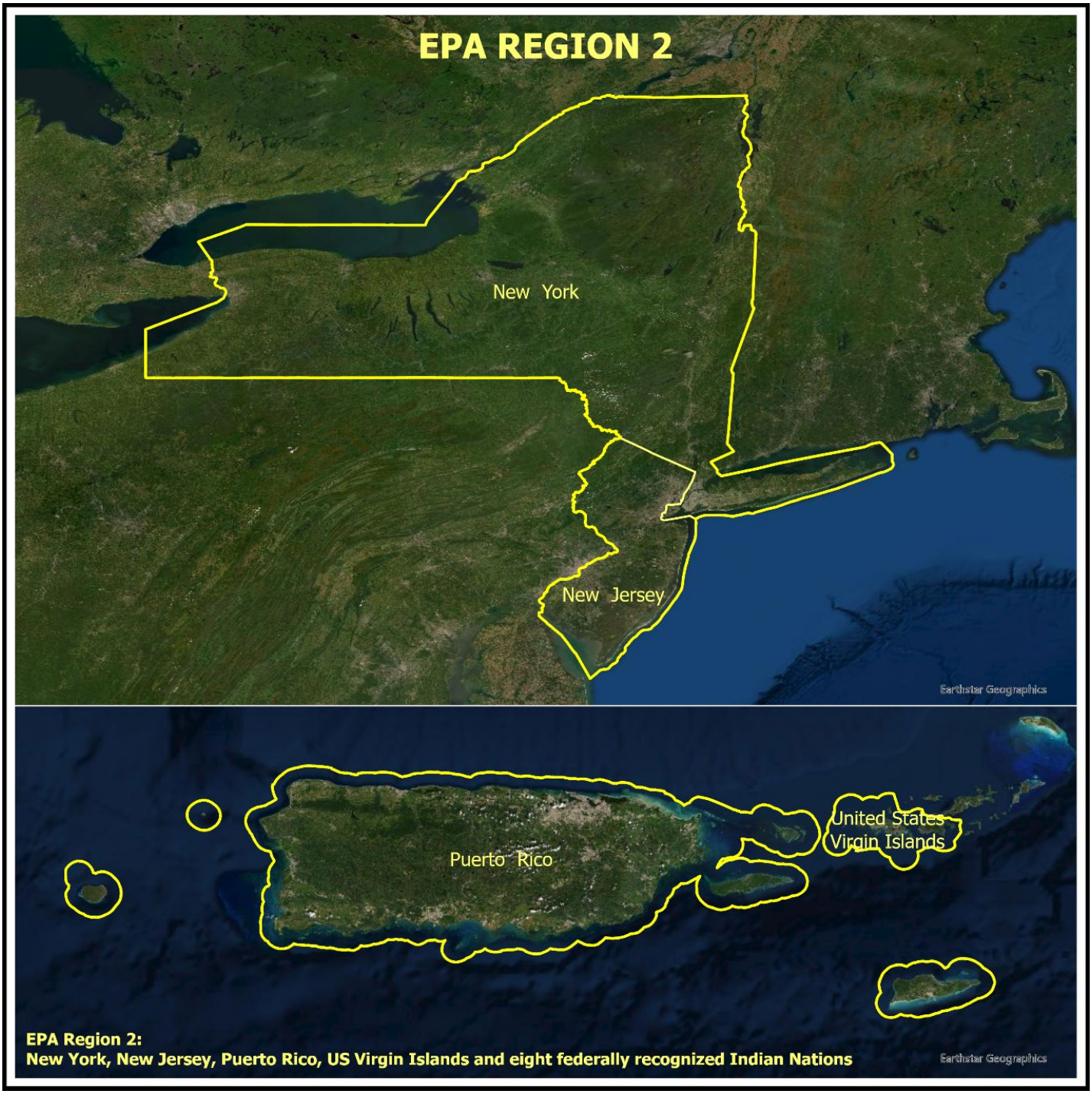
# Region 2 Climate Adaptation Implementation Plan Revised 2022

*Prepared by the U.S. EPA Region 2 – Climate Change Workgroup October 2022*



EPA Publication Number: 902B22001

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# Preface

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 1 2 2022

DEPUTY ADMINISTRATOR

Climate change is threatening communities across the nation. Millions of Americans feel the destructive effects of climate change each year when the power goes down, rivers and lakes go dry, homes are destroyed by wildfires and communities are flooded by hurricanes. Underserved communities are especially vulnerable to the climate crisis and are more likely to experience the negative health and environmental effects of extreme weather events.

The Biden-Harris Administration is actively confronting the climate crisis while also advancing environmental justice. As part of a whole-of-government approach, the U.S. Environmental Protection Agency is strongly committed to taking the actions necessary to protect human health and the environment and to increase the resilience of the entire nation, even as the climate changes.

The EPA's commitment to action is reflected in its FY 2022-2024 Strategic Plan and in the 2021 Climate Adaptation Action Plan. Both documents present priority actions the agency will take to ensure that its programs, policies and operations remain effective under future climate conditions while we work to support states, territories, tribes and communities in increasing their own adaptive capacity and resilience to climate change impacts.

From flooding at Superfund sites, to wildfires causing air pollution, to sea-level rise affecting water quality and infrastructure, the EPA will boldly address climate impacts in both its programs and the communities it serves. We recognize the importance of tribal, state and local government partnerships in efficient, effective and equitable implementation of climate change adaptation strategies. Our plans were informed and improved by input we received in listening sessions we held to engage these and other partners as we developed these plans.

To ensure we are addressing the climate crisis in a comprehensive way, each of our national program and regional offices has developed individual Climate Adaptation Implementation Plans that outline how the EPA will attain the agencywide goals described in the broader Climate Adaptation Action Plan. These plans describe how programs and regions will integrate climate adaptation into their programs, partnerships and operations. They also describe how they will help partners build their resilience and capacity to adapt, while delivering co-benefits, including curbing greenhouse-gas emissions and other pollution, and promoting

public health, economic growth and climate justice. Of course, the EPA has a major role to play on emissions reductions as well, though that is not the focus of these plans. Indeed, we must focus on both climate adaptation and mitigation to ensure our nation and communities thrive in an era of climate change.

As part of this effort, we will empower our staff and partners by increasing awareness of how climate change may affect our collective ability to implement effective and resilient programs. We will also provide them with the necessary training, tools, data, information and technical support to make informed decisions and integrate climate adaptation into our work.

The EPA will work to modernize its financial assistance programs to encourage climate-resilient investments across the nation. We will also focus on ensuring that investments funded by the Bipartisan Infrastructure Law, the Inflation Reduction Act and other government programs are resilient to the impacts of climate change. Finally, as our knowledge advances and as impacts continue to develop, our response will likewise evolve. We will work to share these developments to enhance the collective resilience of our nation.

The actions outlined in these implementation plans reflect the EPA's commitment to build every community's capacity to anticipate, prepare for, adapt to and recover from the increasingly destructive impacts of climate change. Together with our partners, we will work to create a healthy and prosperous nation that is resilient to the ever-increasing impacts of climate change — which is vital to the EPA's goal of protecting human health and the environment and to ensuring the long-term success of our nation.

Janet G. McCabe

# 1. Overview

This document is a revision of the 2014 Climate Adaptation Implementation Plan issued by the U.S. Environmental Protection Agency, Region 2 Office (EPA Region 2). It consists of: (1) a list of EPA Region 2's adaptation staff; (2) a regional vulnerability assessment that builds on the vulnerability assessment contained in the 2014 Adaptation Implementation Plan and examines both general vulnerabilities of the Region and specific vulnerabilities of EPA Region 2's programs and authorities; (3) a set of new Regional priority actions that will help to reduce the impacts of climate change on EPA Region 2 programs and authorities; (4) an adaptation training plan for EPA Region 2; (5) science needs of the Region that, if met, would advance our adaptation work; and (6) a description of the outreach that EPA Region 2 conducted in development of this EPA Region 2 Climate Adaptation Implementation Plan ("Plan").

# 2. Senior Leadership and Staffing

EPA Region 2's leadership and staffing for climate change adaptation flows from the Region's Climate Change Workgroup structure, which consists of a senior leadership chair, Workgroup co-chairs, divisional representatives, and a senior management advisory council, as follows:

a. Senior Leadership Chair - Richard Ruvo, Director, Air and Radiation Division (ARD)
b. Workgroup Co-Chairs – Juan Gutierrez, ARD, and Joseph Siegel, (ORC)
c. Climate Change Workgroup Divisional Representatives: Gavin Lau (ARD), Alex Rivera (CEPD), Hector Velez (CEPD), Kathleen Malone-Bogusky (ECAD), Stephanie Lamster (LCRD), Dale Carpenter (LCRD), Lampros Bourodimos (LSASD), William Sy (LSASD), Kwong Cho (MSD), Joseph Siegel (ORC), Anhthu Hoang (ORC), Tasha Frazier (PAO), Mike Basile (PAO), Jessica Mollin (SEMD), Diane Salkie (SEMD), Anne Rosenblatt (SPO), Rabi Kieber (SPO), Grant Jonathan (SPO), Irene Purdy (WD), Atifa Hoque (WD)
d. Senior Management Advisory Council: Matthew Laurita (ARD), Carmen Guerrero (CEPD), Dore LaPosta (ECAD), Judy-Ann Mitchell (LCRD), Anahita Williamson (LSASD), Linda Timander (MSD), Paul Simon (ORC), Sabina Byck (PAO), Chloe Metz (SEMD), David Kluesner (SPO), Javier Laureano (WD)

We thank all the above for their role in producing this Plan. We are also grateful to our former Climate Change Workgroup members who contributed to this Plan: Nicole Tachiki, Janice Whitney, Esther Nelson, and Sofía Olivero-Lora.

**EPA Region 2 Divisions/Acronyms:**
ARD --Air and Radiation Division
CEPD – Caribbean Environmental Protection Division
ECAD – Enforcement & Compliance Assurance Division
LCRD – Land, Chemicals & Redevelopment Division
LSASD – Laboratory Services & Applied Science Division
MSD – Mission Support Division
ORC- Office of Regional Counsel
PAO – Public Affairs Office
SEMD – Superfund & Emergency Management Division
SPO – Strategic Program Office
WD – Water Division

# 3. Climate Vulnerability Assessment

## INTRODUCTION

Climate change, interacting with changes in land use and demographics, will affect important human facets in the United States, especially those related to human health, communities, and welfare. The challenges presented by population growth, an aging population, migration patterns, and urban and coastal development will be affected by changes in temperature, precipitation, and extreme climate-related events. According to the Intergovernmental Panel on Climate Change (IPCC), the global average temperature over the 21st century is expected to increase between 3.5 and 7°F. This large range is due to the uncertainties in both the future greenhouse gas (GHG) concentrations and the sensitivity of the climate system to GHG emissions. Average temperatures in the United States are expected to increase between 3°F and 12°F by the end of century, depending on whether the world follows a higher or lower future scenario, with proportionally greater increases in extreme temperature levels (Hayhoe, et al., 2018). Hurricane wind speeds, rainfall intensity, and storm surge levels are likely to increase. Other changes include measurable sea level rise and increases in the occurrence of coastal and riverine flooding (Frankson et al., 2022). Given the diverse geography covered by EPA Region 2 --which includes New York (NY), New Jersey (NJ), the U.S. Virgin Islands (USVI) and Puerto Rico (PR) and eight federally recognized Indian Nations-- and the varied environmental programs that EPA implements in this region, climate change presents a broad array of challenges to the achievement of our mission to protect human health and the environment. While challenges vary between the continental states (NY/NJ) and the tropical islands of PR and the USVI, there are common coastal concerns for the Region as a whole. There are also significant differences throughout the Region in terms of local capacity to address climate change impacts. Local responses are often affected by funding, technical resources, existing social inequities, authority, and competing priorities (Maxwell et al., 2018).

This regional vulnerability assessment builds on the vulnerability assessment contained in Region 2's 2014 Adaptation Implementation Plan and is divided into two sections: (1) Background on the changing climate within the geographic area covered by EPA Region 2 and the general vulnerabilities faced by people and ecosystems within the geographic area with a focus on vulnerable populations; and (2) The specific vulnerabilities faced by EPA Region 2 from the perspective of the programs and authorities we implement. Note that this vulnerability assessment is not intended to be an in-depth assessment of the specific vulnerabilities of each community in EPA Region 2 because its purpose is to examine the intersection of Region 2's programs and authorities and the broad Region we serve. However, it does contain elements specific to communities and individuals that are particularly vulnerable to climate change impacts; such as low-income communities, communities of color, children, the elderly, and Indian Nations. In some instances, this vulnerability assessment references strategies already underway to ameliorate specific vulnerabilities.

The information on climate change impacts is derived from authoritative sources and scientific literature, including major climate assessments produced by the U.S. Global Change Research Program (USGCRP), such as the Fourth U.S. National Climate Assessment (NCA4), and the Intergovernmental Panel on Climate Change. It includes broad trends and principles related to climate change vulnerability as well as Region-specific information. The program-specific section of the vulnerability assessment sets forth the Region's assessment of the risks that those climate change impacts pose to the programs that EPA Region 2 implements and to our facilities, assets, and day-to-day operations. This assessment of our programmatic risks and vulnerabilities should be viewed as a living document that will be updated as needed and when possible, to account for new knowledge, data, and scientific evidence. A glossary that includes some of the basic terms used in this vulnerability assessment can be found on the U.S. Global Change Research Program website at https://www.globalchange.gov/climate-change/glossary.

# CHANGING CLIMATE

## PRECIPITATION AND INLAND EFFECTS

Nearly all climate models predict changes in precipitation patterns. In New York and New Jersey, precipitation is expected to increase in intensity during rainfall events and areas will experience more intense heatwaves (Frankson et al., 2022; Runkle et al., 2022). Similarly, the Caribbean may see less frequent but heavier storm events with more severe drought periods (Gould et al., 2015). In New York City, it is projected that today's 50-year rainstorm will be the 5-year rainstorm of 2050. The City's stormwater systems were not built to withstand such events, and there is a need to find alternative ways of managing the larger volumes of rainwater that will occur more frequently (Watson et al., 2021). In the New York area, average precipitation is projected to increase up to 15% in southern New York and up to 20% in northern New York by 2050. Much of this increase is projected to fall in the winter months (Frankson et al., 2022), and more likely to fall as rain instead of snow. In upstate New York, the changing balance between rain and snow has already reduced snowpack and, in addition, many areas have experienced severe flooding from extreme rainfall events like Hurricane Irene. Warming temperatures have led to decreases in ice cover on lakes and rivers. In New Jersey, under a scenario of moderate emissions (RCP 4.5), projections suggest that the amount of precipitation associated with the 100-year, 24-hour storm will increase, on average, by 20-25% in northern New Jersey counties.

In the Great Lakes region, which includes the Eastern Basin of Lake Erie and the Lake Ontario basin in upstate NY, reduction in ice cover will lead to cold air moving over open water that would have otherwise been frozen. This will increase evaporation, leading to heavier and more frequent lake effect snow. Rising atmospheric temperatures will cause annual spring runoff due to snowmelt to occur up to two weeks earlier in the year. This change will decrease the amount of water that would normally reach the area later in the year and stress the ecosystems that depend on the water during the summer months (USGCRP, 2009). Studies also predict a decrease in the Great Lakes water levels due to increased evaporation and decreased runoff from snowmelt. This has implications for energy generation, drinking water intake, and downstream ecosystems (Rosenzweig et al., 2011). Rising air temperatures also increase water temperatures. In lakes and reservoirs, warmer surface water temperatures reduce the frequency of turnover with cooler bottom waters, which results in increased periods of stratification (USGCRP, 2009). Increased stratification isolates the warm layers of water. These warm layers have diminished capacity to retain dissolved oxygen (DO), which is critical to supporting life in aquatic ecosystems (Rosenzweig et al., 2011). While hypoxia in Lake Ontario and the Eastern Basin of Lake Erie is currently limited to a small number of local embayments, this could change with future effects of climate change, i.e., continued increases in air and surface water temperatures.

In contrast to increased evaporation and the potential for low water conditions, Lake Ontario is also the most downstream of the five Great Lakes and as such, precipitation falling across the entire Great Lakes Basin affects water levels in Lake Ontario and the St. Lawrence River. In years with above-average precipitation across the Great Lakes Basin, Lake Ontario is susceptible to high water and flooding. This was the case in 2017 and 2019 when record high water levels occurred in Lake Ontario (International Lake Ontario-St. Lawrence River Board, n.d.).

Climate change trends and models predict more extremes in precipitation levels across the Great Lakes Basin – higher highs and lower lows – as a result, Lake Ontario is likely to experience both high water and flooding events as well as low water effects along the shoreline. Overall, climate models predict more precipitation in the Great Lakes Basin (National Oceanic and Atmospheric Administration [NOAA], 2021).

Variability creates its own challenges and vulnerabilities making it more difficult to model and predict nutrient and other dynamics on a lake-wide basis. This in turn affects our ability to manage and protect lake-wide resources and ecosystem services from water quality and chemical contamination to shoreline habitats and species. Multiple uses of the Lake are affected by variability and vacillations between extremes (extreme high water and low water conditions) from serving as

a source of high-quality drinking water to serving as an important recreational fishery and a key driver for local lakeshore economies in New York State.

## HURRICANES

Hurricanes are a significant climate change-related vulnerability in EPA Region 2. Superstorm Sandy and Hurricane Irene had major consequences for New York and New Jersey in 2012 and 2011, respectively. Increased frequency and magnitude of hurricanes have been observed in the Caribbean. A total of twelve hurricanes and eight tropical storms hit the northern Caribbean between 2004 and 2007, including some of the most powerful storms on record (Burke et al., 2011). The 2017 Atlantic season alone had 17 named storms and 10 hurricanes (NOAA, 2017), including Hurricanes Irma and Maria, which caused catastrophic damage to Puerto Rico and the U.S. Virgin Islands. The destructive power of tropical storms and hurricanes in the Atlantic has notably increased and is associated with warmer sea surface. According to the Fourth National Climate Assessment, climate models project an increase in the frequency of strong hurricanes (Categories 4 and 5) in the Atlantic Basin, including the Caribbean (Gould et al., 2018). In a 2019 analysis, Hurricane Maria was noted to be the single largest rainfall event of the 129 storms since 1956, and similar storms are more likely to occur (Keellings & Hernández Ayala, 2019). Also based on an OIG report, EPA Region 2's Hurricanes Irma and Maria response efforts in Puerto Rico and U.S. Virgin Islands show the need for improved planning, communications, and assistance for small drinking water systems (OIG, 2020). In addition, sediment impacts on marine ecosystems due to stormwater runoff in Puerto Rico and the U.S. Virgin Islands are a concern that has been studied for some time (Castillo et al., 2012; Water Environment Federation Stormwater Report, 2021). Hurricane Maria not only caused runoff of sediments into the marine ecosystems but also destroyed roads and critical infrastructure through washouts and landslides. Moreover, the strong winds plunged vast swaths of the Islands into darkness by compromising the power grid and decimated residences, businesses, and the communication infrastructure. Other impacts from hurricanes in EPA Region 2 are discussed throughout this assessment.

## OTHER EXTREME EVENTS SUCH AS TORNADOES AND SEVERE THUNDERSTORM

New Jersey and New York have also experienced tornadoes, heavy rain, quarter-size hail, and powerful wind that battered parts of Long Island, New York City, and New Jersey in 2021. Observed and projected future increases in certain types of extreme weather, such as heavy rainfall and extreme heat, can be directly linked to a warmer world. Other types of extreme weather, such as tornadoes, hail, and thunderstorms, are also exhibiting changes that may be related to climate change, but scientific understanding is not yet detailed enough to confidently project the direction and magnitude of future change (Hayhoe et al., 2018). This potential increase of thunderstorms, lightning, heavy rain, hail, and tornadoes indicates that threats from climate change are clear and present in the Mid-Atlantic (Hill et al., 2020).

## SEA LEVEL RISE, WATER TEMPERATURE AND pH

Climate change also impacts our marine resources, estuaries, and coastal regions. Currently, sea levels are rising an average of 0.86 to 1.5 inches per decade, as measured by tide gauges, with an average of 1.2 inches per decade since 1900. Sea level at The Battery has been rising at a rate of 0.11 inches per year since 1850 (New York City Panel on Climate Change (NPCC, 2019). While global sea level is projected to rise one to four feet above 1880 levels by 2100, New York's sea level is expected to rise more than the global projection (Frankson et al., 2022). For the Long Island and New York City shorelines, New York has codified into law a rise of 8-21 inches by 2050 and as high as 58 inches by 2080 using the high-emissions scenario (6 NYCRR Part 490 (2017)). New Jersey will likely experience a 1.4 to 3.1-foot increase in sea level by 2070 under a moderate emissions scenario (Hill et al., 2020). The New York City Panel on Climate Change (NPCC, 2015) sea level rise projection provides the current scientific basis for NYC's scientific decision making and planning. Unfortunately, since the IPCC (2013) and NPCC (2015) reports, recent observations show increased glacier and ice sheet losses leading to rising sea levels. Recent modeling interactions between oceans, atmosphere, and ice sheets suggest a higher global mean sea level rise (GMSLR) by 2100 than previously estimated (NPCC, 2019) which will pose serious

adverse consequences to people and infrastructure in low-lying neighborhoods. Compared to 2000 levels, projections of PR's sea level rise in 2050 range from 0.8 feet, 1.2 feet, and 2.8 feet, respectively, under the Intermediate-Low, Intermediate, and Extreme scenarios and in 2100 range from 1.6 feet, 3.6 feet, and 10.2 feet, respectively (Gould et al., 2018). Consequences of this sea level rise in combination with storm surges and poor management of coast lines can be already observed in the form of increased coastal erosion and retreat of coastline in some parts of the Island. The projections of sea level rise throughout EPA Region 2 translate into untold damage in terms of the number of people impacted, property value at risk, and economic impact. For example, sea level rise under higher scenarios will likely increase property losses from hurricanes and other coastal storms for the Northeast region by $6–$9 billion per year by 2100 (Dupigny-Giroux, 2018 ).

Freshwaters and marine waters are all expected to see increases in water temperature with higher air temperatures. Some models predict an ocean temperature increase of 1.8 – 2.5°F for nearshore waters by 2050 (Rosenzweig et al., 2011). Higher ocean temperatures cause thermal expansion, which was responsible for 50% of sea level rise during 1971–2018 (IPCC, 2021).

When atmospheric carbon dioxide ($CO_2$) increases, more $CO_2$ is dissolved in the ocean, decreasing the pH of the water, and creating an acidic environment that dissolves the hard shells of corals, shellfish, and smaller organisms (Doney, 2006; Wood at al., 2008). This process, called ocean acidification, also decreases the availability of calcium carbonate ($CaCO_3$), a building block for the shells and exoskeletons of many marine organisms. Although dissolution of $CO_2$ in oceans is a natural process, the current rate of ocean $CO_2$ dissolution is unprecedented, with serious implications for the marine food chain and ocean ecosystems. In the Caribbean, the sea surface temperatures have risen over the last two decades by 0.43°F per decade and studies indicate that the warming trend should continue during the 21st century, with mass coral bleaching expected at least twice a year within the next decade (Dupigny-Giroux, 2018 ).

## HUMAN HEALTH

Climate-related changes in weather patterns and their associated impacts on air quality, water quality, and incidence of vector-borne diseases are affecting the health and well-being of those who live in EPA Region 2 in a number of ways (Dupigny-Giroux, 2018).

Climate change is beginning to accentuate the disparities already evident in the American health care system. Many of the expected health effects will fall disproportionately on the poor, the elderly, the very young, the disabled, and the uninsured (Ebi et al., 2018).

Urban areas are especially prone to increased morbidity and mortality among the elderly and small children due to heat waves and poor air quality from higher temperatures and dry conditions (Watson et al., 2021). High temperature days are associated with an increase in heat-related illness, including cardiovascular and respiratory complications, renal failure, electrolyte imbalance, kidney stones, negative impacts on fetal health, and preterm birth (Ebi et al., 2018). The Northeast region of the United States is projected to experience the largest increases in heat-related mortality, particularly among vulnerable populations, which include the elderly, young children, outdoor workers and people without air conditioning (Ebi et al., 2018). In addition to air pollution and heat-related impacts on health, extreme weather events increase the risk for injuries and loss of life during storm events where high winds and fast-moving flood waters are involved.

Moreover, flood waters can expose people to harmful environmental contaminants. This includes people who utilize onsite wastewater treatment systems or live near industrial sites or facilities that store or contain hazardous materials. For coastal and waterfront communities, heavy storms that cause storm surges overwhelm or damage wastewater and drinking water treatment systems with high water volumes of salt water. This can result in communities being inundated with sewage and industrial waste-contaminated waters which can cause gastrointestinal and respiratory illnesses. These

flooding events are likely to increase in frequency and magnitude with more frequent heavy rainfall events under climate change (Rosenzweig et al., 2011). Unfortunately, communities most impacted by this flooding risk are also those least able to relocate from flood-prone areas, and therefore are more likely to be impacted by weather events that could disrupt the drinking water and electrical supply as well as damage plumbing and electrical systems at homes and businesses. In PR and the USVI, the potential for adverse human health impacts and increased incidences of vector-borne diseases are anticipated (Centers for Disease Control [CDC], 2020, July). In addition, warmer winters are associated with higher rates of ice-related drownings in the colder portions of our Region (Sharma et al., 2020).

Climate change impacts can also have adverse mental health effects. In the Northeast, flooding from storm surge, sea level rise, and extreme precipitation events associated with climate change can lead to lasting mental health consequences including anxiety, depression, and post-traumatic stress disorder, which were observed following Superstorm Sandy (Dupigny-Giroux et al., 2018 ). Mental health impacts in the Caribbean are also notable, as many survivors of the 2017 hurricane season have experienced a high degree of psychological trauma (Gould et al., 2018). Extreme heat and climate-induced migration are other climate change-related sources of adverse mental health impacts (Dupigny-Giroux et al., 2018).

The National Research Council 2011 report, *Climate Change, the Indoor Environment, and Health,* addresses the impacts that climate change may have on the indoor air environment and the resulting health effects. Extensive research was conducted regarding how climate change affects the outdoor environment, how the outdoor environment affects indoor environments under different climate conditions, and how indoor environments affect occupant health. Results reveal that when there is increased outdoor concentrations of pollutants, the indoor air quality is also negatively impacted. For example, due to increased outdoor concentrations of pollutants caused by alterations in atmospheric chemistry or atmospheric circulation, indoor concentrations of pollutants can also become elevated. Other indoor health impacts can result from excessive moisture and mold, flooding, infectious agents and pests, and thermal stress (Institute of Medicine, 2011).

As most climate change hazards impact human health -- and EPA's programs and authorities are designed to address human health and the environment -- this document references health impacts throughout the remainder of this vulnerability assessment and in the section on priority actions. For a more complete description of the health impacts from climate change, see the U.S. Global Change Research Program's Fourth National Climate Assessment, Chapter 14 (Human Health), Chapter 18 (Northeast Region), and Chapter 20 (U.S. Caribbean) (Ebi et al., 2018; Dupigny-Giroux et al., 2018; & Gould et al., 2018).

## AQUATIC ECOSYSTEMS

Changes in climate have direct and indirect impacts on all aquatic ecosystems, significantly impacting biodiversity within freshwater, coastal and marine systems. As rivers and streams get warmer, warmwater fish are expanding their range to areas previously inhabited by cold water fish, while trout and salmon species are slowly losing their habitat (USGCRP, 2009). The capacity of wetlands ecosystems to absorb floodwaters is diminishing, while coral reefs can no longer protect coasts from storm surges. Warming waters encourage spread of pathogens, parasites and disease significantly impacting oyster, fish, and coral colonies (Cohen et al., 2018).

## VULNERABLE POPULATIONS

Although climate change will affect all residents of EPA Region 2, the risks associated with climate change are not experienced equally. The impacts of climate change on an individual depends on many factors including the degree of exposure, individual sensitivity to exposure, and the individual or community-level capacity to recover (Dupigny-Giroux et al., 2018). Due to the cumulation of many factors, low-income communities and communities of color, children and

older adults are often overburdened with poor environmental conditions and are likely to be disproportionately affected by the impacts of climate change. The disproportionate effect is often compounded in overburdened and underserved populations by a lack of resources and capacity to apply for, and implement, grants and other funding mechanisms. In addition, access to information about funding opportunities for adaptation can be challenging for some communities, particularly where English is not the primary language of the residents. This Plan prioritizes actions to address the disproportionate share of climate-related risks experienced by these communities.

One of the principles guiding EPA's efforts to integrate climate adaptation into its programs, policies, and rules calls for its adaptation plans to prioritize helping people, places and infrastructure that are most vulnerable to climate impacts, and to be designed and implemented with meaningful involvement from all parts of society. Administrator Regan noted that "(T)he impacts of climate change that we are feeling today, from extreme heat to flooding to severe storms, are expected to get worse, and people least able to prepare and cope are disproportionately exposed…." According to EPA's Climate Change and Social Vulnerability in the United States: A Focus on Six Impact Sectors (EPA, 2021, September) report:

- Black and African American individuals ages 65 and older have the most disproportionate risk with the highest projected increases in premature mortality from climate-driven changes in PM2.5
- Black and African American individuals are projected to face higher impacts of climate change for all six impacts analyzed (Air Quality & Health; Extreme Temperature & Health; Extreme Temperature & Labor; Coastal Flooding & Traffic; Coastal Flooding & Property; and inland Flooding & Property) in this report, compared to all other demographic groups. For example, under conservative estimates with 2°C (3.6°F) of global warming, Black and African American individuals are 34% more likely to currently live in areas with the highest projected increases in childhood asthma diagnoses. This rises to 41% at 4°C (7.2°F) of global warming. Additionally, these populations are 40% more likely to currently live in areas with the highest projected increases in extreme temperature related deaths. This rises to 59% under 4°C of global warming.
- Hispanics and Latinos have high participation in weather-exposed industries, such as construction and agriculture, which are especially vulnerable to the effects of extreme temperatures. With 2°C (3.6°F) of global warming, Hispanic and Latino individuals are 43% more likely to currently live in areas with the highest projected reductions in labor hours due to extreme temperatures. With regards to transportation, Hispanic and Latino individuals are about 50% more likely to currently live in areas with the highest estimated increases in traffic delays due to increases in coastal flooding.
- Low-income individuals are more likely to live in areas with; the highest increases in childhood asthma diagnoses from climate-driven changes in PM2.5; the highest percentage of land lost to inundation; the highest increases in mortality rates due to climate-driven changes in extreme temperatures; the highest rates of labor hour losses for weather-exposed workers due to extreme temperatures; and the highest increases in traffic delays associated with high-tide flooding.

As a note, most of the summary findings focus on national-level results for scenarios with 2°C of global warming (relative to the 1986-2005 average) or 50 cm of global sea level rise (relative to the year 2000).
Currently, wide disparities in the adaptive capacity exist among communities within EPA Region 2. Without addressing this and developing strong adaptation measures, climate-related social, economic, and health impacts will become more prevalent as the frequency and severity of extreme climate events such as heat waves, flooding, and severe storms increase. This is especially true in vulnerable communities that are least able to anticipate, cope with, and recover from the impacts. Inequity can compound the effects on vulnerable populations. For example, the NYC Health Department concluded that black New Yorkers are "more likely to die from heat stress, with death rates two times higher than among white New Yorkers, due to past and current structural racism that creates economic, health care, housing, energy, and other systems that benefit white people and disadvantage people of color." (New York City Department of Health and Mental Hygiene [NYCDOHM], 2022). Climate change impacts can also cause disruptions in the food supply throughout our Region with the potential to have disproportionate impacts on those who already experience food insecurity (Jay et al., 2018).

For the past decade, EPA Region 2 communities from the Caribbean to the Northeast have faced summers with increasing numbers of days over 32°C (90◦ F) (CDC, 2020, September). Low-income seniors are at highest risk for heat-related health impacts. From 2010 to 2019, heat stress deaths in New York City were highest among people aged 80 and older (NYCDOHM, 2021). When power producers attempt to meet the increased demand from these high heat days, they put the community at risk for power outages which creates additional hardships. Furthermore, climate change may exacerbate existing problems with aging infrastructure such as energy and transportation infrastructure, as well as waste and drinking water facilities which may potentially result in negative health consequences. As a note, most of our current infrastructure systems were not designed to withstand projected weather extremes and other impacts of climate change.

With sea level rise and the projected increase in the frequency and intensity of storms, overburdened and underserved communities in EPA Region 2 will experience a spectrum of health-related impacts from exposure to mold and mildew to trauma and to lack of clean drinking water immediately after a disaster. In areas where flooding occurs, damages electrical systems, and necessitates the use of residential generators, we expect to see increased health problems related to carbon monoxide poisoning as some residents do not know to ensure proper ventilation when operating generators. Flooding of industrial and environmental infrastructure presents unique challenges to the most vulnerable communities. For example, during and after Superstorm Sandy, the Shinnecock Nation, which is located in a lowland coastal area of the Long Island Sound, was faced with the loss of drinking water because floodwaters infiltrated their private drinking water wells. Similarly, the low-income community of the Ironbound section in Newark, New Jersey, was inundated with floodwaters that carried raw sewage and treatment chemicals from the nearby sewage treatment plant and industrial operations.

This Plan delineates priority actions to be taken to address a number of identified climate risks that are of particular relevance to vulnerable populations and communities. In addition to the priority actions in Section 3, below, that are specifically oriented to these communities, EPA Region 2 will consider vulnerable populations and communities when implementing the other priority actions and work in partnership with these communities to increase their adaptive capacity and resilience to climate change impacts. These efforts will be informed by the experiences EPA Region 2 had in supporting recovery efforts with previous extreme weather events (e.g., Superstorm Sandy and Hurricanes Irma and Maria) and the subsequent recovery efforts. Meaningful engagement also will help EPA to further understand the disproportionate vulnerabilities and cumulative impacts these communities face.

## *COMMUNITIES IN PUERTO RICO AND THE U.S. VIRGIN ISLANDS*

Many communities that are already overburdened on the islands of PR and the USVI are especially vulnerable to the impacts of climate change. Climate change impacts these coastal communities more broadly due to effects on infrastructure and mobility, and can compromise limited water resources, sensitive ecosystems, and overall resilience due to natural hazards and the location of large urban centers near the coastlines. While some actions have been recommended to address these impacts (for example, the Climate Change Council of Puerto Rico issued a report with 100 concrete actions aimed at working on climate change (Comité de Expertos y Asesores sobre Cambio Climático [CEACC], 2022), significant vulnerability remains since acceptance and implementation of these recommendations have been very limited.

Additionally, their limited congressional representation and select programmatic factors result in diminished resources for the territories (e.g. San Juan, Charlotte-Amalie) and isolation (Gould et al. 2018). The isolation and limited geography and economic scale of the Islands can also exacerbate impacts on the local economy, damage to crops, food and water insecurity and impacts on infrastructure (Gould et al., 2018). Droughts, which are one cause of food and water insecurity, are among the most frequent climate hazards in the Caribbean and have resulted in water rationing and agricultural losses. As discussed above, in the “Hurricane” subsection, Hurricanes Irma and Maria had catastrophic

impacts on Puerto Rico and the Virgin Islands. These storms caused the collapse of the region's main energy, water, transport, and communication infrastructure (Gould et al., 2018) which are already stressed by energy supply and other infrastructure challenges. The death toll in Puerto Rico grew significantly after the storm, in part, because of the lack of access to medical facilities and medical care. The storms also caused ecosystem impacts, for example, significant tree loss due to winds and other hazards. Moreover, a changing climate in the Caribbean will also affect plant phenology (timing of biological events) and wildlife dependent on fruiting and flowering (Gould et al., 2018).

Other threats from climate change to the Caribbean include the potential increase by 2100 in sea level of 1.6 feet, 3.6 feet, or 10.2 feet based, respectively, on the Intermediate-Low, Intermediate, and Extreme scenarios and an increase in the average annual air temperature ranging as high as approximately 9°F under a higher emissions scenario. In addition, a 10% decrease in precipitation by mid-century will be coupled with more intense rainfall events associated with tropical cyclones. In addition, the trend of increasing ocean temperature and acidity will continue (Gould et al., 2018). The impacts from these threats will cause a myriad of adverse effects to PR and the USVI including: increases in coastal inundation, storm surges, water pollution from coastal flooding and erosion, landslides, damage to vital infrastructure (e.g. solid waste infrastructure, water infrastructure, energy grid, hospitals, transportation, communications), settlements, and facilities that support the livelihood of near shore and low lying communities; compromised coastal water resources from land based sources impacting coral reefs; and changes in fisheries and other marine-based resources (Gould et al., 2015; CDC, 2020, July).

There are also economic consequences to the climate change impacts affecting the Caribbean. The coastal zone in Puerto Rico and the USVI are significant contributors to the local economy. Climate change-related impacts in the coastal zone can decrease tourism and have other negative effects on the livelihoods of coastal residents (Gould et al., 2018). In addition, rising temperatures are projected to drive up electricity demand and costs (Zamuda et al., 2018), which is of particular concern in PR and the USVI because they already have among the highest electricity rates in the Country. Higher rates could pose challenges for populations that are already economically vulnerable.

## *INDIAN NATIONS*

EPA Region 2 is home to eight Federally recognized Indian Nation communities, all located in NY State. EPA values its unique government-to-government relationship with Indian Nations in planning and decision making. EPA Region 2's government to government treaty-based relationship has been established over time and is further supported by the 1984 EPA Policy for the Administration of Environmental Programs on Indian Reservations and the 2011 Policy on Consultation and Coordination with Indian Nations. These policies recognize and support the sovereign decision-making authority of Indian Nation governments.

Under the Constitution, treaties with tribal and Indian Nations are part of the supreme law of the land, establishing unique sets of rights, benefits and conditions for the treaty-making tribes and Nations who were forced to cede millions of acres of their homelands to the United States, in return for recognition of property rights in land and resources as well as federal protections. Tribal/Indian Nation treaty rights have the same legal force and effect as federal statutes, and they should be integrated into and given the fullest consideration throughout EPA's collective work. Reserved rights are the rights tribes/Nations retain that were not expressly granted to the United States by tribes/Nations in treaties. Treaty and reserved rights, including but not limited to the rights to hunt, fish and gather, may be found both on and off-reservation lands. Agencies should consider treaty and reserved rights in developing and implementing climate adaption plans in order to protect these rights and ensure the Agencies meet their legal and statutory obligations and other mission priorities as we work to combat the climate crisis.

In September 2021, EPA joined 16 other federal agencies in signing a Memorandum of Understanding (MOU) (U.S. Department of the Interior, 2021) that committed those parties to identifying and protecting tribal/Indian Nation treaty rights early in the decision-making and regulatory processes. Accordingly, EPA will consider and protect treaty and

reserved rights in developing and implementing climate adaptation plans through strengthened consultation, additional staff training and annual reporting requirements.

Partnering with Indian Nations to develop adaptive capacity is a priority for the EPA. Nations are particularly vulnerable to the impacts of climate change due to the integral nature of the environment to their traditional lifeways and culture. The lands, waters, and natural resources of the Nations hold sacred cultural significance and are also vital in maintaining these communities' social, health and economic wellbeing. There is a strong need to develop adaptation strategies that promote sustainability and reduce the impact of climate change on Indian Nations.

EPA engaged with the Nations to listen to their concerns regarding the impacts that climate change is already having on their communities. Nations identified some of the most pressing issues as flooding and erosion, temperature change, drought, various changes in access to and quality of water and impacts to biodiversity. The Nations in EPA Region 2 are likely to be impacted by similar vulnerabilities discussed in other portions of this vulnerability assessment. In addition to those vulnerabilities mentioned throughout, Nations in EPA Region 2 have indicated, as discussed below, that there are ecological as well as cultural activities that are vulnerable to the effects of climate change, directly affecting many of the cycles of the natural world.

The Nations have noted for generations a change in the composition of species; introduction of invasive species and reduction in species and habitat biodiversity. This biodiversity is important to the Nations both culturally and ecologically. For instance, the Nations have noted a shift in tree species in forests due to climate change. The change in forest tree species may not be moving at a rate as fast as that of climate change and therefore could lead to diminishing forest size. This has resulted in an increased reliance on the planting by Indian Nation communities of tree species that are more typically found in southern climates like the Carolina region of the U.S. These changes in composition have impacted habitat quality. Moreover, there is a growing concern that climate conditions are affecting many species of culturally significant trees such as the maple tree, causing an infestation of pests, insects, and fungi attacks. Additional impacts to biodiversity include the infestation of gypsy moths in forests in the territories due to drought conditions caused by climate change. The Nations emphasized the significant impact that climate change has on the well-being of the natural world and animal species.

Being primarily agricultural communities, the impacts of climate change on growing conditions and harvesting are of particular concern to the Nations. Erratic weather patterns caused by climate change have, in some cases, negatively affected harvest yields and conditions for gardening and impacting both agriculturally important and culturally important crops. Flooding, from intense precipitation events, for instance, has impacted the ability to grow and harvest crops such as corn. The harvesting of culturally important crops such as maple syrup and wild strawberries as well as the undertaking of ceremonies to celebrate their harvest and medicinal purposes have also been affected by the changing climate. The traditional timing for harvesting crops depends largely upon the weather. If there is a cold winter with a lot of snow, the Nations will have a good harvest of maple syrup in the spring. If there is a mild winter with limited precipitation, the maple syrup is not as plentiful and even in some cases, not available. The wild strawberry plant has unique nutritional and medicinal qualities that contribute to blood purifying and blood building. In particular, the berries, leaves and roots of the wild strawberry plant contribute to a variety of women's health concerns and pregnancies. The mid to late spring is traditionally the time that the wild strawberries come into being. But with changing climate, they now grow in the summer months, or are not as bountiful as previous years.

The trends of warming temperatures and a shorter, milder winter means that a stable winter season is no longer reliable, impacting ice cover and snow accumulation. A decrease in stable ice cover has impacts on ecology, ice fishing, flooding, and public safety as in some river communities the ice is used as a transportation corridor. Steady snow is also relied upon for historically important cultural traditions such as the "snow snake" game that has been played for centuries. This game is not played as much as in previous generations due to the lack of snow during the winter months. Snow and ice melt also has the potential to affect flooding during other times of year. Extreme storm and precipitation

events create their own hazards including flooding, shoreline erosion, and higher water levels along coasts and in riverine areas.

The undertaking of cultural activities such as ceremonies held in Nations' longhouses have significantly been impacted with the unpredictable climate. For example, the Thunder Dance (or "Welcoming of our Grandfathers") is typically held two times per year, with the first being held during the spring when one to three thunderstorms are heard and the second ceremony held during a dry period when rain is needed for crops. The Nations thank the Thunderers or Grandfathers in the ceremony for returning again that year and for continuing to perform their responsibility of providing rain and fresh water, renewing the lakes, rivers, streams and wells. With the changing climate however, thunder is now common during rain and snowstorms in the winter months (December thru February). Likewise, the ceremonies for the Strawberry, String Bean, and Green Corn are determined based upon the time for harvest, which more often depends upon the unpredictable climate conditions. Impacts to cultural ceremonies through the whole calendar are being seen. Other cultural and economic activities such as fishing and hunting of wild game have also been impacted by changes in streams, other fishing waters, and natural habitats.

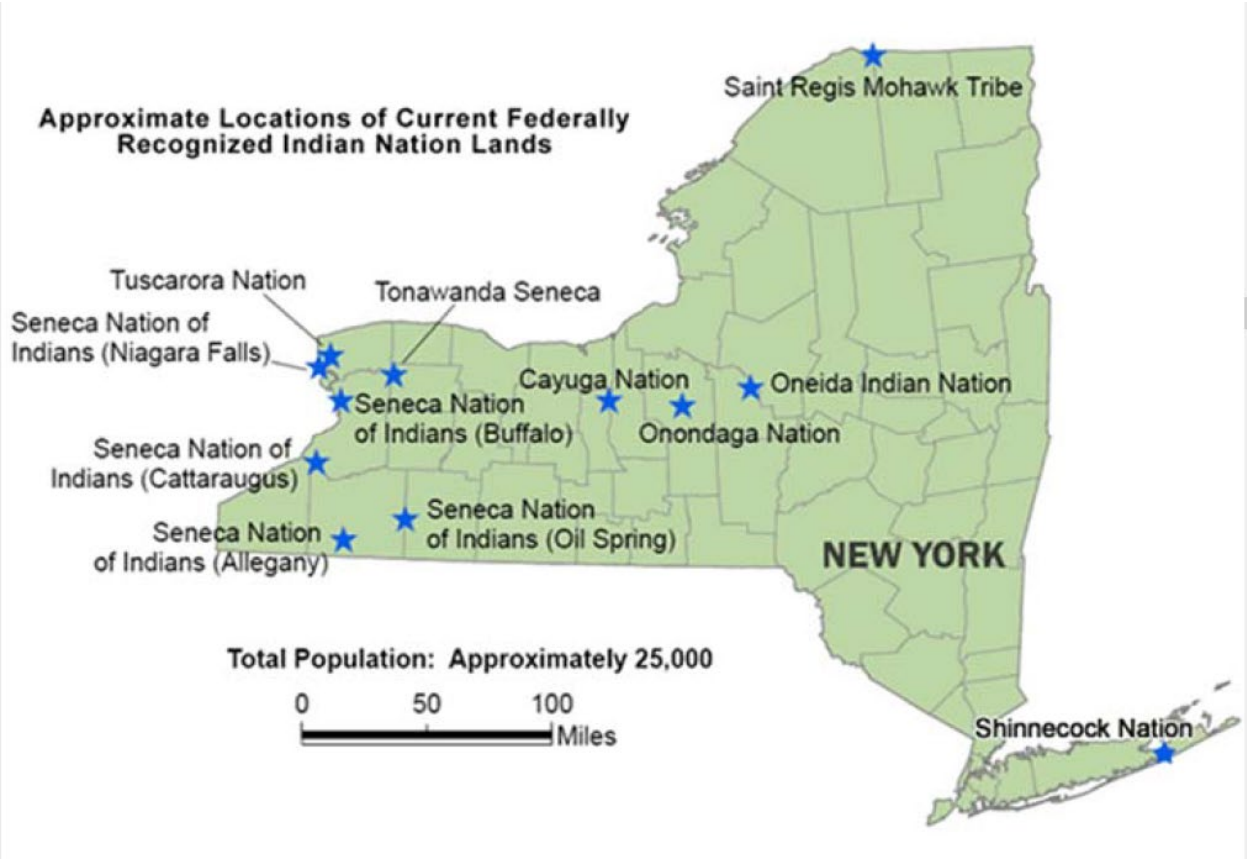
Tribal Nations have had to deal with historical traumas and stress associated with colonization and loss of their traditional lands and way of life. These past traumas and stress continue to impact their present-day health and well-being and are exacerbated by climate change impacts and concerns. The American Psychiatric Association (APA) recognizes that climate change poses a threat to mental health and those with existing stresses are disproportionally impacted.

The Nations have historically had to adapt to changing environments, however climate change presents a new set of challenges to the adaptive capacity given the Nations' dependence on and interconnected relationship with the natural environment.

The Nations challenged EPA to pivot from prioritizing identifying vulnerabilities to develop implementation plans for adaptation and mitigation actions as well as coordinate climate change activities among federal agencies so that resources are better leveraged, and administrative burdens are reduced. Section 4 of this Plan (Priority Actions) identifies specific steps that will be taken to partner with tribal governments on an ongoing basis to increase their adaptive capacity and address their adaptation-related priorities. These collaborative efforts will benefit from the expertise provide by our tribal partners and the Traditional Ecological Knowledge (TEK) they possess. TEK builds on Traditional Cultural Knowledge (TCK) and is a valuable body of knowledge in assessing the current and future impacts of climate change and has been used by Nations for millennia as a valuable tool to adapt to changing surroundings. Consistent with the principles in the 1984 Indian Policy, TEK is shared at the discretion of the Nations and is viewed as a complementary resource that can inform planning and decision-making.

Networks and partnerships already in place will be used to assist Nations with climate change issues, including Regional Tribal Operations Committees, the Institute for Tribal Environmental Professionals (ITEP), and EPA's Indian General Assistance Program (IGAP). Additionally, efforts will be made to coordinate with other Regional and Program Offices in EPA, since climate change has many impacts that transcend media and regional boundaries. Transparency and information sharing will be a focus, in order to leverage activities already taking place within EPA Offices and tribal governments. Additionally, through interagency collaboration with other federal agencies, EPA can coordinate climate change efforts to best address the Nation's needs.

In addition to the Federally recognized Nations in New York, within EPA Region 2 are other indigenous populations including New Jersey's and New York's State-recognized tribes. These tribes face similar vulnerabilities to the federally-recognized Nations and their concerns are considered through EPA Region 2's environmental justice program.




## CLIMATE CHANGE-RELATED CONFLICT AND COLLABORATION CHALLENGES

Climate change is a threat multiplier for conflict due to impacts such as economic shocks and displacement (World Bank, 2018). Following Superstorm Sandy, over 1,400 cases were filed in the Eastern District of New York related to flood and wind insurance claims. The overwhelming number of cases led to the Eastern District's establishment of the Sandy Mediation Program which resulted in many settlements during 2014-2016 (Pollack et al., 2018). Impacts from climate change can also lead to administrative and civil court litigation related to EPA's authorities. Conversely, EPA can use its programs and authorities to build resilience in a manner that will prevent environmental and human health consequences from climate change hazards that lead to disputes.

Creating effective solutions to climate impacts often requires involvement of multiple stakeholders which can present complex process challenges. Despite such challenges, engaging stakeholders in climate change adaptation planning can prevent conflicts between stakeholders and the government (United Nations Framework Convention on Climate Change, et al., 2019). Federal agencies have encountered barriers to making efficient progress on their climate-related initiatives due to the challenges inherent in engagement and collaboration. Such challenges include difficulties in establishing and managing constructive dialogue, lack of follow-through on action items, and an inability to find common ground (DuPraw et al. 2021). Collaborative engagement of communities impacted by climate change in all phases of adaptation planning and implementation was identified by environmental justice stakeholders as a critical need in the New York region (NPCC, 2019). EPA has provided impartial third-party facilitators and mediators to overcome barriers and assist parties seeking to collaborate on climate change-related efforts and resolve climate change-related disputes. EPA Region 2's Environmental Collaboration and Conflict Resolution program works closely with the Conflict Prevention and Resolution Center in EPA's Office of General Counsel, and also has a Regional Facilitator Network. These entities have been sources of facilitators and mediators on climate-related matters.

# PROGRAMMATIC VULNERABILITIES TO CLIMATE CHANGE

This section of the vulnerability assessment focuses on the climate change-related vulnerabilities to the programs and authorities administered by EPA Region 2. They align with the five broad categories of vulnerabilities in the EPA's October 2021 National Climate Adaptation Action Plan: (1) Air Quality; (2) Water Quality; (3) Contaminated Sites; (4) Chemical Safety and Pollution Prevention; and (5) EPA's Facilities and Operations. In some instances, the vulnerabilities in this section overlap with, and further enhance, the broad themes addressed above but through a lens on the programs administered by EPA Region 2.

## 1. AIR QUALITY

### *TROPOSPHERIC OZONE POLLUTION*

Tropospheric, or ground level ozone, is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the presence of sunlight and heat. The increasing temperatures and number of high temperature days due to climate change can impact the formation of tropospheric ozone. Temperature directly impacts tropospheric ozone production by accelerating the rate of reactions between NOx and VOCs. Higher temperatures also increase the emissions of VOCs from vegetation (Coats et al., 2016).

Various studies project that the annual average 8-hour maximum daily tropospheric ozone levels could increase between 2 and 5 parts per billion across the eastern United States between the 2000s and 2050s due to climate change (Stowell et al., 2017). This projected increase in daily maximum ozone is approximately 2-7% of the 2015 8-Hour Ozone National Ambient Air Quality Standard (NAAQS) and could lead to an increased number of daily NAAQS exceedances[1]. The potential lengthening of the ozone season has also been projected (EPA, n.d.).

The EPA Region 2 States of New York and New Jersey are in the Ozone Transport Region, which indicates the sensitivity of this overall area to increased tropospheric ozone concentrations. In particular, the New York City metro and Philadelphia metro areas (Note: the Philadelphia metro area includes portions of EPA Region 2) are nonattainment areas for ozone, which are areas that do not meet the Ozone NAAQS. Thus, these highly populated areas in EPA Region 2 are extra sensitive to the projected increase in tropospheric ozone concentrations due to climate change.

Moreover, such projected ozone impacts of climate change may make it more difficult for New York and New Jersey to meet existing and future Ozone NAAQS. Sources in or upwind of the Region may be required to implement additional control measures or emissions controls for ozone precursors. EPA's air programs would oversee states' efforts to develop state implementation plan (SIP) revisions to address the issue.

### *PARTICULATE MATTER (PM)*

#### WILDFIRES

Though wildfires are not common in EPA Region 2, they have been known to occur in the Pinelands region of central/southern New Jersey, in the New Jersey Meadowlands and on Staten Island, New York. The risks of wildfire occurrences could be enhanced by climate change-induced effects such as higher temperatures, decreased soil

[1] The 2015 8-Hour Ozone NAAQS is 0.070 ppm annual fourth-highest daily maximum 8-hour concentration averaged over 3 years.

moisture, and longer and more numerous periods of drought (Horton, et al., 2014; Hayhoe, et al., 2018; Nolte et al., 2018). All these factors could increase the number, length, and size of wildfires. In addition, large scale wildfires in the western United States and Canada have recently impacted the air quality in the eastern United States. In July 2021, National Oceanic and Atmospheric Administration (NOAA) satellites identified that wildfire smoke from the western United States was impacting the entire North American continent.

The projected particulate matter (PM) impacts from wildfires are not currently expected to hinder areas in EPA Region 2 from meeting or maintaining compliance with the PM NAAQS but may lead to an increased number of unhealthy air quality days. EPA Region 2's air program would oversee states' efforts to develop exceptional air quality events demonstrations and SIP revisions if wildfire events lead to issues in complying with the PM NAAQS.

### OTHER SOURCES OF PM AIR EMISSIONS

An increase in extreme weather events, which in the case of storms could include strong winds and/or heavy precipitation, increase the risk of disrupting energy delivery to many areas in EPA Region 2. For example, electrical and natural gas distribution could be disrupted by downed trees and flooding. Extended periods with energy delivery disruption in cold seasons could lead to increased use of alternative heating fuels such as wood or backup generators. Residences that rarely use fireplaces could begin using them in a manner that does not reflect best practices. Using wood for heating that has not been seasoned properly or using fireplaces improperly increases the amount of wood smoke emissions from wood burning devices, which can have negative impacts on human health and air quality. Occupants of indoor environments where wood is burned could be exposed to wood smoke. A major health threat from smoke comes from fine particles, also known as particulate matter or particle pollution. Particle pollution has been linked to premature death in people with heart or lung disease; nonfatal heart attacks; irregular heartbeat; aggravated asthma; decreased lung function; and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing (EPA, 2022). The increased PM could also affect an area's ability to comply with the PM NAAQS, which could have regional health impacts. The use of backup generators during periods of energy disruption could also negatively impact air quality. Improperly used and ventilated backup generators pose health risks that range from nuisance (noise and odor) to life threatening (carbon monoxide poisoning). In addition, weather events with high winds and storm surges such as those many areas in EPA Region 2 have experienced, can generate a tremendous amount of debris from, among other things, destroyed buildings, displaced sand and felled trees. Efforts to remove construction debris (e.g., from buildings) could last months and involve many vehicles which could generate combustion related emissions. Biomass removal could involve incineration which could also operate for months and adversely impact air quality. EPA Region 2's air program would be required to monitor clean-up efforts to assure compliance with the PM NAAQS.

## *INDOOR AIR QUALITY*

One of the best sources of information on impacts on the indoor environment is *Climate Change, the Indoor Environment, and Health*. The following subsections provide findings from this report from the National Research Council. Indoor environments can be contaminated by chemical, organic, and particulate pollutants that migrate from outdoors. Indoor migration is likely to be of particular concern on high temperature days in residences without air conditioning. Indoor air can also be contaminated by gas stoves and other indoor emission sources, such as building materials, radon, wood stoves, and environmental tobacco smoke. Climate change can affect these factors in various ways. For example, changes in the outdoor concentrations of a pollutant due to alterations in atmospheric chemistry or atmospheric circulation will affect indoor concentrations. The expected increased use of air conditioning, if accompanied by reduced ventilation, could increase the concentrations of pollutants emitted from indoor sources. Additionally, power outages—caused by heat waves or other extreme weather events could lead to the use of portable

electricity generators that burn fossil fuels and emit poisonous carbon monoxide (Institute of Medicine, 2011; Nolte et al., 2018).

### DAMPNESS, MOISTURE, AND FLOODING

Extreme weather conditions associated with climate change may lead to more frequent breakdowns in building envelopes—the physical barrier between outdoor and indoor spaces—followed by infiltration of water into indoor spaces. Dampness and water intrusion create conditions that encourage the growth of fungi and bacteria and may cause building materials and furnishings to decay or corrode, leading in turn to chemical emissions. Poorly designed or maintained heating, ventilation, and air conditioning systems may introduce moisture and create condensation on indoor surfaces. Humid conditions can, however, be improved by well-designed and properly operating systems (EPA, n.d.). Mold growth prevention and remediation activities also may introduce fungicides and other agents into the indoor environment (Institute of Medicine, 2011).

### PESTS AND INFECTIOUS AGENTS

Weather fluctuations and seasonal-to-annual climate variability influences the incidence of many infectious diseases, which may in turn affect the evolution of existing and emergence of new infectious diseases by, for example, affecting the geographic range of disease vectors. The ecological niches for pests will change in response to climate change, leading to changed patterns or routes of human exposure and potentially increased use of pesticides in these locations. Climate change may also lead to shifting patterns of indoor exposure to pesticides as occupants and building owners respond to infestations of pests (e.g., termites) whose geographic ranges may have changed. Although decreases in pest populations in some locations may lower the incidence of allergic reactions to particular pests, the overall incidence of allergic disease may not go down because those individuals with a predisposition to allergies may become sensitized to other regional airborne allergies (Institute of Medicine, 2011).

### BUILDING VENTILATION AND WEATHERIZATION

Leaky buildings are common and cause energy loss, moisture problems, and migration of contaminants from the outdoors (e.g., pests, chemical, volatile organic compounds, and particulates). Research indicates that poor ventilation is associated with occupant health problems and lower productivity in all populations, and is exacerbated in vulnerable populations such as children, seniors, and persons with medical conditions (Institute of Medicine, 2011).

Residents may weatherize buildings to increase comfort and indoor environmental quality in addition to saving energy. Although in general these actions should be encouraged, this may lead to a reduction in ventilation and an increase in indoor environmental pollutants unless measures are taken to preserve or improve indoor air quality. EPA has developed practical guidance for improving or maintaining indoor environmental quality during home energy upgrades or remodeling in single-family homes and schools. EPA's guidance and protocols may need to be revised to include state and local considerations for projected climatic changes. In addition, these programs may need to increase partnerships with other agencies to address training needs and workforce development for building owners, managers, and others, as well as develop new tracking mechanisms to assess the effectiveness of weatherization and remodeling techniques as they relate to indoor environmental quality.

## *THERMAL STRESS*

Extreme heat and cold have several well-documented adverse health effects. High relative humidity exacerbates these effects in hot conditions. As increased frequency of extreme weather events may result in power outages, corresponding increased use of portable generators may expose occupants to potentially dangerous conditions indoors.

Seniors, persons with medical conditions, persons of low income, and residents of urban environments are more likely to be exposed to extreme temperature events. These vulnerable populations experience excessive temperatures almost exclusively in indoor environments. Increased temperatures will result in increased use of air conditioning. Air conditioning provides protection from heat but is associated with higher reported prevalence of some ailments, perhaps because of contaminants in heating, ventilation and air conditioning (HVAC) systems (Institute of Medicine, 2011; Nolte et al., 2018).

### *INCREASED ENERGY DEMAND*

Increased temperatures due to climate change could have a potential two-fold effect on energy consumption for heating and cooling. Energy used for heating is likely to decrease while energy used for cooling is likely to increase. With the Northeast projected to experience a significant increase in summer temperatures and more frequent and longer heat waves, summertime energy peak load demands will be stressed, and could lead to system failures, due to higher air conditioning use (Dupigny-Giroux et al., 2018). It could also lead to operation of "peaker" electric generating units to meet the increased demand. During high energy demand days, peaker units operate and generally produce more emissions than the typical electric generating unit. Furthermore, increased energy use for cooling would occur in the summer, which would lead to increased emissions during the ozone season (unless there is an increase in the supply of renewable energy to match the increased energy demand). The emissions impact from increased energy demand could hinder areas in EPA Region 2 from meeting or maintaining compliance with the NAAQS (PM, Ozone, NOx). Sources in or upwind of the Region may be required to implement additional control measures or emissions controls. EPA Region 2's air program would oversee states' efforts to develop SIP revisions to address the issue.

### *MOBILE SOURCE EMISSIONS*

Warming due to climate change could lead to damages to transportation infrastructure. Increased frequency, intensity, and/or duration of heat events could lead to railway deformities, road softening, and traffic-related rutting due to the road softening (IPCC 2007). If damages to transportation infrastructure lead to increased congestion, traffic-related emissions could increase. Also, if the costs of maintaining roads and rail lines in good repair divert limited funds from planned mass transit capital projects this could hinder work performed by EPA Region 2 and our state partners in promoting and supporting mass transit projects to reduce transportation related emissions such as the New York Metropolitan Transportation Council Congestion Mitigation and Air Quality (CMAQ) Improvement Program.

In addition, heavy precipitation events resulting from climate change can threaten travel routes on coastal and low-lying roadways, lead to the closure of airports, and damage to shipping channels and ports (IPCC 2007). If these damages and closures lead to traffic congestion in other locations or if extended periods of congestion arise in the areas that are flooded, this could cause increases in mobile source emissions.

Finally, extreme events experienced in EPA Region 2, such as hurricanes, that hinder refinery operations or fuel transportation could require EPA to grant fuel waivers to allow more polluting fuels to be used for a short time.

## 2. WATER QUALITY

### *WATERSHEDS, AQUATIC ECOSYSTEMS AND WETLANDS*

#### WATER QUALITY STANDARDS, TMDLs (Total Maximum Daily Loads), and LISTING

Water quality standards established under the Clean Water Act (CWA) are intended to protect public health and welfare; enhance the quality of water; restore and maintain the chemical, physical, and biological integrity of state and

territorial waters; and provide water quality protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water. Various impacts of climate change on water quality have been already reported in the literature and detailed in earlier sections of this document. Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters (i.e., "the 303(d) list"). These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes after the implementation of effluent limitations or other pollution control requirements. Climate related stressors are likely to lead to more water quality impairments, which will need to be reflected on 303(d) lists. Total Maximum Daily Loads (TMDLs) are one tool to help improve the water quality of impaired waters. A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. Future TMDLs may include modeling to evaluate pollution impacts under a range of projected future climatic shifts. One of EPA's priorities is to advance modeling methods to include and regionalize climate change data and information which could be used to inform TMDL development and other water-quality based programs.

## PERMITTING

More intense precipitation, floods, droughts, increases in ambient water temperatures, and rising sea levels pose challenges for the National Pollutant Discharge Elimination System (NPDES) permittees and permit writers. Managing discharges to protect water quality under these changing conditions can be aided by the refinement of the methods, tools, and information used to develop and implement NPDES permits and programs.

For example, both high and low flows in streams in many parts of the United States are affected by weather, water withdrawals, changes in stormwater runoff due to changes in imperviousness, and other factors. This has highlighted the need for improving methods for calculating critical flow statistics, which are an integral element in developing water quality based effluent limits in NPDES permits. Additionally, as different parts of the country become drier, wetter, or hotter, green infrastructure can be used as a permit tool to help improve community resiliency today and into the future In 2019, Congress enacted the Water Infrastructure Improvement Act, which defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters." In developing permit requirements, permitting authorities may structure their permits, as well as guidance or criteria for stormwater plans and combined sewage overflow (CSO) long-term control plans, to encourage or require permittees to use green infrastructure approaches, where appropriate, in lieu of or in addition to more traditional grey infrastructure controls. Such green infrastructure practices can help communities manage flooding, prepare for drought (e.g., stormwater harvest and reuse), reduce urban heat islands (e.g., planting trees and other vegetation), lower building energy demands (e.g., green roofs), spend less energy managing water, and protect coastal areas (e.g., living shorelines).

## ESTUARIES AND WATERSHEDS

Local and regional partnerships, such as those developed through the National Estuary Program (NEP), identify risks to conserving and managing coastal ecosystems due to a changing climate. Such risks are sea level rise, warmer waters and atmosphere, increased drought, increased storm frequency and duration, changing surface water hydrology, loss of wetlands, and coastal acidification. These will have significant impacts on freshwater, marine, estuarine, and terrestrial ecosystems. EPA Region 2 continues to support six NEPs to restore and protect critical estuaries and watersheds in the Region. They are the Barnegat Bay Partnership, Long Island Sound Study, New York-New Jersey Harbor and Estuary Program, Delaware Estuary Program, Peconic Estuary Partnership, and San Juan Bay Estuary Program.

Increasing temperatures can impact water quality and overall marine and freshwater ecosystems. Warmer waters hold less dissolved oxygen and can have impacts on the species that can survive there. The rising temperatures also appear to

be impacting the species that can thrive in these waters with a general shift of species ranges from south to north. Species such as eel grass and the bay scallop appear to be stressed by the higher temperatures and are succumbing to parasites that were previously not an issue for them. Southern species, such as the cow nose ray and black sea bass, which were only occasional visitors to New Jersey and New York, are now appearing in increasing numbers and can consume large amounts of traditionally abundant shellfish (Howell & Auster, 2012; Peconic Estuary Partnership, 2020, March; & Long Island Sound Study, 2021).

Nutrient loading from agricultural lands to watersheds might also be changing due to more intense storms and resulting flooding of cropland, erosion, and runoff. Warming temperatures might also allow once uncommon agricultural and forestry pests to now thrive in new areas, thus posing the potential for increased use of pesticides (Deutsch et al., 2018).

Harmful algal blooms (HABs) have also become more common in recent years in coastal and inland waters. While the direct cause of the HABs is often elusive, they are frequently associated with warmer stagnant waters and higher nutrient loads, both exacerbated by climate change (Gobler, 2020).

Although long-term signals may be undetectable in estuaries due to their dynamic conditions, coastal acidification is an increasingly pressing issue in the Region. Coastal acidification effects are driven by local climate, environmental, and anthropogenic conditions (i.e., temperature, habitat connectivity, nutrient loading and sources, and carbon dioxide ($CO_2$) inputs from upwelling, atmospheric deposition, freshwater discharge, and various anthropogenic activities) (Galavotti et al., 2021).

### WETLANDS

As sea level rises, barrier island configurations will change, and coastal shorelines will retreat. Wetlands will be inundated and eroded, and low-lying areas will be inundated more frequently – some permanently – by the advancing sea. Freshwater wetlands will be subject to changes in hydrology, precipitation and temperatures impacting the ecological services that they provide. Since many coastal areas are already well developed, especially in the New York/New Jersey metropolitan region, there is limited opportunity for wetlands to migrate upland. In addition, as sea level rises, temperature increases, and rainfall patterns change, the salinity of estuaries, coastal wetlands, and tidal rivers are likely to become more variable, further altering the composition and ecosystem function of existing wetlands. Furthermore, mid-Atlantic tidal marshes, mangrove forests and other coastal ecosystems in the Caribbean, which provide important services for shoreline protection, species habitat, and nutrient cycling in the environment, will be vulnerable with sea level rise. Inland wetlands - which provide important services in flood protection, water quality, nutrient cycling, and species habitat - will also be vulnerable with changes in precipitation and groundwater recharge. Thus, there needs to be a focus on wetland protection, restoration, and capacity for resiliency in all wetland ecosystems. Yet EPA Region 2's wetland and mangrove protection and restoration efforts will face challenges due to uncertainty with regards to sea level rise and the wetland's ability to migrate and respond to changes in hydrology and precipitation.

### LAKES AND STREAMS

Changing water flow to lakes and streams, increased evaporation, and changed precipitation in some areas will affect the size of streams and lakes. For example, water levels in the Great Lakes are expected to fall. Headwater streams will be increasingly dry during summer months as drought conditions occur more often and evapotranspiration increases. This will influence aquatic ecosystems because species that are susceptible to higher temperatures or lower dissolved oxygen levels, such as freshwater trout fisheries in New York and New Jersey, will lose viable habitat.

### COASTAL AND MARINE ECOSYSTEMS

As atmospheric $CO_2$ increases, more $CO_2$ is dissolved in the ocean waters. Although the dissolution of $CO_2$ in oceans is a natural process, the current rate of ocean $CO_2$ dissolution is unprecedented and has serious implications for the marine food chain and ocean ecosystems. The increase in $CO_2$ decreases the pH of the water and creates an acidic environment

that dissolves the hard shells of corals, shellfish, and smaller organisms. This process, called ocean acidification, also decreases the availability of calcium carbonate ($CaCO_3$), an important building block for shells and the exoskeletons of many marine organisms.

Both the U.S. Fish and Wildlife Service and NOAA report that nearly all endangered animals are sensitive to climate change impacts. Changing climate is reported to impact species directly or indirectly by threats to their habitats. Many economically important species are also at risk, including types of crustaceans, mollusks, shellfish, fish, and corals, which are especially vulnerable to impacts related to ocean acidification. Although a lot of research is being done on impacts of climate change on corals, there is not much yet known about impacts on various life stages of other culturally and economically important species such as the Caribbean spiny lobster (*Panulirus argus),* Atlantic blue crab (*Callinectes sapidus*), or Queen conch (*Lobatus gigas*).

### CORAL REEFS

Increasing sea surface temperatures and ocean acidification have the potential to reduce the stability of corals in Puerto Rico and the Virgin Islands, especially in the presence of stresses from the existing land-based sources of pollution and overuse of the reefs for fishing and recreation. In the Caribbean, already stressed coral reef ecosystems will be highly compromised by the increasing sea surface temperature, which will result in more chronic bleaching events and subsequent vulnerability to diseases associated with bleaching. It is well documented in the literature that ocean acidification decreases coral calcification rates and negatively affects their recovery, reproduction, and recruitment (Hoegh-Guldberg et al., 2007).

Ocean acidification will not only reduce the capacity of reef corals to calcify but also will result in decreased ability for corals to protect themselves against more frequent hurricanes (Gould et al., 2018). Damage to coral reef ecosystems will have a significant impact on greater ocean ecosystems, food supplies and recreation and tourism industries. This will make implementation of local stormwater runoff reduction and improved coral reef management efforts to preserve current coral reef habitat by EPA and its partner agencies much more critical.

Coral Reefs provide an important infrastructure for coastal communities, supporting fisheries, local jobs and businesses. According to NOAA, coral reefs structures support approximately 4,000 species of fish, 800 species of hard corals and hundreds of other economically valuable species (National Ocean Service, n.d.). Coral reef infrastructure also protects coastal land, providing shorelines with a buffer against 97 percent of the energy from waves, storms, and floods, helping to prevent loss of life, property damage, and erosion. This is important for protection from more frequent and severe hurricanes and storms. Both reef-building hard corals and soft coral species are important components of coral infrastructure (Paoli et al., 2017; Valisano et al., 2016). Both are able to regulate sedimentation and affect water currents, providing a natural barrier protecting coastal communities and land from increased wave action and storms. When coral reefs are damaged or destroyed, this natural barrier becomes absent, making several million people living in U.S. coastal areas adjacent to or near coral reefs more vulnerable to effects of climate change.

## *DRINKING WATER, WASTEWATER AND STORMWATER INFRASTRUCTURE*

### QUALITY AND AVAILABILITY OF SAFE DRINKING WATER

Protecting public health from contaminants in drinking water will require adapting to the impacts of climate change. Warmer waters foster pathogen growth, which affects the reliability and the cost of drinking water disinfection. Increased precipitation and more extreme rainfall events will result in additional pollutant loadings from nutrients, pesticides, and other chemicals, further challenging drinking water treatment. Impacts of severe storm events (i.e., heavy flooding, sustained loss of power) could also disrupt a water system's water treatment processes, inhibiting the system's ability to maintain water quality standards and control contaminant levels such as lead and copper. Storm

impacts can also wash away roadways, which can result in impacts to water distribution systems. For example, the New Jersey Department of Environmental Protection reports that during Hurricane Sandy roadways were washed away, which forced water systems to use GPS or old maps to locate buried assets.

The New York City Watershed's ability to supply drinking water to 8.5 million people and continue to meet the criteria for the drinking water filtration avoidance (thereby reducing the need for water supply treatment) may be affected due to increased runoff and turbidity. Small water systems, such as non-PRASA (Puerto Rico Aqueduct and Sewer Authority) systems in Puerto Rico, are particularly vulnerable due to reduced water yields and/or poor water quality. Droughts are one of the most frequent climate hazards experienced in the Caribbean (Gould et al., 2018). Longer periods of drought are expected to occur and may produce an increase in the energy needs and costs associated with the production of drinking water and result in competition with agricultural sector water needs, particularly during periods of high temperature.

New drinking water infrastructure, sources and/or enhanced treatment will be needed in some state and tribal localities, including relocating water intakes and building desalination plants. Rising sea levels cause intrusion of saltwater into the underground freshwater aquifer, contaminating the supply of usable groundwater and reducing the freshwater supplies in the Caribbean, on Long Island, and in some coastal sections of New Jersey. The consequences of saltwater intrusion vary widely depending on the extent of the intrusion and intended use of the water. Long Island's freshwater demand is supplied exclusively by the Nassau-Suffolk Counties Sole Source Aquifer System (New York Water Science Center, 2017). This sole source of drinking water may be threatened by sea level rise, insufficient groundwater recharge, and increased demand during periods of drought – all of which would contribute to salinization of the Sole Source Aquifer System (Barrett, 2019). In areas such as Cape May, New Jersey, saltwater contamination caused by groundwater extraction has caused the closure of over 100 water supply wells since the 1960s (Lacombe et al., 2002). Saltwater contamination can also increase the need for desalination, an energy-intensive and costly process, to remove salt. Desalination to treat marine or brackish water is becoming increasingly important in certain locations in the Virgin Islands as increased periods of drought along with population growth lead to higher demand for water.

Wastewater or stormwater utilities could distribute reclaimed water from a centralized treatment system for park irrigation or other uses, which may require additional treatment. Aquifer Storage & Recovery (ASR) is a process of storing water underground and then using it to meet future domestic industrial, and agricultural needs. ASR is increasingly used where freshwater demand is beginning to or projected to exceed supply and impact water quantity. While ASR is likely to increase in drought prone areas, when applied to stormwater, this practice can also reduce nonpoint source pollution of our lakes, streams, and rivers. However, the infiltration or injection of polluted stormwater increases the risk of contamination of freshwater aquifers. In EPA Region 2, most ASR facilities are in New Jersey. Considering the increasing demand for water, EPA will need to ensure that groundwater quality and supply are maintained given greater use of this resource.

## GROUNDWATER RECHARGE

Increased temperatures will lead to increased evapotranspiration, which could reduce the amount of water available to recharge groundwater aquifers (Condon et al., 2020). In the Northeast, the increased precipitation is forecast to occur with heavy downpours while the snowpack will continue to be reduced. These scenarios could result in increased surface runoff with reduced infiltration and groundwater recharge, particularly in upland areas. This would place strains on the use of groundwater for municipal, industrial, and agricultural water supply needs.

Using data from the United States Geological Survey (USGS) circular entitled "Estimated Use of Water in the United States in 2015" and omitting freshwater withdrawal for power generation, we estimate that, in 2015, aquifers supplied groundwater to NJ at a rate of 567 million gallons per day (mgd) (37% of NJ's total freshwater withdrawal), to NY at a rate of 883 mgd (28% of NY's total freshwater withdrawal), to PR at a rate of 118 mgd (18% of PR's total freshwater

withdrawal), and to the USVI at a rate of 2.67 mgd (51% of the USVI's total freshwater withdrawal) (Dieter et al., 2018). Because aquifers supply a substantial portion of freshwater demand in EPA Region 2 and climate change could decrease groundwater recharge, preventing groundwater contamination will become more crucial in maintaining water supplies for the Region.

## WATER INFRASTRUCTURE CAPACITY

An increased number of flood events of greater intensity is impacting water infrastructure. This trend is expected to continue in the northeastern United States as extreme precipitation, sea level rise and storm surge are projected to cause more flooding in both coastal and inland areas, particularly in urban areas where runoff is more likely due to large amounts of impervious surfaces (Dupigny-Giroux et al., 2018). Many water and wastewater treatment systems and pumping stations in New York and New Jersey were damaged due to Hurricane Irene and Superstorm Sandy in 2011 and 2012, and Tropical Storm Ida in 2021. Many of the wastewater facilities were flooded and/or shut down or lost power during these events, after which only primary treatment was performed for a period until the digester systems stabilized resulting in untreated or partially treated sewage to be discharged to local waterbodies. Furthermore, providing emergency support to these facilities was complicated by flooding of low-lying access roads, damaged electrical supply systems, shortages of fuel for backup generators, and overstretched personnel. In New Jersey, the Passaic Valley Sewerage Authority facilities alone suffered $300 million in damage due to Superstorm Sandy. This has required major financial resources to pay for the repair or replacement of damaged infrastructure or to proactively retrofit existing infrastructure, including treatment plants, pumping stations and conveyance systems. After Tropical Storm Ida, several communities in New Jersey were under boil water advisories due to increased turbidity in drinking water resulting from flooding impacts on infrastructure (e.g., water main breaks) and/or source water. An increase in future flood occurrences relative to the 1-in-10 and 1-in-100-year flood events is likely to occur if increases in storm frequency or intensity continue to take place. Based on the changes in sea level rise alone, it is predicted that the once in a decade coastal flood levels, which are currently observed, could soon occur once every one to three years (Rosenzweig et al., 2011, May).

In June 2013, New York City presented a comprehensive coastal protection plan that articulates a diverse selection of coastal protection measures tailored to the specific geomorphology of and risks facing neighborhoods most in peril; other local governments will likely develop similar plans as well. Dredged material management plans will need to be adjusted because several of the coastal resiliency projects will use dredged sediments and more intense storm events will cause potentially greater sediment loadings to enter our waterways and harbors. While the Army Corps of Engineers is the primary permitting authority on dredged material management in the coastal zone, EPA and the states have oversight roles of dredged materials management activities and are involved in developing dredged materials management plans. Coastal protection measures may also have an impact on water quality in EPA Region 2 coastal waters, particularly in the New York and New Jersey Harbor and Estuary.

General population growth, a loss of snowpack in the Northeast, and potentially declining surface and groundwater quality and quantity – particularly in the Caribbean – may increase competition for water among the energy and agricultural sectors, public drinking water suppliers, and the overall maintenance of ecological services. This would have an impact on water supply and water use, along with the water body's ability to provide ecosystem services. An example is the stress placed on the cold-water trout fishery due to inadequate reservoir releases in New Jersey's Pequannock River when drinking water diversions cause elevated stream water temperatures during the summer months.

Sea level rise in coastal areas threatens fresh water supplies and puts drinking water at increased risk. Saltwater intrusion into coastal aquifers is a problem in areas where withdrawals outpace recharge and the increased pressure head from higher sea levels worsen this problem. As sea level rises, community drinking water intakes may end up in brackish waters as the salt front migrates up coastal rivers and streams.

The integrity of coastal water infrastructure systems could be put at increased risk because systems designed for current sea levels will likely need to operate under conditions when the sea level is 2 to 5 feet greater than current levels. Wastewater outfalls will have reduced capacity and will have to be redesigned given increased water heights in receiving waters. Communities may need infrastructure improvements, or to relocate their drinking water and wastewater treatment plants to become more resilient to sea level rise and more frequent storm events.

## SEWERS AND WASTEWATER SYSTEMS

Variability in precipitation patterns and an increase in the intensity and severity of storms may lead to an increase in the number of sewer overflows and wastewater bypasses. Predicted increases in storm events and rainfall intensity, as well as sea level rise and storm surges, are estimated to contribute to the frequency and volumes of combined sewer overflow (CSO) discharges in heavily urbanized regions in New York, New Jersey, and Puerto Rico. New York State has 59 CSO permit holders with 816 outfalls, New Jersey has 25 CSO permit holders with 210 outfalls and Puerto Rico has 1 CSO permit holder with 12 outfalls. These include the Region's largest cities, such as New York City, Albany, Binghamton, Rochester, Syracuse, Buffalo, Jersey City, Newark, and San Juan. Furthermore, increased heavy precipitation events could trigger increased sewer overflows and wastewater bypasses, especially in low-lying communities like those surrounding the Martín Peña Canal in San Juan, PR and in the Meadowlands area of NJ. These overflows contain not only stormwater but also pollutants such as untreated human and industrial waste, toxic materials, debris, and oil and grease. Consequences include increased risks of waterborne diseases; greater loads of pollutants entering our waterways; aquatic habitat impairments; loss of recreational access to water bodies due to high bacteria levels, fish kills, and fishing and shellfishing restrictions; and increased flows in streams and other conveyance channels that could be eroded. This reduces EPA's ability to achieve our goal to make waterbodies fishable and swimmable.

Utilities face financial challenges when planning for more severe and frequent storm events. Municipalities must evaluate the costs and benefits of alternative approaches for capital infrastructure planning and outlays to address climate impacts. Communities seeking to reduce sewer and wastewater overflows will need to coordinate with the state agencies administering EPA's State Revolving Fund (SRF) programs, which are water infrastructure funds that provide financing options for eligible projects, usually at or below market interest rates. Climate change may lead to greater demand for low-interest infrastructure funding, including from EPA's SRF program.

Increased precipitation may also result in additional pollutant loadings of nutrients, pesticides, and other chemicals, further challenging permittees' ability to meet water quality standards and permit requirements. For industrial dischargers and wastewater treatment plants, lower baseflows due to increased evapotranspiration and increased likelihood of drought conditions will make meeting permit requirements more challenging. This will have an impact on our watershed programs as well as our regulatory programs, including the National Pollutant Discharge Elimination System (NPDES) and TMDL programs.

## SEPTIC SYSTEMS

Just as centralized wastewater systems are impacted by climate change, decentralized wastewater systems (septic systems or onsite wastewater treatment systems) face similar, albeit more localized, challenges. The basic components of a septic system include a septic tank to receive, collect, store, and treat solids and a soil drainfield to treat liquid effluent. Drainfield treatment effectiveness and efficiency is dependent on soil type and characteristics. When septic systems are properly planned, designed, sited, installed, operated, and maintained, they can provide excellent wastewater treatment. However, a system's performance depends on having aerobic, and then anaerobic soil conditions in the drainfield for nitrifiers and denitrifying bacteria to properly treat nutrients and nitrogen in wastewater effluent. When overland flooding occurs, or when soils are saturated for extended periods of time, septic tanks can overflow and drainfields will not function properly. With increased variability and intensity of precipitation events that saturate soils, flooding events can inundate these systems and cause sewage to back up into homes and/or release to

the environment and expose property owners and others to untreated sewage. The sewage release contains pathogens and nutrients that can enter surface and groundwater, thereby negatively impacting drinking water supplies, public health, water quality and recreation. Septic systems located in low lying areas, near the coast, or in poorly drained soils are most vulnerable to climate change induced failure.

In EPA Region 2, the major contaminants that could increase due to climate change induced septic system failures are human pathogens, nutrients, and other household sewage related contaminants. Pathogen contamination is a human health risk and nutrient contamination (both nitrogen and phosphorous) will fuel greater marine and freshwater algal blooms, some of which may be HABs. Failures or substandard systems also lead to higher nitrate concentrations in groundwater and surface waters. Certain areas such as Suffolk County, NY, The Shinnecock Indian Nation, and areas of Puerto Rico and the U.S. Virgin Islands are particularly threatened as they are coastal communities that still rely on numerous substandard cesspools for wastewater management. These antiquated systems lack adequate treatment via a horizonal drain or distribution field and are prone to backups and/or overflows with high rainfall events. EPA works with local officials and partner organizations to support onsite wastewater management; provide public education and outreach; and develop and implement voluntary guidelines, policies and technical guidance for onsite wastewater management. EPA also provides technical assistance and technology development to support more effective use of Innovative/ advanced (I/A) septic system technologies, particularly in coastal marine areas.

## 3. CONTAMINATED SITES

### *RISK OF CONTAMINANT RELEASES*

The prospect of more intense and more frequent storms and sea level rise carries with it the risk of contaminant releases from RCRA Corrective Action sites, Superfund sites, Brownfield sites and landfills. As noted in EPA's Agency-wide Climate Change Adaptation Plan, inundation and flooding may lead to transport of contaminants through surface soils, sediments, groundwater, surface waters and/or coastal waters. Uncontrolled migration of contaminants may pose an increased risk of adverse health and environmental impacts.

One example in EPA Region 2 is American Cyanamid, a Superfund site on the banks of the Raritan River in Bridgewater Township, NJ. The site has two impoundments of harmful chemicals that released contamination during major flood events caused by Hurricanes Floyd and Irene (1999 and 2011 respectively). Since then, a remedy was selected to excavate waste within the impoundments, solidify/stabilize materials impacted by the waste, and place a protective cover over the entire area. However, September 2021's Tropical Depression Ida caused a 500-year flood event and even though most of flood resiliency infrastructure improvements remained operational, the impoundments were overtopped by floodwater and an estimated 300+ million gallons of floodwaters had to be released into a brook in a controlled manner. Thus, moving forward, the containment berms around the impoundments will need to be raised to protect against future 500-year flood events.

An example in Puerto Rico is the Upjohn Facility, a 2-acre former pharmaceutical manufacturing plant. The site experienced strong tropical-storm-force winds from Hurricane Irma and hurricane-force winds and flooding from Hurricane Maria, with sustained loss of grid power to the pump and treat system. In addition to damage to electrical equipment, the aeration tower, containing the groundwater treatment system, was substantially destroyed by wind and debris. Damage was also reported to the soil vapor extraction system due to power surges. To addresses these issues the site now uses an automated computerized monitoring and data collection system with remote access and automated notification system for groundwater extraction and treatment, dedicated electrical feed, security camera system and solar powered lighting which allows for site managers to monitor, control and suspend remedial activities during emergencies (Office of Land and Emergency Management [OLEM], 2018).

Tutu Wellfield is located in east-central St. Thomas in the U.S. Virgin Islands. The site consists of a plume of contaminated groundwater with remedies that include groundwater pump and treat and soil vapor extraction. The systems are housed in hurricane proof structures with solid concrete walls and roofs and steel doors. Three extraction wells are constructed in flood resistant vaults. The site experienced hurricane-force winds from Hurricanes Irma and Maria. The hurricane proof structures remained intact but sustained a five-month long loss of power due to area wide utility damage. During this five-month period in the moist tropical environment, equipment and programmable logic controller components required replacement after they oxidized and seized (OLEM, 2018).

While contaminant release and dispersal is most relevant to sites that have not yet been remediated, sites with certain types of remedies may also be vulnerable. For example, a rise in groundwater levels could lead to a failure in a groundwater containment system.

Other climate considerations include saltwater intrusion and increased groundwater salinity in coastal aquifers that may increase the permeability of clay liners installed at waste sites, such as landfills, allowing contaminants to spread to nearby properties. Several landfills in PR and the USVI are located at or near sea level. Many of these landfills are still operating and/or have been improperly closed. Rising sea level poses a significant risk of erosion to these landfills and the potential migration of contaminants towards nearby communities and ecosystems (i.e., coastal wetlands and coral reefs). Examples of these are the Culebra Island Landfill and the Rincon Municipal Landfill.

Climate stressors can impact solid waste facilities both directly and indirectly. For example, while higher temperatures may directly alter decomposition rates, climate change may also affect access to roads, ports, and energy, indirectly limiting the collection of waste and operation of waste management sites. Flooding poses the biggest threat to solid waste infrastructure. Without proper water catchment systems around a landfill, heavy rain events can degrade the landfill, causing breaks in the containment structure that allow debris and leachate to escape from the landfill and contaminate local resources.

Flooding from extreme storms may undermine landfill foundations, releasing leachate into groundwater or block collection routes, sweep waste into waterways, and cause waste to clog other infrastructure. Landfills near the coast or in low-lying areas are vulnerable to sea level rise and storm surge. Water infiltration of the pit can lead to an overflow of waste from the landfill. Saltwater infiltration from below can deteriorate the impermeable lining of sanitary landfill facilities. A compromise of the sanitary landfill liner could result in the uncontrolled release of leachate into the subsurface and potentially impact groundwater or surface water.

Temperature increases may necessitate more frequent waste collection schedules and rigorous landfill management practices, as odors will be stronger. Higher temperatures and drought may also increase the risks of fire at waste facilities. These and other climate change risks vary in relative importance, with a range of cost implications, compounding effects, and impacts on development objectives.

Severe storms, storm surge and sea level rise may also cause flooding of coastal or other riparian located facilities in EPA Region 2 where chemicals, oil or other hazardous substances are present. Of notable concern are pesticide and chemical production or storage facilities, which are governed by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Toxics Substances Control Act (TSCA), respectively. These facilities are also vulnerable to extreme weather events, possibly leading to the dispersal of such materials to nearby properties or surface waters and, in turn, creating risks to public health and the environment. This is an issue raised by local environmental justice groups to EPA, since several such facilities in the Region are located near low-income minority communities. Releases of hazardous substances or other materials from such facilities could potentially lead to cleanup actions by EPA's Superfund program, the oil spill response program, or state or local government response programs**.** Large storms can also impact Superfund sites during construction resulting in possible exposure or redistribution of contamination.

Power outages impact groundwater pump and treat facilities at Superfund sites during storm events such as Superstorm Sandy. Some sites have begun to address this vulnerability. At the Ciba Geigy Superfund Site, the owner, BASF leased 166 acres of the site for a 35-megawatt grid-tied ballasted, solar array system within the footprint of the former manufacturing area and connects to an on-site substation. A smaller 2-megawatt net-metered solar array provides nearly 100% of the electricity to power the site's groundwater extraction and treatment system, thereby allowing the system to remain powered during outages.

## *ADVERSE EFFECTS ON CLEANUPS AND EMERGENCY RESPONSE*

As noted in the Agency's National Climate Change Adaptation Plan, changes in precipitation patterns and temperature as a result of climate change may adversely affect the performance of some site cleanup remedies and may require some remedies to be changed. In August 2018, EPA's Office of Land and Emergency Management (OLEM) released a report, Evaluation of Remedy Resilience at Superfund NPL (National Priority List) and SAA (Superfund Alternative Approach) Sites, which identified vulnerabilities and resiliency measures based on sites impacted by Hurricanes Harvey, Irma and Maria. This report built upon earlier efforts to understand how resiliency measures are considered in conceptual site models, remedy system designs and operations, and how resilience is built into remedies at Superfund sites. The assessment identified sites with remedies that EPA considers to be the most vulnerable to the direct effects of a hurricane. The data gathered, although not comprehensive, provides some general observations, as well as some insight, regarding the design measures that can help remedies remain protective during extreme wind and flooding, including automated shut-off controls to prevent tank overflow; the use of berms, dikes and other erosion control; and hazard preparedness plans such as moving drums to enclosed structures. The analysis completed for this study concludes that resiliency measures are being implemented at Superfund NPL and SAA sites where remedies are in place. The report pointed out the vulnerability of relying on the power grid, including sites in Puerto Rico and the U.S. Virgin Islands which experienced sustained power outages and the extensive damage to roads, powerlines, and other infrastructure which made restoring power or providing alternative power challenging. Research into solar power and other alternative power sources may help alleviate sustained shutdown of operating remedial systems, such as groundwater pump and treat systems.

# 4. CHEMICAL SAFETY AND POLLUTION PREVENTION

## *USE OF TOXIC CHEMICALS*

A changing climate will likely result in changes in the timing and kinds of agricultural crops planted in New York, New Jersey, and the Caribbean. For example, increased precipitation expected in the Northeast could cause delays in Spring planting of crops (Dupigny-Giroux, et al., 2018). This in turn will affect the quantity, type, and timing of agricultural chemical use as well as the appropriate application method. These changes in chemical use and application could impact the appropriate risk management decisions made by EPA Region 2's Pesticides Program in determining what pesticides and geographic areas to focus our efforts to ensure compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), with particular focus on the protection of migrant farm workers and rural communities. For instance, soil fumigation as a method to apply pesticides is now rarely used in EPA Region 2 but would be expected to become more common as crops move into the area that requires pest techniques that are associated with longer growing seasons and warmer winters (NYSERDA 2011). Soil fumigants are among the most hazardous of all pesticides and rapidly volatilize once in the soil. Once in gaseous form, the fumigant can disperse throughout the soil and contact target pests making them extremely effective. However, because of the volatility of fumigants, people who live, visit, and/or work near fumigated fields may be exposed to these toxic emissions if the gases travel offsite either via wind aboveground or through wells, sewers, vaults and other underground pathways to the surface. Consequently, EPA Region 2's Pesticides Program would likely need to reevaluate its priorities if spray drift from fumigants becomes more common in EPA Region 2.

Similarly, changes in temperature and precipitation levels are expected to result in increased cases of the West Nile Virus and other diseases carried by mosquitoes, some not usually found this far north. In fact, the migration of Aedes albopictus (Asian tiger mosquito) has resulted in increasing populations in more northern regions, especially EPA Region 2, and the spread of the mosquito Aedes aegypti due to warmer temperatures, may have been a factor in the Zika virus outbreak in PR and the USVI. (Ebi et al., 2018; Shope, 1991). These mosquitoes have begun to take over areas previously inhabited by the Culex species of mosquito during the winter (i.e., NYC). The movement of this invasive species may increase the northward spread of Dengue. As the incidence and type of diseases carried by mosquitoes increases, EPA Region 2's Pesticides Program will likely need to broaden their knowledge of new types of pesticides and/or application methods to ensure compliance with FIFRA. EPA will also need to engage diverse stakeholders with disparate views on the merits of spraying pesticides. These activities will have resource implications for EPA Region 2 as will most of the programmatic impacts referenced in this Assessment.

## *EXPOSURE TO TOXIC CHEMICALS FROM INFRASTRUCTURE DAMAGE*

The extreme weather events that are likely to occur as a result of climate change (e.g., high winds, heavy precipitation events) may damage community infrastructure (e.g., schools and childcare facilities) and residential homes. As a result, there may be an increased risk of exposure to lead, asbestos and PCBs, when these buildings are initially damaged and when they are renovated/demolished as part of the recovery efforts. Children are particularly vulnerable to this risk, particularly those living in underserved communities where buildings tend to be older and poorly maintained. Therefore, to mitigate/prevent such exposure and ensure compliance with the Toxic Substances Control Act (TSCA), EPA Region 2's Toxics Substances program will need to educate the affected communities about safeguarding themselves and provide technical assistance to debris removal companies and the construction/renovation industry. Depending on the extent of the communities impacted and the amount of damage resulting from these extreme weather events, the capacity of EPA Region 2's Toxic Substance program to provide such information/assistance in a timely manner, especially in a face-to face format, could be sorely tested.

The Environmental Protection Agency's Risk Management Plan (RMP) Rule requires certain facilities that make, use, handle, or store hazardous substances to develop and implement a risk management program to detect and prevent or

minimize the consequences of an accidental release. These facilities, known as RMP facilities, include chemical manufacturers and water treatment plants. Natural hazards that are exacerbated by climate change could, for example, result in flooding that inundates tanks and pipelines, leading to corrosion, severance of pipe connections, and rupture. Other climate-related hazards that could impact RMP facilities include sea level rise and hurricane force winds. Risks from RMP facilities affect minority and low-income populations to a greater degree than they affect other populations given the proximity of such communities to RMP facilities (U.S. Government Accountability Office, 2022).

## 5.FACILITIES AND OPERATIONS

EPA Region 2's main office is in Lower Manhattan, with other facilities in Edison, NJ, and Guaynabo, PR, as well as small field offices in Hudson Falls and Buffalo, NY, Stamford, CT and in the U.S. Virgin Islands. Our Edison, NJ facility houses, among other things, our regional laboratory, and EPA's Emergency Response Team. Overall, EPA Region 2 currently has approximately 750 employees. The climate change impacts discussed in the above sections present a number of risks to EPA Region 2's staff, facilities, assets, and day-to-day operations, as summarized below.

### *FACILITY OPERATIONS, SAFETY AND EMERGENCY COMMUNICATIONS*

Extreme heat, poor air quality or other weather conditions exacerbated by climate change may increase the health risks of EPA Region 2 employees and contractors engaged in field work (such as sampling, remediation and inspections). This may force them to either delay such work or forgo it completely. In addition, increased demands placed on electrical grids during heat waves could jeopardize the grids' integrity or force utility providers to institute rolling brownouts or blackouts. The occurrence of such outages would force EPA to use auxiliary power sources (generators, uninterrupted power supplies). Building lighting, HVAC systems and/or elevator service may have to be reduced or adjusted to compensate for the loss of power. EPA offices could potentially close for short periods of time due to impacts of hurricane, tropical storms or other weather events and potential impacts on the facilities themselves and the employees' ability to safely travel to and from work. In addition, potential water shortages due to reduced water availability as a result of prolonged drought could disrupt day to day operations. Severe storms (for example, as seen during Superstorm Sandy) could also cripple public transportation systems, highways, and roads, and/or result in significant gasoline shortages, thus preventing EPA Region 2 employees from being able to come into work. Many of these scenarios are already addressed as a result of the implementation of EPA's COVID-19 Protocol, as EPA has prepared and continues to prepare for such scenarios through our telework program, portable computing equipment for employees, remote networking capabilities, and development of e-recordkeeping, e-reporting and e-workflow systems, but at a minimum, some impact on productivity can be expected. In addition, many regional staff conduct field-based work, such as site remediation, sampling, and inspections and instability of weather patterns (with more heavy snow and ice events in winter months in Northeast; more severe tropical storms in the Caribbean) impacts the safety of such staff traveling to and from remote (and sometimes off-road) locations and increases the chance for automobile accidents with government vehicles. Although it is true that over the course of EPA's response to the COVID-19 pandemic, we have been able to adjust some of our field-based work to accomplish some portion remotely (i.e., off-site compliance record reviews, MS teams closing/opening meetings), not all field-based work could be so handled and thus, an impact on the effectiveness of EPA Region 2's field activities will likely occur as a result of climate change.

EPA Region 2 has Continuity of Operations Plans that are formulated to address an "all hazards" approach. Damages to EPA facilities and/or impacts to critical infrastructure due to extreme weather events could force EPA Region 2 to implement those plans, or even Devolution of Operations Plans, for EPA to continue to execute Mission Essential Functions. The Region maintains a Continuity of Operations site in Edison, NJ that can provide fully supported workspace for up to 200 emergency support personnel. The site has backup power and was constructed to withstand hurricane force winds and earthquake level forces.

Over time, climate change may result in EPA Region 2 personnel, including those working in our emergency response program or who collect and/or analyze environmental samples (and our contract support staff, public affairs staff, and others) being increasingly drawn way from their normal day-to-day activities to respond to extreme weather events or emergencies. This, in turn, could lead to a reduced capacity to perform regular duties (e.g., monitoring compliance with and enforcing hazardous waste laws).

### *IMPACTS ON WATER SUPPLIES USED BY EPA REGION 2*

As described previously, water availability, quality, and safety could be compromised by climate influenced events. At all regional offices and the laboratory, the staff relies upon potable drinking water from municipalities. The availability of safe drinking water (as described in the Superstorm Sandy example) needs to be considered for all offices. Water supply issues could impact the Regional Lab at Edison, NJ, and its ability to operate. In Edison, the ORD National Risk Management Research Laboratory conducts research on stormwater management practices and technologies. In-situ research requires copious amounts of water to mimic various storm intensities (and related overflows). Droughts can impact the Laboratory staff's ability to test technologies and conduct research because access to water could be limited through rationing/availability.

EPA developed a Water Conservation Strategy that identifies water conservation projects and approaches that reduce potable water use by 2% annually. This strategy applies to EPA-owned spaces, such as the Edison, NJ facility and laboratory that are owned and operated by the EPA Region 2. Projects to ameliorate local water supply issues include gray water (rainwater runoff and water condensation) capture for cooling. Increased drought intensity – and overall changes with the frequency and intensity of storm events – may reduce the availability of gray water over time.

In addition, water shortages could impact office operations of leased space in Puerto Rico, U.S. Virgin Islands, New York, and New Jersey. Spaces leased from the U.S. General Services Administration (GSA) may be dependent upon water for consumption, cooling, landscaping, etc. However, GSA (directly or indirectly) is the responsible party for addressing water conservation and stormwater reduction. During extreme drought conditions, employees may be asked to conserve water such as limit watering plants, showering at the facility gym, etc. Long-term droughts and increased scarcity of water may cause local water rates to increase thereby increasing operational costs related to potable water use in office buildings and negotiated during lease renewal.

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# 4. Priority Actions

This section presents a list of priority actions that represent Regional actions to reduce the impacts of climate change on EPA Region 2 programs and authorities. EPA Region 2's 42 priority actions are categorized into six thematic areas: (1) Advance Research, Systems and Guidance that Support Climate Adaptation in EPA Region 2; (2) Leverage Partnerships & Conduct Outreach to Enhance Adaptative Capacity in EPA Region 2; (3) Seek Opportunities to Integrate Environmental Justice into Each of Our Climate Change Priority Actions, to the Extent Practicable; (4) Support the Use of Disaster Recovery Resources and Mitigation Strategies to Assist States, Local Communities, Indian Nations, and Territories in their Adaptation Efforts; (5) Use our Authorities to Innovate and Expand our Work on Climate Adaptation; and (6) Maintain EPA Region 2 Facilities and Operations.

In alignment with EPA's October 2021 National *Climate Adaptation Action Plan* and Administrator Regan's 2021 *Policy Statement on Climate Change Adaptation,* each listed Regional priority action includes the following information: (1) a description of the priority action; (2) a brief explanation of how the Region will measure progress on the priority action; (3) the vulnerabilities addressed by the priority action; (4) any co-benefits associated with the priority action (such as mitigation of greenhouse gases and other pollution, public health, economic growth and job creation, national security, and environmental justice); (5) whether sufficient resources currently exist to implement the priority action or additional resources will be required; (6) linkages to the priorities in EPA's October 2021 National *Climate Adaptation Action Plan* (see "Climate Adaptation Priorities" insert, Box 1, below); and (7) linkages to the non-climate change goals in EPA's strategic plan (see "FY 2022-2026 EPA Strategic Plan Framework" insert, Box 2, below).

The climate adaptation priorities in EPA's October 2021 National *Climate Adaptation Action Plan*, which are referred to by number in each action, below, are as follows:

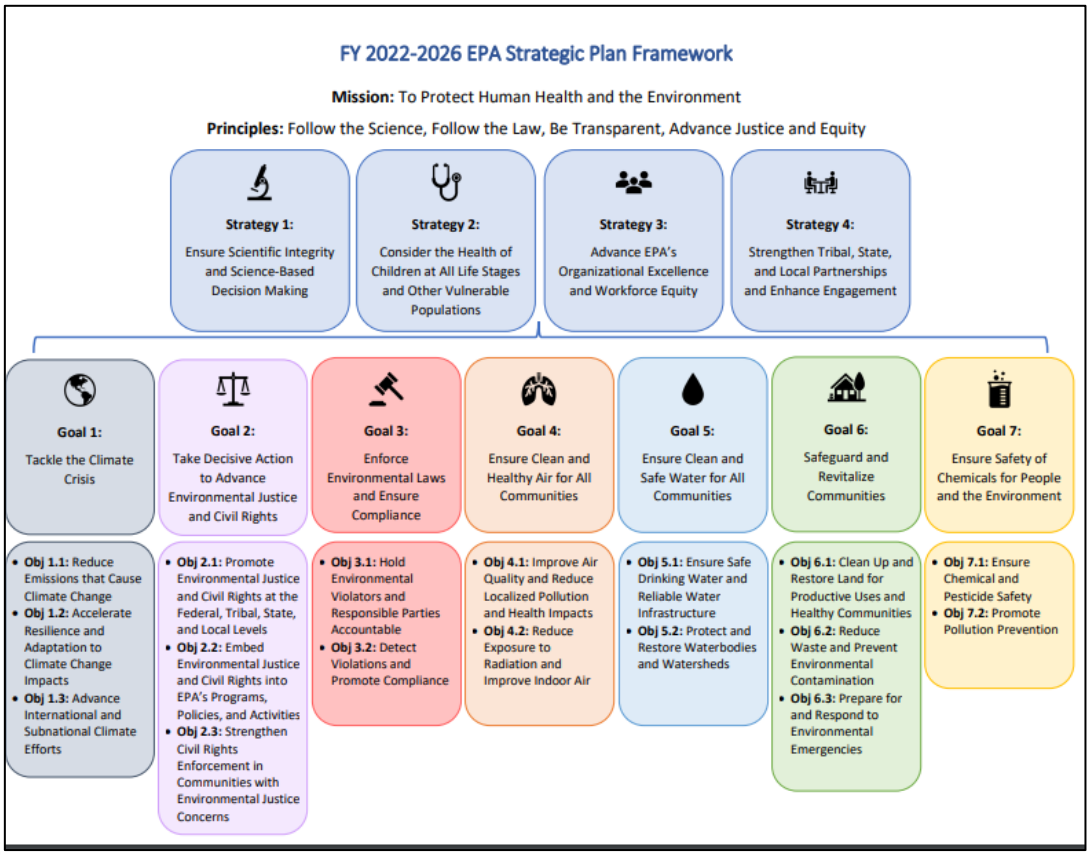
**BOX 1:**

**Climate Adaptation Priorities**

1. **Integrate climate adaptation into EPA programs, policies, rulemaking processes, and enforcement activities.**
2. **Consult and partner with states, tribes, territories, local governments, environmental justice organizations, community groups, businesses, and other federal agencies to strengthen adaptive capacity and increase the resilience of the nation, with a particular focus on advancing environmental justice.**
3. **Implement measures to protect the agency's workforce, facilities, critical infrastructure, supply chains, and procurements processes from the risks posed by climate change.**
4. **Measure and evaluate performance.**
5. **Identify and address climate adaptation science needs.**

The linkages to EPA's non-climate change goals in EPA's Fiscal Year 2022-2026 Strategic Plan Framework, which are referred to by number in each Regional priority action, below, are as follows:

**BOX 2:**




EPA Region 2 recognizes the iterative nature of adaptation planning. We will therefore use an adaptive management framework, to revisit, adjust, amplify and narrow these priority actions and align our work with adaptation planning developments in EPA's national offices. An adaptive management framework will assist the Region to address evolving information and uncertainties about regional climate impacts, effectiveness and feasibility of our priority actions, and changing resources and needs. We view this Plan as a living document that the Region will periodically revisit, and we will do so in an inclusive manner in collaboration with our partners and stakeholders, recognizing that there are needs common to many stakeholders within the region as well as distinct needs specific to certain populations and communities. EPA Region 2 also recognizes that our governmental partners and non-governmental stakeholders have been advancing adaptation within NY, NJ, PR, the USVI and in the Indian Nations for some time. It is our intent to partner with them as we consider future revisions to the priority actions in this Plan.

The priority actions in this Plan cover both fiscal year 2022 (FY'22) and FY'23 unless otherwise noted. Although partial work on some of these priority actions can begin, and have begun in FY'22, many of the actions depend on receiving additional resources. Therefore, we have indicated "use existing and additional resources" for those priority actions that can begin but depend on additional resources to reach the stated measure/metric/target. In addition, some of the actions are dependent on in-person events, for example at schools, and are therefore subject to change based on changing COVID restrictions.

In carrying out the priority actions, EPA Region 2 will take steps to ensure that the outcomes of investments using Infrastructure Investment and Jobs Act (IIJA, or Bipartisan Infrastructure Law [BIL]) funds are resilient to the impacts of climate change. While one of the priority actions described below – priority action number 2.2 -- specifically references partnering with state and federal agencies on the BIL funds, EPA Region 2 will more broadly explore opportunities to integrate climate change considerations into its financial assistance programs in order to expand support for projects that increase climate resilience while delivering co-benefits for public health, the mitigation of greenhouse gases, and

the reduction of other pollution. EPA Region 2 will also provide technical assistance to recipients of BIL funds to help them make climate smart infrastructure investments.

## Theme 1: Advance Research, Systems and Guidance that Support Climate Adaptation

EPA Region 2 has identified the following 9 priority actions under this theme:

- 1.1 - Update the climate change portion of EPA Region 2's Five-Year Review Guidance to provide additional guidance to Remedial Project Managers (RPMs) on screening sites for climate vulnerabilities, update Green Remediation metrics and expanding collection of data, and develop tools RPMs can use to evaluate Climate Risks, such as remedy database and best practices. (SEMD)
    - Measure/Metric/Target: Train staff on updated Five-Year Review Guidance and tools. Goal is 2-3 trainings per year with additional trainings for new RPMs if necessary.
    - Vulnerability Addressed: Changes in precipitation patterns and temperature as a result of climate change may adversely affect the performance and permanence of some site cleanup remedies and may require some remedies to be changed.
    - Strategic Plan Linkage: 6
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Protection of public health and the environment by making Superfund remedies more resilient.
    - Resources: Requires current and additional resources

- 1.2 - Conduct a vulnerability assessment of existing remedies using various screening tools available and prioritize those that need further evaluation. (SEMD)
    - Measure/Metric/Target: In FY'22, through section and/or branch meetings, promote conducting vulnerability assessments for each site in EPA Region 2.
    - Vulnerability Addressed: Changes in precipitation patterns and temperature as a result of climate change may adversely affect the performance of some site cleanup remedies and may require some remedies to be changed.
    - Strategic Plan Linkage: Goal 6
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 4
    - Co-Benefits: Protection of public health and the environment by making Superfund remedies more resilient.
    - Resources: Uses current resources

- 1.3 - Develop and implement changes to regional compliance monitoring and enforcement processes to strengthen the Region's adaptive capacity and resiliency such as e-workflows, e-reporting, and electronic recordkeeping. (ECAD)
    - Measure/Metric/Target: In FY'22, work with IRMB to modernize ECAD's SharePoint Field Activity Sites to be able to add recordkeeping schedules and improve efficiency of existing e-workflows. In FY '23, begin implementation of such sites across ECAD's enforcement programs for new compliance assurance and enforcement work and begin adding the correct recordkeeping information to historical data transferred over in FY'22.
    - Vulnerability Addressed: Facility Operations, Safety and Emergency Communications
    - Strategic Plan Linkage: Goal 3
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 4

    - Co-Benefits: Government-wide priority to go paperless, more efficient records management; enable workplace flexibilities; improve timeliness of compliance monitoring and enforcement processes.
    - Resources: Requires additional resources

- 1.4 - Determine the impacts of increased residential electrification (non-gas homes), vehicle electrification, and cryptocurrency on electrical grid resilience in the face of extreme heat events, and on increased climate-related ozone formation (ARD)
    - Measure/Metric/Target: Quantification of impacts of electrification. In FY'22 ARD will scope and develop an EPA research proposal on determining the impacts of electrification in EPA Region 2. In FY'23, if the proposal is selected, EPA Region 2 will begin modeling and quantification of electrification.
    - Vulnerability Addressed: Extreme heat vulnerabilities to human health and the built and natural environment.
    - Strategic Plan Linkage: Goal 4
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 4
    - Co-Benefits: If the impacts of residential and vehicle electrification demonstrate a reduction in emissions in the Region, the information can be used to increase support for these efforts and demonstrate the need to develop zero carbon emissions energy generation. The impact of cryptocurrency could shape how the Region looks at these activities as sources that electrical suppliers need to account for in determining generation needs. This action will also provide information on particulate matter emissions. There are vulnerable communities that are impacted by ozone nonattainment issues.
    - Resources: Requires additional resources

- 1.5 - Modeling and demonstrating the increased impacts of increased cooling degree days (CDD) and High Electric Demand Day (HEDD) emissions by out-of-Region sources to quantify and demonstrate the impacts on the NY metro area O3 nonattainment area. (ARD)
    - Measure/Metric/Target: Meeting the National Ambient Air Quality Standards (NAAQS) for O3 (Ozone). In FY'22 ARD will scope and develop an EPA Research Proposal on modeling the impacts of CCD and HEDD emissions on ozone concentrations in the NY metro area. In FY’23, if the proposal is selected, EPA Region 2 will begin working on the action.
    - Vulnerability Addressed: Extreme heat vulnerabilities to human health and the built and natural environment
    - Strategic Plan Linkage: Goal 4
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 4
    - Co-Benefits: Information from this action can be used to assist energy suppliers on how to plan for meeting future demand. Vulnerable communities are impacted by the increased CDD with respect to both air quality impacts and economic impacts due to increased energy use.
    - Resources: Requires additional resources

- 1.6 - Monitor/review the identified biannual Regional Science Needs and research proposals to ensure climate adaptation needs are recognized, where applicable (LSASD)
    - Measure/Metric/Target: Quarterly meetings to monitor/review needs and proposals to ensure climate adaptation needs are addressed.
    - Vulnerability Addressed: All vulnerabilities
    - Strategic Plan Linkage: Goal 1
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 2 and 5
    - Co-Benefits: Development of tools and gathering of data
    - Resources: Requires additional resources

- 1.7 - Finalize the EPA/Federal Emergency Management Agency (FEMA), New York State Department of State (NYS DOS) RISE Tool, with consideration of environmental justice concerns, and expand the number of communities the Region is supporting in the Technical Assistance workshops provided and in the number of communities we are able to support in follow-up steps (SPO)
    - Measure/Metric/Target: In FY'22, the RISE Tool will be finalized, and EPA Region 2 will seek Hurricane Ida funding to support implementation of the RISE tool in at least one community during FY'23; In FY'23, EPA Region 2 will partner with FEMA and NYS DOS to implement the RISE tool in the Hurricane Ida-funded community. EPA will also look to use Local Foods Local Places to address food supply shortages after disasters.
    - Vulnerability Addressed: Communities vulnerable to disasters and extreme storm events.
    - Strategic Plan Linkage: Goal 6
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 2
    - Co-Benefits: Environmental justice
    - Resources: Uses current resources

- 1.8 - Identify opportunities to evaluate site locations and incorporate green cleanup techniques and more resilient cleanup approaches as part of the long-term stewardship of RCRA corrective action and Polychlorinated biphenyls (PCBs) cleanup approvals. (LCRD)
    - Measure/Metric/Target: Measure: Increase outreach and education around green cleanup techniques; Metric = # of sites utilizing green cleanup techniques for corrective action and PCB
    - Vulnerability Addressed: RCRA corrective actions located in floodplains, areas subject to sea level rise, or other areas that could be affected by threats from climate change.
    - Strategic Plan Linkage: Objective 6.1
    - Oct. 2021 National Adaptation Plan Linkage: Priority 1
    - Co-Benefits: Public health and environmental justice
    - Resources: Uses current resources

- 1.9 - Promote research and monitoring within EPA and in collaboration with other federal agencies and local stakeholders to conduct research and management of coral reef infrastructure and advance climate adaptation measures for coral reefs. (CEPD, LSASD, WD)

    - Measure/Metric/Target: In FY'23, collaborate with the Caribbean Coral Reef Partnership, USVI Reef Resilience Network, Sea Grant, including participating in annual meetings; Seek opportunities for research with EPA's Office of Research and Development (ORD); Seek opportunities for Supplemental Environmental Projects (SEP).
    - Vulnerability Addressed: Water acidic environment that dissolves the hard shells of corals, shellfish, and smaller organisms.
    - Strategic Plan Linkage: Goal 5
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 2 and 4
    - Co-Benefits: Aquatic ecosystems
    - Resources: Requires additional resources

## Theme 2: Leverage Partnerships & Conduct Outreach to Enhance Adaptative Capacity

EPA Region 2 has identified the following 17 priority actions under this theme:

- 2.1 - Organize and promote wide participation at the *3rd Climate Change in the Caribbean Conference: Promoting Climate Resilience in the U.S. Virgin Islands and Puerto Rico*. This conference is an educational

tool that, in addition to climate adaptation and mitigation, will include discussions related to Indigenous Engagement, Climate Justice including Equity and Environmental Justice, and will promote more collaboration among the federal and the U.S. Caribbean territorial governments (PR and the USVI), community organizations, academia, philanthropy entities, among others. (CEPD and ORC)

- Measure/Metric/Target: Hold one of two conferences in FY'22 (second conference centered on Pacific U.S. Insular Areas and Hawai'i); In FY'23, develop workplan for U.S. Pacific and Caribbean Islands, based on outcome of the conferences, for 2022-2024
- Vulnerability Addressed: All vulnerabilities
- Strategic Plan Linkage: Goal 2
- Oct. 2021 National Adaptation Plan Linkage: Priority 2
- Co-Benefits: Public health and environmental justice
- Resources: Uses existing and additional resources

- 2.2 - Partner with state and federal agencies to include climate resiliency and climate justice considerations in all Bipartisan Infrastructure Law-related projects such as water infrastructure, National Solid Waste for Recycling Infrastructure Grants, Brownfields, Pollution Prevention and Source Reduction Assistance Grants. (WD, LCRD, and CEPD)
  - Measure/Metric/Target: Since this is the first year that we are implementing this new grant program, we can estimate that 20% of all WD projects will include climate justice considerations. However, this is subject to on-the-ground implementation experience.
  - Vulnerability Addressed: Sewers and wastewater systems; drinking water quantity and quality; recreational water quality; water infrastructure; solid waste infrastructure.
  - Strategic Plan Linkage: Goal 5, Obj 5.1, 5.2; Goal 2, Obj 2.1, 2.2; Goal 6, Obj 6.1
  - Oct. 2021 National Adaptation Plan Linkage: Priority 2
  - Co-Benefits: Environmental justice
  - Resources: Use current and additional resources

- 2.3 - Increase water-related climate literacy and information exchange, this includes the development of workshops and presentations where the Water Division highlights climate change as a significant component (WD)
  - Measure/Metric/Target: Offer two workshops to communities and/or schools with environmental justice concerns in FY'22 and at least two workshops in FY'23.
  - Vulnerability Addressed: All water-related vulnerabilities
  - Strategic Plan Linkage: Goal 5, Obj 5.1, 5.2
  - Oct. 2021 National Adaptation Plan Linkage: Priority 2
  - Co-Benefits: Environmental justice
  - Resources: Uses current and additional resources

- 2.4 - Incorporate climate change language into news releases and social media content (including funding opportunities), as appropriate, and plan and execute public events and elected official briefings that support EPA Region 2 Climate change related programs and activities. Distribute existing climate change literature and tools the public can take. (PAO)
  - Measure/Metric/Target: In FY'23, 5 news releases and 5 social media posts, each with reference to number of funding opportunities.
  - Vulnerability Addressed: All vulnerabilities
  - Strategic Plan Linkage: Goal 2, Obj 2.1
  - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 2
  - Co-Benefits: Environmental justice, public health, other pollution, resiliency
  - Resources: Use Current resources

- 2.5 - Advance adaptation in EPA Region 2 through the Mid-Atlantic Federal Climate Partners (MAFCP) including efforts to coordinate on programs and resources with our Partners. (CCWG)
    - Measure/Metric/Target: Raise opportunities for cross-Agency collaboration on adaptation during at least 4 MAFCP meetings in FY'22 and identify at least one project for FY'23.
    - Vulnerability Addressed: Any of the vulnerabilities could potentially be addressed through cross-Agency collaboration
    - Strategic Plan Linkage: Goals 2 and 6
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Environmental justice
    - Resources: Uses existing and additional

- 2.6 - Partner with Indian Nations, through collaboration and consultation, on their current and future resiliency efforts. (SPO)
    - Measure/Metric/Target: Have at least 5 engagements a year to collaborate with Nations.
    - Vulnerability Addressed: A number of different specific vulnerabilities of Indian Nations.
    - Strategic Plan Linkage: Objective 1.3, 2.1, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Environmental justice, disaster mitigation, resiliency
    - Resources: Requires current and additional resources

- 2.7 - Partner with Indian Nations to identify techniques for addressing invasive species impacting biodiversity and crop harvesting. (SPO)

    - Measure/Metric/Target: Hold meetings with the Indian Nations within EPA Region 2 and with EPA Region 2's program offices to develop a strategy and identify resources for next steps. Develop a draft resource list and strategy in FY '22 and finalize the resource list and strategy in FY '23.
    - Vulnerability Addressed: This action will address agriculture-related and trauma-related vulnerabilities
    - Strategic Plan Linkage: Objective 5.2
    - Oct. 2021 National Adaptation Plan Linkage: Priority
    - Co-Benefits: Water quality, environmental Justice
    - Resources: Requires additional resources

- 2.8 - Partner with Indian Nations to identify shoreline stabilization techniques. (SPO)
    - Measure/Metric/Target: Meet with Nations within EPA Region 2 and with EPA Region 2 program offices to develop a strategy and identify resources for next steps. Develop the draft resource list and strategy in FY'22 and finalize the resource list and strategy in FY'23.
    - Vulnerability Addressed: Water-related vulnerabilities
    - Strategic Plan Linkage: Objective 2.1, Objective 5.2, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 2 and 5
    - Co-Benefits: Water quality, environmental justice
    - Resources: Requires additional resources

- 2.9 - Promote Integrated Pest Management Practices (IPM) and compliance assistance to schools in environmental justice areas by collaborating with them through IPM assessments. (LCRD)
    - Measure/Metric/Target: Measure = Number of IPM assessments conducted; Metric = Number of schools receiving outreach and education on IPM and Pesticide Safety. Target for FY'22 is 5-10 private schools and 3 public schools, in 3 environmental justice areas.
    - Vulnerability Addressed: Changes in temperature and precipitation levels are expected to result in increased cases of the West Nile Virus and other diseases carried by mosquitoes and pests.

    - Strategic Plan Linkage: Objective 7.1
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Environmental justice
    - Resources: Uses current and additional resources

- 2.10 - Expand the monthly "Resource Newsletter" that currently focuses on community development to include adaptation and recovery resources to the extent possible. We will also work to expand the audience to ensure communities most at risk to disaster impacts are able to access the newsletter. This will include translation of the Newsletter into Spanish. (SPO)

    - Measure/Metric/Target: Include adaptation/recovery resources in 75% of editions.
    - Vulnerability Addressed: Several vulnerabilities related to extreme weather
    - Strategic Plan Linkage: Goal 2, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 2
    - Co-Benefits: Environmental justice, disaster mitigation
    - Resources: Uses current resources

- 2.11 - EPA Region 2 will leverage its partnerships with ORD and other agencies and institutions to address the mental health and trauma-related impacts of climate change using our respective programs and authorities. (SPO)
    - Measure/Metric/Target: In FY ’22, EPA Region 2 will have an initial meeting with ORD and at least two other partners to explore opportunities for collaboration on climate change-related mental health. EPA Region 2 will also pilot the use of ORD’s ERB tool during FY’22 in one EPA Region 2 community and meet at least once with HUD, HHS and FEMA to identify how to support communities experiencing trauma after disasters using our base programs and resources. In FY’23, EPA Region 2 will highlight the results from the ERB pilot and explore expansion to other communities.
    - Vulnerability Addressed: Mental health and trauma-related effects from climate hazards
    - Strategic Plan Linkage: Goal 2
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health, environmental justice
    - Resources: Uses current and additional resources

- 2.12 - Advance the use of Environmental Collaboration and Conflict Resolution (ECCR) (which includes the use of facilitators and mediators) within EPA Region 2 and/or with our partners and stakeholders to support collaborative processes on climate change adaptation. (ORC)
    - Measure/Metric/Target: In FY’22, promote the use of ECCR for climate change adaptation, highlighting the linkage with environmental justice, at three events available to EPA Region 2 staff and/or our partners and stakeholders.
    - Vulnerability Addressed: This action addresses the challenges experienced during collaborative efforts and potential conflicts related to climate change
    - Strategic Plan Linkage: Goal 4; Cross-Agency Strategy 4
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 2
    - Co-Benefits: Improved relationships with EPA Region 2 partners and stakeholders
    - Resources: Current and additional resources

- 2.13 - EPA Region 2’s Climate Change Workgroup will form a subgroup to explore strategies to support communities that lack capacity to access grants and other funding opportunities on adaptation (All Divisions)

    - Measure/Metric/Target: The subgroup will have at least 3 meetings during FY'23 with the goal of establishing steps the Region can take to build community capacity to access funding and encourage workforce development.
    - Vulnerability Addressed: The disproportionate impacts on overburdened and underserved populations is compounded by a lack of resources to access grants.
    - Strategic Plan Linkage: Goal 2, Objective 2.2 & Goal 6, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health, Environmental justice, disaster mitigation
    - Resources: Requires additional resources

- 2.14 - EPA Region 2 will meet with government and academic partners to explore opportunities to collaborate on addressing the heat island effect in our Region and use social media to raise awareness about the heat island effect and strategies to address it, for example, white roofs and green roofs (SPO and ARD)
    - Measure/Metric/Target: At least 3 meetings by the end of FY'23 with the goal of establishing steps the Region can take to build community capacity to address the heat island effect
    - Vulnerability Addressed: The disproportionate impacts on overburdened and underserved populations are compounded by a lack of resources to access grants.
    - Strategic Plan Linkage: Goal 2, Objective 2.2 & Goal 6, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health, Environmental justice, disaster mitigation
    - Resources: Requires additional resources

- 2.15 - Conduct outreach on healthy public housing adaptation strategies. (ARD and SPO)
    - Measure/Metric/Target: Meet at least twice with Housing and Urban Development (HUD) and/or other partners by the end of FY'23 with the goal of establishing steps that can be taken to conduct outreach to housing authorities about healthy public housing
    - Vulnerability Addressed: The disproportionate impacts on overburdened and underserved populations
    - Strategic Plan Linkage: Goal 2, Objective 2.2 & Goal 6, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health, environmental justice, disaster mitigation
    - Resources: Requires additional resources

- 2.16 - Engage with youth on climate adaptation to promote learning and capacity among future generations (All Divisions)
    - Measure/Metric/Target: Initiate a climate adaptation webinar speaker series by the end of FY '23 geared to youth that will draw upon both EPA Region 2 adaptation experts and adaptation youth leaders in the Region.
    - Vulnerability Addressed: All vulnerabilities
    - Strategic Plan Linkage: All goals
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health, environmental justice, disaster mitigation
    - Resources: Requires additional resources

- 2.17 - Conduct outreach to municipal separate storm sewer system (MS4) permit communities to support the use of green engineering and native plants that build resilience to droughts and floods and advance food security. (CEPD)
    - Measure/Metric/Target: Conduct 3 (exact number to be confirmed) workshops with MS4 permit communities in Puerto Rico in FY'23.
    - Vulnerability Addressed: Droughts and floods, food insecurity

- Strategic Plan Linkage: Goals 2 and 5
- Oct. 2021 National Adaptation Plan Linkage: Priority 2
- Co-Benefits: Environmental justice
- Resources: Uses current and additional resource

## Theme 3: Seek Opportunities to Integrate Environmental Justice into Each of Our Climate Change Priority Actions, to the Extent Practicable

EPA Region 2 has identified the following 3 priority actions under this theme:

- 3.1 - EPA Region 2 will integrate environmental justice into our adaptation work and, in part, accomplish this priority through coordination of the Region 2 Climate Change Workgroup and Region 2 Environmental Justice Workgroup. (ALL DIVISIONS)
    - Measure/Metric/Target: In FY'22, five of the nine Water Division sections will propose ideas to better integrate climate change and environmental justice into the work they perform. In FY'23, the remaining four of the nine Water Division sections will propose ideas to better integrate climate change and environmental justice into the work they perform.
    - Vulnerability Addressed: All vulnerabilities
    - Strategic Plan Linkage: Goal 2 Obj. 2.1, 2.2
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Environmental justice
    - Resources: Requires additional resources

- 3.2 - Showcase in EPA Region 2 Water Division's annual report our grantees' and partners' efforts to implement climate change adaptation activities, especially in vulnerable populations. (WD).
    - Measure/Metric/Target: In FY'22 and FY'23, WD will include five climate change-related highlights in our annual highlights report.
    - Vulnerability Addressed: Water-related vulnerabilities and vulnerable populations
    - Strategic Plan Linkage: Goal 2
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2 and 3
    - Co-Benefits: Environmental justice
    - Resources: Uses current and additional resources

- 3.3 - Continue to integrate the concept of climate justice into our programs and activities. (WD)
    - Measure/Metric/Target: In FY'22 and FY'23, WD will integrate the concept of climate justice into five (5) of our speeches or talking points for internal or external engagements.
    - Vulnerability Addressed: All water-related vulnerabilities
    - Strategic Plan Linkage: Goal 2 Obj. 2.1, 2.2
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Environmental justice
    - Resources: Uses current and additional resources

## Theme 4: Support the Use of Disaster Recovery Resources and Mitigation Strategies to Assist States, Local Communities, Indian Nations, and Territories in their Adaptation Efforts

EPA Region 2 has identified the following 5 priority actions under this theme:

- 4.1 - Work with our inter-agency partners to identify how disaster funding could be used to support state and local mitigation activities. (All Divisions [SPO Coordinating])
    - Measure/Metric/Target: In FY'22, participate in at least 5 interagency meetings and the National Mitigation Investment Strategy (NMIS) Demonstrate Workgroup to begin to identify BMPs and case studies.
    - Vulnerability Addressed: All
    - Strategic Plan Linkage: Goal 2 and Goal 6
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health and environmental justice
    - Resources: Uses current and additional resources

- 4.2 - Integrate climate change adaptation in disaster recovery and mitigation by supporting energy resiliency efforts in communities, including impacts on utilities, through natural based solutions in watershed management, storm water and flood control to address coastal erosion, and flooding in the Caribbean and other impacted states and communities in EPA Region 2 through coordination with the Disaster Recovery and Mitigation Workgroup. (CEPD and SPO)
    - Measure/Metric/Target: Work with communities in EPA Region 2 to showcase and promote the integration of stormwater management and energy resiliency into their adaptation efforts. In addition, in FY'22, continue to participate in monthly RSFLAG Caribbean energy subgroup meetings and pilot energy efficiency and nature-based solutions in at least 1-2 EPA Region 2 communities.
    - Vulnerability Addressed: Public health and environmental justice
    - Strategic Plan Linkage: Objective 5.3, Objective 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health and environmental justice
    - Resources: Requires additional resources

- 4.3 - Support and develop internal capacity/workforce to develop and implement disaster mitigation, response, and recovery initiatives in EPA Region 2, in particular, for the Caribbean. (ALL DIVISIONS)
    - Measure/Metric/Target: In FY'22, the WD will transfer one full-time equivalent (FTE) to CEPD in order to better coordinate EPA's drinking water program in Puerto Rico. Drinking water is currently threatened by extreme weather that can go from droughts to floods. WD will continue to provide support to CEPD to support drinking water protection from climate threats in FY'23.
    - Vulnerability Addressed: Water infrastructure capacity, solid waste infrastructure, water quality and quantity in estuaries and wetlands, drinking water quality, sewers and wastewater systems
    - Strategic Plan Linkage: Goal 5 Obj. 5.1; Goal 6 Obj 6.3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 3
    - Co-Benefits: Public health and environmental justice
    - Resources: Requires additional resources

- 4.4 - Expand inter-agency partnerships to support disaster mitigation activities in communities, populations, and facilities most at risk to climate impacts. (SPO, ARD, CEPD)

- Measure/Metric/Target: Meet with inter-agency partners on disaster mitigation topics at least 3 times per year.
- Vulnerability Addressed: All vulnerabilities
- Strategic Plan Linkage: Goal 2 and Goal 6
- Oct. 2021 National Adaptation Plan Linkage: Priority 2
- Co-Benefits: Public health, environmental justice, and disaster mitigation
- Resources: Uses current resources

- 4.5 - Work along with Puerto Rico and US Virgin Islands governments and federal partners such as FEMA and HUD to recognize coral reefs, beaches, wetlands, mangroves, dunes, and seagrass meadows as critical infrastructure (CEPD, ORC)
    - Measure/Metric/Target: Hold one public outreach climate change conference to obtain input from federal, territorial, and local stakeholders to discuss the need to recognize these assets as critical infrastructure. We are planning on holding a series of meetings with the Puerto Rico Council of Advisors on Climate Change, academia, and local stakeholders.
    - Vulnerability Addressed: All vulnerabilities
    - Strategic Plan Linkage: Goal 5
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Public health and Environmental Justice
    - Resources: Requires additional resources

## Theme 5: Use our Authorities to Innovate and Expand our Work on Climate Adaptation

EPA Region 2 has identified the following 5 priority actions under this theme:

- 5.1 - Research statutes and regulations that provide discretion for EPA Region 2 to advance adaptation and feed the knowledge we gain/lessons-learned into the broader national effort on climate change. (ORC)
    - Measure/Metric/Target: In FY'22, formulate an internal plan to research the statutes and regulations in conjunction with our participation on the OGC Climate Change Legal Workgroup.
    - Vulnerability Addressed: Potentially All
    - Strategic Plan Linkage: Goal 3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 1
    - Co-Benefits: Protection of public health
    - Resources: Requires additional resources

- 5.2 - Focus regional compliance monitoring activities on sources where compliance with new and/or existing regulations will have the co-benefit of mitigating/adapting to a changing climate (e.g., volatile organic compound inspections in nonattainment areas, Clean Air Act New Source Performance Standards inspections at landfills, or stormwater inspections in flood zones), especially where such activities will advance environmental justice. (ECAD)
    - Measure/Metric/Target: In FY'22, hold 5 internal meetings within ECAD on current climate change-related inspections and tracking; In FY'23, in line with OECA guidance, develop internal tool to begin gathering climate change-related inspection data.
    - Vulnerability Addressed: Actions will help in addressing all known EPA Region 2 vulnerabilities including human health, sewers and wastewater systems, septic systems, wetlands, water quality, overburdened communities, tropospheric ozone pollution, particulate matter, risk of and response to contaminant releases; and use of and exposure to toxic chemicals.

    - Strategic Plan Linkage: Goal 3.2
    - Oct. 2021 National Adaptation Plan Linkage: Priorities 1 and 2
    - Co-Benefits: Mitigation of greenhouse gases and other pollution, protection of public health, and environmental justice
    - Resources: Requires additional resources

- 5.3 - Factor climate change adaptation into enforcement actions/settlements, such as promoting green infrastructure as part of injunctive relief in NPDES stormwater cases. (ECAD and ORC)
    - Measure/Metric/Target: In FY'22, participate in one meeting with the national OECA Climate Adaptation Network. In FY'23, participate in at least two meetings with the OECA Climate Adaptation Network to advance adaptation in our enforcement work such as implementing climate change adaptation enforcement training. In addition, in FY'23 EPA Region 2 will highlight opportunities to incorporate climate change adaptation into enforcement actions/settlements to at least 85% of inspectors/enforcement attorneys.
    - Vulnerability Addressed: Actions will help in addressing all known EPA Region 2 vulnerabilities including human health, sewers and wastewater systems, septic systems, wetlands, water quality, overburdened communities, tropospheric ozone pollution, particulate matter, risk of and response to contaminant releases, and use of and exposure to toxic chemicals.
    - Strategic Plan Linkage: Goal 3.1
    - Oct. 2021 National Adaptation Plan Linkage: Priority 1
    - Co-Benefits: GHG mitigation; protection of public health; environmental justice
    - Resources: Requires additional resources

- 5.4 - Advance adaptation in our permitting actions. (ORC)
    - Measure/Metric/Target: In FY '22, meet with at least two of EPA Region 2's program offices to explore opportunities to incorporate adaptation into permitting in addition to supporting all program offices as opportunities arise.
    - Vulnerability Addressed: Potentially All
    - Strategic Plan Linkage: Goal 3
    - Oct. 2021 National Adaptation Plan Linkage: Priority 1
    - Co-Benefits: GHG mitigation; protection of public health; environmental justice
    - Resources: Requires additional resources

- 5.5 - Coordination with state, local and federal agencies to ensure consideration of hazards and vulnerabilities resulting from climate change are adequately incorporated in NEPA documents. Various adaptations can range from behavioral, management/operations to infrastructural/physical. The range of alternatives should be expanded to include such recommendations. (SPO, CEPD, WD, ARD)
    - Measure/Metric/Target: Meet with state, local and/or federal agencies on ways to address climate hazards and vulnerabilities including potential supply chain management disruptions. Conduct at least 3 meetings.
    - Vulnerability Addressed: All vulnerabilities
    - Strategic Plan Linkage: Goals 2 and 4-7
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Resiliency
    - Resources: Uses current resources

## Theme 6: Maintain EPA Region 2 Facilities and Operations

EPA Region 2 has identified the following 3 priority actions under this theme:

- 6.1 - Maintain Utilities (energy, water, gas) required for facility operation
    - Measure/Metric/Target: Continuing operational utilities for EPA Region 2 facilities.
    - Vulnerability Addressed: Utility loss
    - Strategic Plan Linkage: Develop plans with local utilities
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Maintaining a working base of operations to continue the mission of the agency
    - Resources: Uses current resources

- 6.2 - Provide working space for base operations
    - Measure/Metric/Target: Providing a viable working environment.
    - Vulnerability Addressed: Loss of base operations
    - Strategic Plan Linkage: Develop strategies for obtaining and maintaining office areas for base operations.
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Maintaining operational function
    - Resources: Use current resources

- 6.3 - Maintain communications and technological connectivity
    - Measure/Metric/Target: Maintain communications and technological connectivity.
    - Strategic Plan Linkage: Develop contingencies to maintain off-site communications and remote work locations.
    - Vulnerability Addressed: Loss of off-site productivity and computer communication links.
    - Oct. 2021 National Adaptation Plan Linkage: Priority 2
    - Co-Benefits: Maintaining coordination of all operations.
    - Resources: Use current resources.

# 5. Training Plan for Enhancing Staff Knowledge About Climate Adaptation

Training on climate change impacts and adaptation is a key element of building capacity for adaptation within EPA Region 2. The Region plans to enhance staff, management and partner awareness and knowledge of relevant climate impacts and climate adaptation approaches and to incorporate an environmental justice lens to the extent practicable.

In FY '22, EPA Region 2 will offer to all staff within the Region a Climate 101 training to be developed and finalized by the Office of Policy as well as other training listed in the table below if it becomes available prior to the end of the fiscal year. EPA Region 2 will also initiate an internal speaker series on adaptation and disaster mitigation in FY '22 for EPA Region 2 staff with the goal of having two sessions before the end of the fiscal year that feature panelists presenting on behalf of our governmental partners. EPA Region 2's Water Division, in consultation with the Strategic Programs Office, will also plan to launch an educational initiative to increase water-related climate literacy and information exchange. The Region's Superfund and Emergency Management Division will provide one internal training for its staff in FY' 22 on climate change adaptation and site remedy resiliency.

In FY '23, EPA Region 2 will offer its staff from each Division the opportunity to participate in program-specific training relative to their Division to the extent that it is developed by their counterpart Headquarters program office and ready for distribution before the end of FY '23 (see Headquarters schedule in Table 1, below). The Region will also build upon its speaker series on adaptation and disaster mitigation by hosting four additional internal presentations.

**Table 1**

| Climate Adaptation Training / Webinar Module by Lead Office or EPA Region 2 | Tentative Date Modules will be Available | Tentative R2 Administration Dates | Targeted R2 Staff to be Trained |
|---|---|---|---|
| **Office of Policy (OP) Climate Adaptation 101** | Summer 2022 | Fall 2022, Fall 2023, Fall 2024 | All R2 Employees |
| **Regulation Writers** | End of 2022 | Spring 2023, Spring 2024 | All R2 Employees |
| **Office of Water (OW)** | End of 2022 | Spring 2023, Spring 2024 | WD |
| **Office of Land and Emergency Management (OLEM)** | End of 2022 | Spring 2023, Spring 2024 | LCRD & SEMD |
| **Office of Air and Radiation (OAR)** | End of 2023 | Spring 2024 | ARD |
| **Office of Chemical Safety and Pollution Prevention (OCSPP)** | End of 2023 | Spring 2024 | LCRD |
| **Office of Enforcement and Compliance Assurance (OECA)** | End of 2023 | Spring 2024 | ECAD plus credentialed inspectors in other Divisions and ORC |
| **Office of Mission Support (OMS)** | End of 2023 | Spring 2024 | MSD |
| **Office of Homeland Security (OHS)** | End of 2023 | Summer 2024 | All R2 Employees |
| **Office of International and Tribal Affairs (OITA)** | End of 2023 | Summer 2024 | All R2 Employees |
| **Office of Research and Development (ORD)** | End of 2023 | Summer 2024 | All R2 Employees |
| **Water Division – R2 Water-related educational initiatives** | Fall of 2022 | Fall 2022 | R2 Employees & EJ Communities |
| **SEMD – R2 Climate Change Adaptation and Site Remedy Resiliency** | Summer / Fall 2021 | Summer / Fall 2021 | SEMD Staff |
| **ECAD – R2 Modernization Field Activities Sites Training** | Spring 2022 | Spring 2022 | ECAD Staff |

# 6. Climate Science Needs

EPA Region 2's overarching science need is a tool that integrates sea level rise, storm surge, high tides and extreme rainfall so that we can better make decisions and assist the communities in our Region based on the total water-related impacts of storms. The tool should also incorporate underground hydrology, pumps, and stormwater and groundwater discharges. This is particularly relevant to EPA Region 2 given the climate-related increased intensity of hurricanes and Nor'easters in the Caribbean and Northeast. Tools that have a simplified user interface for local planning within communities would be particularly helpful. If there are existing tools that provide the total water-related impacts, EPA Region 2 would like assistance with understanding which tool to use in a given circumstance so that the Region can most effectively incorporate decisions across-the-board. This information could impact many decisions in the Region, from Superfund remedial actions to Clean Air Act permitting and Clean Water Act enforcement cases as well as community engagement and assistance.

Other EPA Region 2 science needs include:

1. Wetland and Stream Restoration and Preservation - Climate change is predicted to increase coastal and inland flooding, increase the severity and the frequency of storm events, and cause a rise in global sea level resulting in erosion of coastal and riparian areas and periodic inundation of low lying, coastal, and/or riparian areas. Using wetlands and streams to mitigate these adverse effects can increase climate resilience. There are two categories of science needs associated with this item:

    a. **The first category of science need** is to have 1) accurate sea level rise and inland flooding projection tools; 2) existing floodplain, floodplain migration, and marsh migration geospatial data; and 3) mapping that can be used to consider siting of wetland and stream restoration and preservation to help buffer against the effects of flooding and storm surges. Further support for wetlands restoration could come from the GHG sequestration potential of restored wetlands. A tool for calculating this potential would be helpful. The science to effectively design and evaluate the ecosystem and community protection of living shorelines can also increase climate resilience.

    b. **The second category of need** is to evaluate potential impacts of climate change on the health of existing wetland habitats. Healthy wetlands will not only protect land from winds, flooding and storm surges, but also protect other coastal and marine habitats (e.g., coral reefs) from land-based pollution. Overall, wetlands improve water quality, protecting aquatic life from excess carbon, nutrients, and sediments. Wetlands are reservoirs of biodiversity often including threatened and/or endangered species. This information will be used to assist with wetlands restoration, preservation, and resilience.

2. Harmful Algal Blooms (HABs)/Water Quality – HABs, blue-green algae or cyanobacteria, can produce dangerous toxins, such as microcystins and cylindrospermopsin, that can sicken or kill people and animals, raise treatment costs for drinking water, and cause dead zones in water bodies.

    a. **The science need** is to 1) improve analytical methods for measurement and monitoring of toxics related to HABs in freshwater systems; 2) track the presence of cyanobacteria-producing toxins; 3) assess ecosystem response and recovery to changing nutrient loads; 4) assess effects of exposure to cyanobacterial toxins on wildlife and humans; 5) optimize treatment methods (e.g. activate carbon filtration) to remove cyanobacterial toxins; 6) understand nutrients in a changing climate (e.g. hypoxia); 7) examine coastal acidification.

3. Green Infrastructure - encouraging the use of green infrastructure (GI) practices a sustainable mechanism to manage stormwater, treating it as a resource rather than a waste product. There are multiple benefits associated with GI, such as improved habitat and reduced heat island effects.

    a. **The science need** is for continued research regarding design efficiency and optimizing locations. Economic research on lifecycle costs and maintenance is needed. The quantification and the valuation of co-benefits is important to support promoting the expanded use of GI.

4. Superfund – Due to climate change and the resulting increase of major storm events leading to inland and coastal flooding and increased temperatures (i.e., excessive heat) there is a need for RPMs to consider potential site and remediation system vulnerabilities. This would include remedial actions under consideration, under construction or already in place. Implementing remedy resilience measures would ensure that the cleanup of sites would be less affected by climate change.

    a. **The science needs** are as follows: 1) guidance on updated and expanded green remediation metrics that would improve mitigation efforts of cleanups, 2) further development of flood mapping tools and development of tools related to other climate risks (i.e., sea level rise projection) so that assessments can be taken a step further for use in conducting a ranking exercise of site vulnerabilities, 3) ongoing training for RPMs on the use of these tools and 4) development of a website where RPM's can find tools, guidance, training and other resources all in one place to make decisions at their site regarding potential climate change issues.

5. Modeling the Impacts of Climate Change – predicting the impacts of climate change will help develop strategy and policy to improve and protect recreational waters and drinking water supplies. The water quality impacts of climate change can be modeled by linking regional global climate, watershed landside and receiving water quality models. This suite of models can be used to address potential impacts of climate change on water supply systems such as: increased nutrient loading; longer lake stratification periods; increased sediment erosion; and dominance of cyanobacteria. In addition, climate change may also increase pathogen levels and disinfection byproduct precursors. An application of the modeling framework would be to mechanistically represent the production of microcystins in future climate scenarios and develop appropriate nutrient reduction strategies. There are two categories of research needs associated with this item:

    a. **The first science need** is to inventory and evaluate modeling methods that support our programs; build technical capabilities of staff to execute modeling projections; and procure computing space needed to run such models, as needed.
    b. **The second science need** is to continue research regarding production of microcystins from nutrient loadings to be able to develop modeling predictions.

In addition, EPA Region 2 has several project/initiatives in common with other EPA Regions/offices and Agencies that connect with science needs. EPA Region 2 is working with EPA Region 1, and the States of New York and Connecticut on the Long Island Sound Study (LISS) to restore and protect the health of Long Island Sound. Science research questions sometimes arise in the context of the LISS partnership that might benefit from additional support. EPA Region 2 is working with NOAA's Ocean Acidification Project on research on monitoring coastal wetlands and sentinel monitoring related to climate change. This effort might require some additional research support from ORD. EPA Region 2 is also exploring opportunities to collaborate with Regions 3 and 1 on a project they initiated on "blue carbon" resources such as wetlands, tidal marshes, and sea grass that represent potential climate change adaptation, mitigation, and coastal resilience solutions for communities. EPA Region 2 is also participating discussions with Regions 10 and 9 and ORD on island-specific issues and is exploring potential research-related resources identified by ORD. In addition, EPA Region 2 (along with EPA Region 3) is a member of the Mid-Atlantic Federal Climate Partners which could present opportunities for cross-Agency collaboration on science needs.

# 7. Public Outreach

EPA Region 2 values the input of our partners and stakeholders and views their collaboration as critical to development of our final Plan. Even before release of the draft Plan on May 24, 2022, EPA Region 2 met with most of the federally-recognized Indian Nations in our Region over four meetings in early 2022. The information gained during those meetings informed the Indian Nation section of the draft Plan's vulnerability assessment and some of our draft priority actions. After release of the draft Plan, EPA Region 2 initiated an additional consultation period with the Indian Nations that began on June 8, 2022 and ended on July 8, 2022. No further comments were received during that time.

The Region also held two virtual outreach meetings for all of our governmental partners and non-governmental stakeholders. The first meeting took place on June 14, 2022 and was conducted in English with simultaneous Spanish translation. The second meeting, which was focused on Puerto Rico, took place on June 16, 2022 and was conducted in Spanish with simultaneous English translation. Notices of the meetings had previously been sent to over 1,000 partners and stakeholders on June 1, 2022. The notice informed the partners and stakeholders of the two meetings and provided an email address for submitting written input by June 30, 2022.

In total, approximately, 164 participants attended the meetings over the two days. During each meeting, after introductions and a presentation by EPA Region 2 that included an overview of the draft Plan, participants had an opportunity to brainstorm ideas in small simultaneous World Café-style breakout rooms facilitated by EPA Region 2 staff using a virtual whiteboard to capture the participants' ideas. Each meeting included two successive breakout sessions with plenary feedback after each session. To foster robust conversation and generation of ideas during the breakout sessions, two successive questions were posed that were intended to help EPA Region 2 enhance the draft Plan:

(1) "What are your biggest concerns regarding the impacts of climate change in EPA Region 2?"; and
(2) "What adaptation actions should EPA Region 2 take to address your concerns about climate change impacts?"

Participants generated 141 ideas in response to the two questions. EPA Region 2 also received nine letters in advance of the June 30, 2022 deadline at the email address provided in the notice letter. The letters contain additional helpful feedback on the draft Plan. In total, there were 217 distinct suggestions at the meetings and in the letters, many of which touched on similar themes such as access to information, funding opportunities, youth engagement, jobs and food security, among others. These suggestions came from a wide variety of stakeholders including community organizations, academia and government partners.

Because the development of this Plan is not a regulatory action, the Region is not providing a responsiveness summary. However, we have internally tracked each idea presented during the June 14 and 16, 2022, meetings on the draft Plan as well as the ideas offered in the letters submitted to the EPA Region 2 climate change email address. Many of the ideas were incorporated into this final Plan. For example, we added six new priority actions that address input we received related to topics such as building capacity in communities to access funding, healthy public housing, heat island effect, youth engagement, green infrastructure, native plants, food security and coral reefs. We also amended existing draft priority actions to incorporate input we received on topics such as funding (including translation of information on funding opportunities into Spanish), droughts and flooding, food security, impacts on utilities, and supply chains. In addition, the input received during the outreach sessions and in the letters helped us to improve many subsections within the Vulnerability Assessment of this final Plan.

While not every idea provided to EPA is reflected in this final Plan, EPA Region 2 views the Plan as a living document and will revisit many of the ideas provided to us as the Plan develops over time. As of the date of this final Plan, the Region has not received additional resources to carry out its adaptation work. We hope to be able to do much more as we begin to receive resources for this important work. The Region will continue to consider input received during the outreach process for this Plan as we make future revisions, including new and amended priority actions. Note that some partners and stakeholders, after reviewing the draft Plan, recommended that the targets and metrics for the final priority actions include measures that will produce more tangible results in communities. We recognize that, in some cases, the targets and metrics create the beginning of a process that will lead to more tangible results in the future even though those results will not be achieved in FY'22 or FY'23 which are the fiscal years covered by this Plan. However, given the current lack of resources, our strategy is to ensure that, at a minimum, a process is initiated and underway that will create more tangible results in the future.

The input from partners and stakeholders on the draft Plan resulted in significant enhancements to this final Plan and we are grateful for all the suggestions. EPA Region 2 looks forward to continuing the collaborations that we initiated during the outreach on the Plan. We recognize that successful adaptation depends on working with our partners and stakeholders. Therefore, we welcome further opportunities to collaborate after issuance of this Plan.