great Lakes in the U.S. and Canada. EPA’s work on aquatic macrophyte models, bio-accumulative compounds in fish tissue, benthic invertebrate communities and spatial data sets has accelerated the implementation of our plan to complete all project work in the AOC by 2020 so that BUI’s can be removed by the target date of 2025,” said Minnesota Pollution Control Agency Commissioner John Linc Stine.

The St. Louis River is listed as a Great Lakes Area of Concern (AOC) under the Great Lakes Water Quality Agreement of 1987 and is the only AOC in Minnesota. The AOC has several “Beneficial Use Impairments” including loss of fish and wildlife habitat, restrictions on fish and wildlife consumption, excess loadings of sediment and nutrients, and degradation of aquatic invertebrate communities (benthos).

The Minnesota Pollution Control Agency conveyed a need to identify improvements and advance progress toward removing use impairments and eventual AOC delisting. In response, EPA ecologists worked closely with state agency staff to develop analytical tools to assess conditions in the river. These tools included indices of community health for benthos, predictive models for floating and submerged aquatic vegetation, a probabilistic sample design approach for assessing water quality, and assessment approaches that associate specific remediation sites with contaminant-related effects in fish (tumors and deformities, contaminant biomagnification). The tools have been used for determining which areas of the St. Louis River require sediment remediation and habitat restoration, designing habitat restoration, and assessing progress toward delisting targets. These and additional tools now being developed will also be useful for post-restoration monitoring and future ecological assessments.

Partners: New York City Department of Health and Mental Hygiene; EPA Office of Emergency Management

Challenge: Increasing emergency response capabilities after a biological incident

Resource: Environmental Response and Remediation Plan for Biological Incidents



“Developing the New York City Department of Health and Mental Hygiene’s Environmental Response and Remediation Plan for Biological Incidents was a tremendous effort and collaboration between EPA, NYC DOHMH and Sandia National Lab, with support from the CDC Public Health Emergency Preparedness grant. Characterization, remediation and re-occupancy, following a wide-area biological incident, is challenging anywhere, but especially in a city as unique and complex as NYC. This is the first plan of its kind. Over 50 EPA subject matter experts from seven different EPA offices and three EPA Regions contributed to developing the Plan. The first version of the Plan was completed

in July 2015 and since then the EPA has continued to offer subject matter expertise and guidance to operationalize the Plan,” said Marisa Raphael, Deputy Commissioner of Emergency Preparedness and Response, New York City Department of Health and Mental Hygiene.

EPA scientists and engineers provided research and scientific expertise to assist the New York City (NYC) Department of Health and Mental Hygiene develop an "Environmental Response and Remediation Plan for Biological Incidents." EPA’s Office of Emergency Management led the development of the Plan, which addressed the release of a persistent biological agent, specifically “anthrax” spores. EPA ORD experts ensured that the Plan integrated the latest science and technology products and information, including the large portfolio of EPA research on biological agents. The Plan also addresses issues related to waste management, a key state responsibility.

In addition to improving NYC’s preparedness related to responding to a wide-area release of a biological agent, it also provides a response and remediation framework for other metropolitan areas across the country.

Partners: Ohio EPA; Association of State Drinking Water Administrators; EPA Office of Water; other contributors from states and universities

Challenge: Providing information, technical assistance and training to small drinking water systems

Resource: Webinars and workshops to address challenges and treatment solutions for small systems



“It’s very important that we provide small water systems with timely, easy to use and accessible tools and training to assist in operating these critical public water systems, and the webinars and one-on-one meetings are perfectly suited to meet this need,” said Ohio EPA Director Craig Butler.

EPA ORD and EPA Office of Water, in coordination with Ohio EPA and the Association of State Drinking Water Administrators (ASDWA), began hosting a monthly webinar series targeted for state agencies on challenges and treatment solutions for small water systems. Because they have fewer resources than larger systems, small systems face enormous challenges in consistently providing safe

and reliable drinking water. The series allows EPA to provide training and foster collaboration and dissemination of information, which, in turn, will help state agencies communicate the latest scientific advancements and current guidance to their small systems. It also serves as a forum for the invaluable flow of information, providing critical insight about the problems small water systems are currently encountering in their day-to-day interactions. With that increased awareness, EPA experts can then modify their research to offer real-world solutions. In 2015, the series attracted more

than 7,800 participants from all 50 states, including tribes and Island territories, and a host of foreign countries, and provided 3,300 continuing education credits (supported by Ohio EPA). EPA is continuing the webinar series in 2016 with the addition of external presenters from state drinking water agencies to help encourage communication among the states. For the webinar series schedule, registration and past recordings, visit EPA's website at epa.gov/water-research/small-systems-monthly-webinar-series.

In addition to the webinar series, EPA hosts an annual small drinking water systems workshop in collaboration with ASDWA. This free, face-to-face workshop offers in-depth training and information for handling small drinking water systems problems and compliance challenges. It is primarily designed for state personnel responsible for drinking water regulations compliance and treatment technologies permitting. The workshop typically attracts over 200 attendees from across the Nation. Registration for the workshop is usually open by late May and will be available on EPA's website at epa.gov/water-research.

Partners: Ohio EPA; EPA Office of Water; public water utilities along Lake Erie

Challenge: Managing algal toxins in drinking water treatment plants

Resource: Algal toxin and water quality studies at drinking water treatment plants using Lake Erie as their source



“Ohio and EPA ORD continue to lead the Nation in working with public water systems to ensure safe drinking water and minimize the threat of harmful algal blooms (HABs) and other emerging contaminants,” said Ohio EPA Director Craig Butler. “Research that EPA ORD is doing is providing Ohio with immediate and practical information as we implement first in the Nation rules on HABs, and we are grateful and fortunate and thankful for the collaboration on these important issues.”

Increasingly, drinking water treatment plants are challenged by changes in the quality of their source waters and by their aging treatment and distribution infrastructure. Individually or in combination, factors such as decreasing water and financial resources, climate change, agricultural runoff, harmful algal blooms and landscape development increase the probability that pesticides, pharmaceuticals, personal care products, endocrine disrupting compounds, algal toxins and other contaminants of emerging concern will remain after treatment, ending up in drinking water.

In cooperation with public water utilities along Lake Erie, EPA ORD is conducting studies to improve our understanding of the propagation of contaminants of emerging concern (particularly cyanotoxins) through the drinking water treatment process, and to identify the best approaches for removing them. The recent sampling campaign provided a unique opportunity to conduct an intensive, highly detailed analysis of the cyanobacterial bloom and its associated toxins in Lake Erie. That work allowed EPA researchers to provide utilities and regulators with technical and other recommendations to help them make better informed, long-term decisions regarding water treatment operations and modifications in the face of harmful algal blooms.

Partner: Oregon Department of Environmental Quality

Challenge: High and variable nitrate levels in drinking water wells

Resources: Development of Best Management Practices and Stable Isotopic Analysis



“EPA ORD scientists have made significant contributions to the monitoring program in the southern Willamette Valley Groundwater Management Area (GWMA). Their technical expertise has enhanced analyses of complex hydrological systems, as well as informed Oregon Department of Environmental Quality’s synthesis of multi-scale factors impacting nitrate concentrations in the southern Willamette Valley GWMA” said Oregon Department of Environmental Quality Acting Director Joni Hammond.

The state of Oregon has designated a Groundwater Management Area (GWMA) in the southern Willamette Valley of Oregon because of high nitrate levels in many domestic wells. EPA ORD scientists have partnered with EPA

Region 10, Oregon Department of Environmental Quality (DEQ), and other state and local groups to develop best management practices for agriculture within the area. The team has been working with local farmers to measure nitrate leaving their fields and to demonstrate how those levels change under different fertilization and crop management practices.

In addition, EPA ORD scientists have provided stable isotopic analyses to identify the causes of high temporal nutrient variability within local wells. These efforts have helped illuminate complex groundwater-surface water interactions, and greatly improved Oregon DEQ’s monitoring program for the GWMA. EPA ORD’s involvement has greatly improved efforts to both reduce potential new inputs of nitrate into the groundwater system, and to understand the complex dynamics of groundwater in general.

Partner: Washington Department of Fish and Wildlife

Challenge: Managing nutrients in riparian ecosystems for fish and wildlife benefits

Resource: Science Synthesis of Nutrient Processes in Riparian Ecosystems



“EPA’s willingness to co-author the nutrient chapter of Washington State’s Department of Fish and Wildlife’s riparian science synthesis document was critical to providing the best science to biologists, managers and policy makers throughout Washington. We viewed EPA as an essential partner that provided a very high level of expertise that WDFW simply did not have,” said Dr. Timothy Quinn, Washington Department of Fish and Wildlife Chief Scientist.

Riparian ecosystems and their streams are critically important locations for sustaining a healthy balance of nutrients—primarily carbon (C), nitrogen (N) and phosphorus (P)—across watersheds and far downstream. Vegetated riparian areas can be efficient natural filters—storing, removing and “fixing” potentially harmful excess nutrients that flow into aquatic ecosystems from uplands dominated by human activities such as agriculture and urbanization.

To assist Washington State’s Department of Fish and Wildlife, EPA scientists provided state-of-the-science information on nutrients and riparian ecosystems as a chapter in an upcoming guidance manual designed for states, tribes and commercial interests responsible for managing riparian zones. The chapter provides a basic understanding of nutrient (C, N and P) cycling in riparian zones, including stream channels and Pacific Northwest groundwater. It highlights the

well-studied effects of various land uses which suggest that hydrologic connection, vegetation type, soil condition and salmon use of streams are some of the key factors state officials need to consider for maintaining conditions needed for optimal nutrient transport.

Partners: Local and regional beach managers across the Great Lakes states and U.S.

Challenge: Predicting water quality at beaches

Resource: Virtual Beach software



“Virtual Beach is a very helpful tool for Wisconsin’s coastal communities: This reliable, predictive water quality model is key to protecting health and promoting recreational enjoyment of our beaches. The model provides same-day public notifications of beach conditions at a lower cost than traditional monitoring,” said Wisconsin Department of Natural Resources (DNR) Secretary Cathy Stepp. *“Communities that use Virtual Beach can dedicate more of their resources to locating and correcting sources of contamination and improving local beaches. The Wisconsin DNR’s partnership with EPA in the development of this practical scientific tool offers a great pay off.”*

To protect public health, beach managers need to continually assess the level of potentially harmful microbes (primarily bacteria) in the water. However, traditional, culture-based testing methods take a full 24 hours to get results—preventing same-day, proactive beach closures and leaving many recreational swimmers open to sickness or infection. EPA’s Virtual Beach (VB) tool offers a solution.

Virtual Beach is a Windows desktop-based software package designed by EPA researchers that provides rapid, real-time assessments of microbial water quality with model accuracy typically exceeding 80%. Beach managers use VB to develop site-specific statistical models for predicting fecal contamination based on readily-available data, such as wind direction/speed, rainfall and cloud cover as well as wave height, water turbidity and sunlight intensity. Once a model is developed for a site using historical data, environmental information can be collected at a site in the morning, and moments later the model can produce a prediction to guide decisions about closing the beach for the day or for issuing advisories.

VB is used to assist in advisory issuances in the Great Lakes states and to forecast water conditions in numerous locations in Wisconsin, Minnesota, Ohio, Illinois, Indiana, Pennsylvania, New York and Michigan. Outside of the Great Lakes region, VB has been used to develop predictive models for beaches around Boston Harbor, in Horry County, SC, and at sites in the Gulf of Mexico.

Partners: Alabama DEM; Connecticut DEEP; Delaware DNREC; Georgia DNR; Kentucky DEP; Maine DEP; Maryland DNR; Massachusetts DEP & DFG; New Hampshire DES; New Jersey DEP; New York DEC; North Carolina DENR; Pennsylvania DEP; Rhode Island DEM; South Carolina DHEC; Tennessee DEC; Vermont DEC; Virginia DEQ & DGIF; West Virginia DEP; Red Lake Nation DNR (tribal); Susquehanna River Basin Commission; Tennessee Valley Authority; USFS; USGS; EPA Regions 1, 2, 3, 4, 5 and 7

Challenge: Develop a baseline monitoring network to detect long-term trends

Resource: Technical support to states and tribes through workshops and stream monitoring network development



“As an interstate agency, the Susquehanna River Basin Commission certainly recognizes the value of the regional partnership EPA has assembled to address the need for collecting the data necessary for detecting changes to water quality and aquatic life communities over time, especially as it relates to any regional trends that may result from climate change effects. The establishment of an effective regional network is a bigger task than any single agency can undertake given the resources involved, and EPA’s staff provided the needed leadership to establish and guide the partnership, as well as the scientific expertise on the study methods for characterizing any future changing conditions,” said

Susquehanna River Basin Commission Executive Director Andrew Dehoff.

EPA is working with states, tribes, river basin commissions, its regional offices and other entities to establish Regional Monitoring Networks (RMNs) for freshwater wadeable streams. The objectives of the RMNs are to collect long-term biological, thermal, hydrologic, physical habitat and water chemistry data to document baseline conditions across sites and detect long-term changes. Consistent methods are being used to increase the comparability of data, minimize biases and variability, and ensure that the data meet data quality objectives. Continuous sensors are being employed when possible. RMN surveys build on existing state and tribal bioassessment efforts with annual sampling of a limited number of sites that can be pooled at a regional level. Pooling data enables more robust regional analyses and improves the ability to detect trends over shorter time periods. The collaborations across states, tribes and other entities resulted in the development of RMNs, some of which have collected data since 2012.

RMN data can be used for many purposes, over short and long-term timeframes. These applications include informing water quality and biological criteria development and protection planning priorities, refining lists of biological, thermal and hydrologic indicators, and detecting trends in commonly-used water quality and biological indicators. The RMN data are also important for detecting climate change effects in the context of biomonitoring. There are a number of climate change projections that are relevant to aquatic life condition, including increasing temperatures and changing frequency and magnitude of extreme precipitation events and frequency of summer low flow events. Managers can use the monitoring data to help inform adaptive management.

Partners: City of Baltimore, MD; Stafford County, VA; York, PA; NOAA and their partners

Challenge: Methods to address the effects of current and future changes in storm intensity, heavy precipitation events and more frequent and severe floods in stormwater management planning

Resource: Technical support to identify barriers and provide tools, data, methods and actions to facilitate planning for impacts of more frequent and severe storms and floods



“Virginia is experiencing an increase in storm intensity and flooding, especially in the eastern part of the state. Effective planning requires a clear understanding of the science. To that end, the help we are receiving from EPA scientists is critical to enabling us to come up with short and long range plans that will protect our lands and our waterways,” said Virginia Department of Environmental Quality Director David Paylor.

Changes in storms and heavy precipitation events, along with land use changes such as development, can significantly affect the volume of stormwater runoff that municipalities must manage to protect public health and water quality. Local decision makers have identified the need for information useful for planning and adapting local stormwater

management plans and controls to account for these changes.

To address this need EPA scientists, together with colleagues from the National Oceanic and Atmospheric Administration, held workshops and led other community-level efforts across states within the Chesapeake Bay and Great Lakes regions. The collaborations resulted in jointly derived insights into how scientific information on weather and climate can be most effectively produced to help communities increase the resiliency of stormwater systems in the face of current and future land use changes and more intense storms and floods. In particular, discussions focused on opportunities to implement green infrastructure, such as rain gardens that collect and absorb runoff from rooftops, sidewalks and streets, low-impact development and other alternative management strategies. A summary report is being finalized to inform states and communities on implementing stormwater management plans.

Partners: Pennsylvania State University; Lancaster County Clean Water Consortium; Lancaster County Conservancy; Susquehanna River Basin Commission; Alliance for Chesapeake Bay; Chesapeake Bay Foundation; Lebanon County Conservation District; Dauphin County Conservation District.

Challenge: Managing stormwater treatment systems to protect and to restore water quality in the Chesapeake Bay

Resource: Center for Green Infrastructure and Stormwater Management



“An ounce of stormwater pollution prevention is worth a pound of cure, particularly when it adds multiple benefits through green infrastructure and natural treatment systems,” said Maryland Department of the Environment Secretary Ben Grumbles. *“The Center helps Chesapeake Bay states and stakeholders find solutions to some of our most challenging water quality problems through science-based innovation and collaboration.”*

The EPA-supported Center for Green Infrastructure and Stormwater Management was established to conduct interdisciplinary research to understand and to influence how decisions are made at multiple spatial and jurisdictional scales to manage stormwater treatment systems to protect and to restore water quality in the Chesapeake Bay. By the time that indicators of impairment are measured within the

Chesapeake Bay, the opportunity for adaptive management to alleviate the degradation of water quality may have already passed. It is therefore imperative to identify headwater landscapes that are particularly vulnerable to stress from high pollutant loads, population growth and changes in land management.

The Center serves as a focal point to bring together stakeholders and researchers from multiple disciplines to improve stormwater management in urban and suburban settings; to reduce pollutant loads of nutrients, sediments, organics and metals; and to minimize stormwater volume and energy use across a range of storm event magnitudes. To accomplish these objectives, the Center identified the cognitive and institutional barriers preventing communities from adopting green infrastructure measures to manage stormwater. Additionally, the Center designed green infrastructure and developed methods to help stakeholders visualize alternative infrastructures. It modeled the environmental and financial benefits of these alternative infrastructures and served as a forum for stakeholder discussions.