RIEC4 ANNUAL REPORT

RHODE ISLAND EXECUTIVE CLIMATE CHANGE COORDINATING COUNCIL

JUNE 2016

(Rendering of new beach pavilion at Lincoln Woods State Park)

Cover

Lincoln Woods New “Green” Beach Pavilion

- Passive ventilation and daylighting to minimize the need for cooling/heating
- Highly efficient mechanical, electrical and plumbing systems conserve natural resources
- Native, non-invasive species that require minimal irrigation
- Bike racks added to promote more active/carbon neutral forms of transportation
- Pourous pavers are being utilized around the facility
- Bioretention areas
- Utilization of solar energy
- Scheduled to open summer 2017

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EC4 SCIENCE & TECHNICAL ADVISORY BOARD ANNUAL REPORT (May 2016)
EC4 ADVISORY BOARD ANNUAL REPORT (May 2016)

EXECUTIVE SUMMARY

The impacts of climate change, from rising sea levels to more extreme rainfall events, are already being felt in Rhode Island, like elsewhere in New England. It is widely accepted that action is needed now, not just in the future. By encouraging action now, we can protect people and natural areas from climate change risks, enhance our economic base, increase our competitiveness, and help build resilient communities. The range of potential impacts is extremely broad, and impacts are not exclusive to RI's coastal communities.

The information provided in this report clearly shows that climate change impacts all aspects of RI's well-being – our economy, our infrastructure, our health, and our environment. This year's Annual Report summarizes the activities of the EC4 and the nine agencies/offices that comprise the Council into seven key categories:

- **Adaptation** - *Planning for changes that are expected to occur.*
- **Vulnerability Assessments** - *An important process oriented tool to help make informed choices on topics as complex as climate change.*
- **Mitigation** - *Human intervention to reduce impacts on the climate system, including strategies to reduce greenhouse gas sources and enhancing greenhouse gas sinks. In the context of emergency preparedness, mitigation encompasses a broad range of efforts to reduce loss of life and property by lessening the impact of disasters.*
- **Leading by Example** - *Using our actions to influence others to behave and respond in ways that society deems valuable and appropriate.*
- **Municipal Collaboration** - *Refers to the reality that cities and towns are on the front line of addressing the causes and impacts of climate change. Municipalities can play a significant role in implementing both emission reduction strategies and adaptation plans.*
- **Economic Resilience** - *Goes hand in hand with climate resilience. Thinking creatively about ways to persevere and prosper will require combining public and private sector leadership.*
- **Research and Analysis** - *Improves knowledge of the health and environmental effects of climate change while helping provide long-term solutions.*

Both mitigation and adaptation are necessary to Rhode Island's resilience. To date, the public discourse on climate change has largely focused on greenhouse gas emissions reduction strategies. Moving forward, the public discussion needs expand to prepare Rhode Island for the numerous consequences of climate change. Effective adaptation strategies and actions require further collaboration as we collectively work towards implementation. Now and in coming years, engaging the business community, providing assistance to communities, tracking progress in a transparent manner, and increasing outreach capabilities by weaving climate change (both adaptation and mitigation) into the basic culture of our state continues to be the goal of the EC4.

EC4 HIGHLIGHTS

RI Greenhouse Gas Emissions Reduction Study

The Executive Climate Change Coordinating Council (EC4), with the services of the Northeast States for Coordinated Air Use Management (NESCAUM), is currently conducting a study to evaluate various strategies for reducing greenhouse gas emissions in the state. NESCAUM is currently developing data and methodologies, undertaking modeling and analysis, and performing policy research that will support the creation of the final emissions reduction study. The purpose of the study is to suggest possible strategies, programs, and actions to meet the targets for greenhouse gas emissions reductions according to the schedule specified in the Resilient Rhode Island Act. The EC4 anticipates using the conclusions of the study to recommend a plan by year's end to meet the targets for greenhouse gas emissions reductions.

Shoreline Change Special Area Management Plan

The Coastal Resources Management Council (CRMC) continues work on the **Shoreline Change Special Area Management Plan (SAMP)**, better known as the Beach SAMP developing scientifically-based data and tools to aid in coastal hazard adaptation planning. Revised CRMC Shoreline Change Maps are now completed for five Washington County communities (Westerly, Charlestown, South Kingstown, Narragansett and North Kingstown). These revised maps use 2014 aerial photographs to show how RI's shoreline has changed over time due to erosion, and how we might expect it to change in the future. Additional tools and other key resources are available from the Beach SAMP website to aid the state and municipalities in supporting sound policy decisions which address coastal erosion, sea level rise and storm surge inundation problems. Using an approach similar to that used in developing the Ocean SAMP, CRMC expects this new effort to become a national model for dealing with coastal zone management issues.

RI State Energy Plan – Energy 2035

In October 2015, the State Planning Council voted to adopt RI's new State Energy Plan "Energy 2035" as an element of the State Guide Plan, codifying the Plan as the state's formal long-term, comprehensive energy strategy. The Plan, produced by the RI Office of Energy Resources (OER) in collaboration with the RI Division of Planning, represents Rhode Island's first data-driven energy planning and policy document. Its vision is to provide energy services across all sectors—electricity, thermal, and transportation—using a secure, cost-effective, and sustainable energy system. The Plan sets bold and ambitious goals and strategies for transforming Rhode Island's energy system and charges OER with providing a yearly status update on implementation. Directly related to the work of the EC4, the Plan identifies what opportunities exist in each sector of Rhode Island's energy economy to achieve GHG emission reductions beyond the "business-as-usual" condition. Similarly, the Plan's modeling shows that viable paths exist for Rhode Island to shift to a sustainable, low-carbon future, while simultaneously producing net economic benefits and increasing sector fuel diversity. The EC4

will continue to track the progress of the implementation of Energy 2035 and coordinate across agencies to help RI meet its key goals.

Amendments to Section 145 – Climate Change and Sea Leve Rise of the Coastal Resources Management Program

In January 2016, the CRMC adopted amendments to Section 145 - Climate Change and Sea Level Rise of the Coastal Resources Management Program (CRMP) to update sea level rise (SLR) projections for short-, mid- and long-term timelines of 2035, 2050 and 2100 respectively, as calculated using the current National Oceanic Atmospheric Administration (NOAA) methodology, and based on the Newport, RI NOAA tide gauge. The SLR curves are calculated by the U.S. Army Corps online Sea Level Change Calculator. The Section 145 amendment will provide the state and municipalities with appropriate sea level rise projections to be considered in the planning and design of public and private investments and natural resource restoration projects. CRMC is leading by example in accordance with the Resilient Rhode Island Actions and establishing the sea level rise baseline and projections for the state and municipalities to use in their climate change vulnerability assessments.

Driving Rhode Island to Vehicle Electrification (DRIVE)

In early 2016, OER launched the state's first ever electric vehicle rebate program to support adoption of electric vehicles by Ocean State drivers: Driving Rhode Island to Vehicle Electrification (DRIVE). The program made $200,000 available for qualified Rhode Island residents interested in purchasing or leasing an electric vehicle (EV) to apply for a financial rebate of up to $2,500, based upon vehicle battery capacity. Modeled closely on existing rebate programs offered in other states, DRIVE offers the potential to increase the total number of EVs on Rhode Island roadways by 20-35%. Between February 1 and May 1, 2016, OER issued or reserved 43 DRIVE rebates, representing a 180 percent increase in EV adoption compared with the same period the previous year. For more information on DRIVE, please visit: www.drive.ri.gov.

Lead by Example

In December 2015, Governor Gina M. Raimondo signed Executive Order 15-17: "**State Agencies to Lead by Example in Energy Efficiency and Clean Energy"** establishing a "Lead by Example" program within the Office of Energy Resources to oversee and coordinate efforts at State agencies to reduce energy consumption and greenhouse gas emissions. To achieve these goals and advance its agency mission to lead Rhode Island toward a secure, cost-effective, and sustainable energy future, OER is coordinating efforts across State agencies to reduce energy consumption and costs, lower GHG emissions, deploy renewable energy resources, and foster clean transportation solutions. Among the Governor's directives, OER has been tasked with overseeing and coordinating activities across State government to reduce electric consumption by at least 10 percent below FY14 levels by the end of FY19, identify opportunities to support a full transition toward renewable energy sources by 2025, support the integration of clean

transportation solutions in the State's fleet, and establish a stretch building code for use in all State construction and renovation projects. In 2015, OER advanced a number of initiatives under Lead by Example, including work with the Department of Transportation to convert all State-owned highway streetlights to energy efficient LEDs by the end of 2016. This project has the potential to save hundreds of thousands of dollars in energy and equipment and maintenance costs annually, while enhancing the quality of and control over state roadway lighting. The member agencies of EC4 will continue to collaborate and assist in the implementation of the state's Lead by Example program in 2016 and beyond.

Clean Energy Jobs Report

Strong state support for energy efficiency and renewable energy policies have stimulated a robust market for clean energy goods and services, making Rhode Island home to a new, growing clean energy industry. In early 2016, OER and the RI Executive Office of Commerce released the second annual Clean Energy Jobs Report, which found that employment in Rhode Island's clean economy increased by a staggering 40% over 2015, far exceeding last year's projected growth of 17%. Clean energy jobs now support about 14,000 workers across the state, representing 3% of statewide employment.

Block Island Offshore Wind Project

The 30 Megawatt (MW) Block Island Offshore Wind Project will be the first offshore wind project in the country. Located approximately 3 miles southeast of Block Island, the project started construction in 2015 with the installation of the foundations, which will support the turbine installations. The five jacket system foundations were completed between July and October 2015, and the wind turbine towers began arriving at the Port of Providence in late 2015. The next phase of the project started in January 2016 with cable line preparation work in both Narragansett (adjacent to Scarborough Beach) and Block Island, which will be connected with the 30 MW project. The installation of the cable between the island and mainland is expected to be completed this summer. The wind turbines are scheduled to be installed in the summer of 2016, and the system is expected to be commercially operational by the end of 2016.

CRMC played a key role in the development of the project through the development of the RI Ocean Special Area Management Plan (Ocean SAMP) and subsequent permitting responsibilities. In addition, the Office of Energy Resources alongside a number of Northeast states/partners received $35,000 (out of a total of $600,000 set aside for the project) in competitive funding from the US Department of Energy to explore the potential for mutual action to develop offshore wind at the scale necessary to reduce costs and establish a regional supply chain. *"A Roadmap for Multi State Cooperation on Offshore Wind Development. A Strategy to Achieve a Regional Market of Scale"* will allow OER to share best practices from Rhode Island's experience with the development of the Block Island Wind Farm.

INTRODUCTION

It is our pleasure to submit the 2016 Annual Report of the Executive Climate Change Coordinating Council (EC4) pursuant to RIGL §42-6.2-7. The members of the EC4 approved the submittal of this annual report at its May 2016 council meeting.

The members of the EC4 include the Directors and Commissioners of the following nine agencies/offices: Department of Environmental Management (RIDEM), Coastal Resources Management Council (CRMC), Department of Administration (DOA), Department of Transportation (RIDOT), Department of Health (HEALTH), RI Emergency Management Agency (RIEMA), Office of Energy Resources (OER), RI Division of Planning (Planning) and RI Commerce Corporation (Commerce RI). RIDEM Director Janet Coit continues to serve as the EC4 Chair, with OER Commissioner Marion Gold serving as Vice-Chair.

In July 2014, the General Assembly approved legislation which formally established the EC4. The new law, the Resilient RI Act, sets specific greenhouse gas reduction targets and incorporates consideration of climate change impacts into the powers and duties of all state agencies. The law emphasizes the concept of resilience and developing practical solutions through reductions in greenhouse gas emissions, making preparations for the effects of current and future changes in the state's climate, and ensuring RI prospers by being at the leading edge of the transition to a lower carbon future. These priorities are similarly emphasized in the 2016 RI Clean Energy Jobs Report and the Governor's December 2015 Executive Order to RI state agencies on leading by example in energy efficiency and clean energy.

Two separate advisory bodies, the "EC4 Advisory Board" and the "EC4 Science & Technical Advisory Board" were created by the Resilient RI Act, and significant progress has been made since last summer by both advisory boards on a number of projects. Further details about these two important boards are provided below, and their respective annual reports to the EC4 in May 2016 are attached.

Since the submittal of the Council's last annual report in 2015, the full Council has met eight times. The Council engaged in debate and heard presentations on a wide range of topics including RI riverine flood behavior and climate trends (from the National Weather Service), the President's Clean Power Plan (CPP) as announced in August 2015, Fortified home building standards, The Nature Conservancy's resiliency approach to coastal adaptation planning, URI/CRC's programs to engage local governments in hazard mitigation and coastal resilience, OER's Lead by Example program, HEALTH's climate change initiatives (targeting heat impacts and senior resiliency), Providence's Office of Sustainability new SustainPVD initiative, progress on CRMC's Beach SAMP, CDBG Disaster Recovery funding opportunities in RI, green infrastructure, and many more important topics directly relevant to Rhode Island's mitigation and adaptation priorities. The Council continuously strives to identify ways in which all RI

agencies, offices and arms of government can coordinate to advance the state's carbon reduction efforts and adaptation goals.

The EC4 was pleased to hear directly from Governor Raimondo in November 2015 regarding RI's successful 2015 legislative session on resiliency priorities. She acknowledged the state's unique vulnerability to climate change, and highlighted RI's unique opportunities to be creative and collaborate across all sectors of our economy on real solutions. The members of the EC4 are hoping the 2016 legislative session produces even more victories for RI's resilience efforts.

The work of the EC4 has been guided by a series of goals and objectives outlined in the June 2014 Executive Climate Change Council (EC3) Report "A Resilient Rhode Island: Being Practical About Climate Change". The goals and objectives outlined in the report will continue to drive the priorities of the EC4 over the course of the upcoming year. In coordination with the Office of Management and Budget and the Governor's Office, the EC4 and its members are establishing clear and tangible adaptation and mitigation metrics (both short-term & long-term). We look forward to reporting out additional details on those metrics later in 2016, and how they relate to the goals and objectives of the June 2014 EC3 Report.

Also later in 2016, the EC4 plans, pursuant to RIGL §46-6.2-2, to submit to the Governor and General Assembly a study that includes strategies, programs and actions to meet specific targets for greenhouse gas emissions reductions as follows: (i) ten percent (10%) below 1990 levels by 2020; (ii) forty-five percent (45%) below 1990 levels by 2035; and (iii) eighty percent (80%) below 1990 levels by 2050. OER, RIDEM, RIDOT, and Planning have coordinated in the funding and administration of the Rhode Island Greenhouse Gas Emissions Reduction Study. A project team led by the Northeast States for Coordinated Air Use Management (NESCAUM) is assisting the EC4 with the development of the study. It is important that Rhode Island continue to coordinate its work with other states in the region that are undertaking similar studies.

ADAPTATION

***Adaptation** means planning for climate changes that are expected to occur. These climate changes impact society and ecosystems in a broad variety of ways. For example, climate change can increase or decrease rainfall, influence agricultural crop yields, affect human health, cause changes to forests and other ecosystems, or even impact our energy supply. Climate-related impacts are occurring across regions of the country and across many sectors of our economy. Many state and local governments are already preparing for the impacts of climate change. (US EPA)*

- In January 2016, the CRMC adopted amendments to **Section 145 - Climate Change and Sea Level Rise of the Coastal Resources Management Program (CRMP)** to update sea level rise (SLR) projections for short-, mid-, and long-term timelines of 2035, 2050 and 2100, respectively, as calculated using the current National Oceanic Atmospheric Administration (NOAA) methodology, and based on the Newport, RI NOAA tide gauge. The SLR curves are calculated by the U.S. Army Corps online Sea Level Change Calculator. The Section 145 amendment will provide the state and municipalities with appropriate sea level rise projections for consideration in the planning and design of public/private investments and natural resource restoration projects. CRMC is leading by example in accordance with the Resilient Rhode Island Act and establishing the sea level rise baseline and projections for the state and municipalities to use in vulnerability assessments.

- CRMC continues work on the **Shoreline Change Special Area Management Plan**, better known as the Beach SAMP, developing scientifically-based data and tools to aid in coastal hazard adaptation planning. Revised CRMC Shoreline Change Maps are now completed for five Washington County communities (Westerly, Charlestown, South Kingstown, Narragansett and North Kingstown). These revised maps use 2014 aerial photographs to show how RI's shoreline has changed over time due to erosion, and how we might expect it to change in the future. Additional tools and other key resources are available from the Beach SAMP website to aid the state and municipalities in supporting sound policy decisions which address coastal erosion, sea level rise and storm surge inundation problems. Using an approach similar to that used in developing the Ocean SAMP, CRMC expects this new effort to become a national model for dealing with coastal zone management issues.

- **STORMTOOLS** is a web-based mapping tool to examine the impact of storm surge and sea level rise in Rhode Island. It was developed as part of the Beach SAMP by the URI Ocean Engineering, URI Coastal Resources Center/RI Sea Grant and CRMC project team. Launched in January 2015, this online mapping tool illustrates potential flooding from a variety of different storm events and sea level rise and how coastal flooding will change with sea level

rise. State and municipal planners, public works officials, emergency managers and others can use this tool to identify both where flooding is likely to occur today (e.g. as the result of a tropical storm or hurricane) and where flooding is likely to happen in the future (e.g. in 10, 25, 50+ years as sea level continues to rise). There are two versions, one for homeowners called "STORMTOOLS for Beginners" that provide basic information a property owner would need, and "STORMTOOLS for Municipalities" that provides more in-depth analyses to assess public infrastructure risk. STORMTOOLS has been updated this past year with new water levels and wave data from the 2015 U.S. Army Corps North Atlantic Coast Comprehensive Study (NACCS).

- HEALTH's **Senior Resiliency Project** has received another round of funding from the Office of Housing and Community Development (OHCD) and is entering into Phase 2. In partnership with the Division of Elderly Affairs, Brown University, and other community partners, HEALTH's Climate Change Program is continuing to assist long-term care facilities, senior housing complexes, and older adults prepare for weather related emergencies, such as extreme heat and power outages. Their team of local partners, stakeholders, and Yale New Haven Health System Center for Emergency Preparedness and Disaster Response have completed Phase 1 of the project with 3 pilot sites to help them prepare for these scenarios through intensive and site-specific energy resiliency audits and the development of all-hazards emergency plans that emphasize sheltering in place. Currently in Phase 2, the Project will assist 5 more sites in developing their emergency plans and assessments. In Phase 3, the Project will expand statewide and assist an additional 25 sites.

- HEALTH's Climate Change Program continues to monitor and assist with the surveillance of **ticks, mosquitoes and related vector-borne diseases** that can be exacerbated by changes in climate. The program is assisting with the State Zika preparedness efforts and connecting with national partners to monitor vector relationships to climate change, species, and disease projections. The Program is helping coordinate the distribution of education materials, toolkits, and media related to Lyme disease.

- In order to address **impacts from stormwater run-off from state roads**, in late 2015, RIDOT entered into an agreement (consent decree) with the United States Environmental Protection Agency (EPA) to mitigate failure to meet the conditions of the "General Permit – Rhode Island Pollutant Discharge Elimination System Storm Water Discharge from Small Municipal Separate Storm Sewer Systems and from Industrial Activity at Eligible Facilities Operated by Regulated Small MS4s" (known as the MS4 Permit). Part of the agreement set specific requirements for inventory, maintenance, and capital improvements to the drainage systems of the state. One of the first steps involves an inventory of all drainage structures, along with an assessment of condition. In the face of more frequent heavy rain events in Rhode Island affecting stream flow and run-off, inventorying, maintaining and improving the state's drainage system is a critical step in RIDOT's resilience efforts.

- In September 2015, RIEMA partnered with the United States Army Corps of Engineers (USACE) to establish a **Silver Jackets Team** in Rhode Island. The quarterly Silver Jackets meetings are comprised of State and Federal representatives who support comprehensive and sustainable actions that reduce the level of risk from flooding which result in the protection of life, property and the beneficial functions of floodplains in RI.

- RIDEM - with the assistance of the RI Chapter of The Nature Conservancy and the University of Rhode Island - was one of the first states to forge ahead towards a revision of its **State Wildlife Action Plan (SWAP)**, which aims to: reassess priority species/habitats, and provide more detailed mapping of priority conservation areas; analyze threats affecting fish and wildlife, including those posed from habitat loss, degradation, population growth, and climate change; outline a number of conservation actions to address or alleviate threats and help effectively conserve Rhode Island's valuable wildlife resources. RIDEM worked with multiple key stakeholders to develop this comprehensive plan. Rhode Island wildlife experts are already reporting observable loss of habitat and impacts to species. The updated SWAP recently received final federal approval.

- In the fall of 2014, OER was awarded Hurricane Sandy Community Development Block Grant Disaster Recovery (CDBG-DR) funds to implement a proposed "Energy Resilience Project" centered on the use of **resilient microgrids for critical services**. Microgrids are localized grids that can disconnect from the traditional grid to operate autonomously and help mitigate grid disturbances to strengthen grid resilience. OER is working with a contractor to help develop a list of potential host sites for microgrid implementation. Recommendations will be issued by the end of 2016.

- RIDEM, in collaboration with CRMC and RI Natural History Survey, received a competitive grant proposal from EPA to carry out a multi-year project to **strengthen the wetland monitoring and assessments components of state programs** in order to support adaptation of wetland protection and restoration programs, with an emphasis on coastal wetlands. This will be achieved by strengthening coordination among state programs and partners, refining monitoring strategies and enhancing the foundation of information available to state wetland programs to support adaptive management. In addition the project will serve to foster integration of freshwater and coastal wetland program activities in a manner that will yield improved effectiveness over time.

- The RI Division of Planning, in coordination with CRMC and RIDEM, is considering how climate change will have a significant impact on aquatic habitats and water quality management across Rhode Island as it continues to work on the **Water Quality 2035** State Guide Plan Update. This new guide plan element will consolidate policies and actions targeting water quality and aquatic habitat protection and restoration in one comprehensive plan.

VULNERABILITY ASSESSMENTS

*A **Vulnerability Assessment** is an important process oriented tool to help make informed choices on topics as complex as climate change. Climate change vulnerability assessments convey critical, scientifically based information on how sensitive infrastructure, resources, and populations are to climate change, as well as their capacity to adapt to change. Vulnerability assessments can be utilized in terms of both the "built" and "natural" environment.*

- The **Socioeconomics of Sea Level Rise** project serves as a continuation of RI Statewide Planning Program's sea level rise research efforts. While previous research assessed transportation infrastructure, the Socioeconomics of Sea Level Rise project takes a unique approach, identifying the people and businesses vulnerable to several sea level rise scenarios within RI's coastal communities. Project deliverables will include fact sheets for each of Rhode Island's 21 coastal communities, highlighting the populations and socioeconomic variables most vulnerable to sea level rise.

- The **Transportation Assets Vulnerable to Sea Level Rise** project is seeking to utilize the newly available data from STORMTOOLS to determine what local road and bridge assets will possibly be affected by sea level rise and storm surge within the next century. That information will then be provided to municipal decision makers and members of the public in a dynamic and easy to understand format. The project is on schedule to be completed by the end of FY16.

- The **Coastal Environmental Risk Index** (CERI) project has been launched to assess coastal hazard risk and damage costs in coastal communities. CRMC has partnered with URI Ocean Engineering and URI Coastal Resources Center/RI Sea Grant on this CERI pilot project that will focus on 2 coastal communities, Charlestown and Warwick, with a project completion date of June 2017. The CERI tool will estimate potential damage costs from coastal storms (inundation and waves) to existing homes, businesses, and public infrastructure and will be invaluable in developing adaptation strategies. Following the proof of concept pilot project, the CRMC hopes to extend the CERI tool statewide provided additional funding (approximately $250-$300K) can be secured to complete the analysis for the remaining 19 coastal communities. The CERI tool will be integrated within the STORMTOOLS platform.

- RIDEM's Bureau of Environmental Protection is commencing a multi-office examination at facilities regulated by RIDEM with the intent of cross-referencing risk - *in terms of the types & amounts of chemical used or managed* - and vulnerability to impacts from climate change.

Relying heavily upon GIS, STORMTOOLS, RI's floodplain maps, and similar resources, it is designed as a mapping project that will assist RIDEM's programs to proactively **address the hazards that arise from chemical and fuel use** in numerous regulated sectors. RIDEM is in the preliminary stages of designing this project, which is being managed out of the Office of Customer and Technical Assistance. Eventually, RIDEM would like to provide technical assistance to companies or facilities to help mitigate some of the risks of storing and using these materials in areas vulnerable to the impacts of climate change. RIDEM is seeking EPA P2 funding to support certain aspects of the project.

- In late 2014, RIDEM launched a comprehensive **Wastewater Infrastructure Vulnerability Assessment.** This project responds to a growing nationwide concern about the potential effects of climate change on existing wastewater collection and treatment infrastructure, particularly acute after the historic March 2010 floods. This assessment will evaluate the potential for physical and operational impacts to wastewater infrastructure. The goal is to identify specific vulnerabilities as well as adaptive strategies. These concerns relate to how issues such as increased storm and precipitation frequency and intensities, as well as sea-level rise and greater storm surge heights, will impact existing and planned wastewater infrastructure. The planning tools identified in the assessment are expected to include both short and long-term actions that result in modifications of infrastructure or operations in order to improve reliability under changing conditions. The assessment is expected to be completed in the fall of 2016.

MITIGATION

Mitigation *is human intervention to reduce impacts on the climate system; it includes strategies to reduce greenhouse gas sources and emissions, and enhancing greenhouse gas sinks. It is important to note that the term "mitigation" has a different meaning in the context of emergency preparedness, where "hazard mitigation" encompasses a broad range of efforts to reduce loss of life and property by lessening the impact of disasters.*

- In 2015, OER and RIDEM continued their collaboration to implement **The Regional Greenhouse Gas Initiative (RGGI)**, a market-based cap and trade program among nine northeastern and Mid-Atlantic states (RI, CT, DE, MA, ME, MD, NH, NY, VT) to reduce emissions of carbon dioxide (CO2), the principal gas that contributes to climate change. The program establishes a regional budget (cap) of CO2 allowances and each state's allocation of CO2 allowances under the budget. In Rhode Island, the RIDEM Director and the Commissioner of the OER are on the RGGI Inc. Board. Rhode Island primarily invests CO2 allowance proceeds in energy efficiency and conservation, and renewable energy technologies. OER develops plans annually for the distribution of RGGI proceeds. RGGI is one of the critical tools Rhode Island is utilizing to meet state, regional, national and international commitments to reduce carbon emissions from the power sector.

- In order to reduce carbon pollution from power plants, **the Clean Power Plan (CPP),** announced by EPA in August of 2015, has set forth customized carbon dioxide reduction goals for states and gives the states flexibility in how to achieve their respective goals. The Clean Power Plan aims to maintain an affordable, reliable energy system, while cutting pollution and protecting public health and the environment. In order to meet the requirements of the CPP, RIDEM is currently leaning towards having RGGI and Rhode Island submit a multi-state emission standard plan to EPA based upon RI's continued participation in RGGI. A critical component of the CPP State Plan requirements is stakeholder participation. RIDEM has begun stakeholder outreach by conducting a CPP community workshop on March 11, 2016 as well as meeting individually with various interested parties. The Department will continue to engage stakeholders throughout the process, including a public hearing in the future after revised regulations have been promulgated. On February 9, 2016, the U.S. Supreme Court ruled to stay the Clean Power Plan. However, Rhode Island continues ahead in planning for implementation of the Clean Power Plan pending further legal direction from the courts.

- RIDEM's **Energy-Saving Trees Program** helps homeowners conserve energy, reduce utility costs, and beautify their neighborhood. RIDEM and the Arbor Day Foundation are teaming up to give away an additional 1,000 trees this spring. Financial support is provided by the

Regional Greenhouse Gas Initiative (RGGI) over the next 3 years. When planted properly, a single mature tree can save $30 annually in heating and cooling costs. Last fall, a total of 805 trees were planted as part of the first round of the Energy-Saving Trees Program, engaging 745 homeowners in the program.

- In the fall of 2015, OER continued its partnership with the Renewable Energy Fund at Commerce RI and non-profit SmartPower to implement the state's third round of **Solarize Rhode Island** campaigns across selected municipalities. Solarize is a targeted marketing and education campaign aimed at increasing the adoption of small-scale solar. Two pilot rounds of the program were completed in North Smithfield, Tiverton, and Little Compton in 2014 and early 2015. The municipalities selected for the fall 2015 program were Foster, Barrington, South Kingstown, as well as the Aquidneck Island communities of Middletown, Newport and Portsmouth. In spring 2015, the Solarize Little Compton and Tiverton program had 67 contracts signed for 388 kW of solar capacity and more than 250 homeowner and business owners learned more about solar PV. The fall 2015 program results indicated that 250 customers signed contracts for more than 1.7MW of solar PV capacity. Providence, Warren and Bristol are participating in the spring 2016 round of Solarize.

- The **Renewable Energy Growth (REG) Program** launched in June 2015 to support the deployment of locally-based wind, solar, anaerobic digestion and small scale hydropower projects. The REG Program is administered by National Grid with oversight by OER and the Distributed Generation Board, and provides 15 or 20 year tariff payments to finance renewable energy systems for homeowners, businesses and municipalities. In turn, the construction and operation of these new clean energy resources reduce and stabilize consumer energy costs, create job opportunities for clean energy workers, and help offset demand for more carbon-intense energy resources throughout the energy system. In the first seven months of program implementation, tariff payments were approved for more than 150 small solar projects; a dozen medium, commercial, and large solar projects; and three commercial-scale wind turbines.

- Commerce RI administers the **Renewable Energy Fund (REF)** which is dedicated to increasing the role of renewable energy throughout Rhode Island. The REF provides grants and loans for renewable energy projects with the potential to produce electricity in a cleaner, more sustainable manner, while stimulating job growth in the green technology and energy sectors of Rhode Island's economy. In 2015 alone, the REF awarded over $5 million in funding to 357 applications. The funds went to small scale and commercial scale renewable energy projects totaling over 6 MegaWatts.

- The Executive Climate Change Coordinating Council (EC4), with the services of the Northeast States for Coordinated Air Use Management (NESCAUM), is currently conducting a study to evaluate various strategies for reducing greenhouse gas emissions in the state. NESCAUM is

currently developing data and methodologies, undertaking modeling and analysis, and performing policy research that will support the creation of the final emissions reduction study. The purpose of the Study is to suggest possible strategies, programs, and actions to meet targets for greenhouse gas emissions reductions according to the schedule specified in the Resilient Rhode Island Act. The EC4 anticipates using the conclusions of the Study to recommend a plan by year's end to meet the targets for greenhouse gas emissions reductions.

- From 2013-2015, OER staff led efforts to develop a ten-year update to the **Rhode Island State Energy Plan** ("Energy 2035"). On October 8, 2015, the State Planning Council voted to adopt Energy 2035 as an element of the State Guide Plan, codifying the Plan as the state's formal long-term, comprehensive energy strategy. The Plan represents Rhode Island's first data-driven energy planning and policy document. Its vision is to provide energy services across all sectors—electricity, thermal, and transportation—using a secure, cost-effective, and sustainable energy system. The Plan sets bold and ambitious goals and strategies for transforming Rhode Island's energy system, and charges OER with providing a yearly status update on implementation. The status update provides information on (1) progress toward implementing each of the Plan's 20 recommended strategies; and (2) progress toward achieving the Plan goals and performance measure targets. The EC4 will continue to track the progress of the implementation of Energy 2035.

- The 30 Megawatt (MW) **Block Island Offshore Wind Project** will be the first offshore wind project in the country. Located approximately 3 miles southeast of Block Island, the project started construction in 2015 with the installation of the foundations, which will support the turbine installations. The five jacket system foundations were completed between July and October 2015, and the wind turbine towers began arriving at the Port of Providence in late 2015. The next phase of the project started in January 2016 with the cable line preparation work in both Narragansett and Block Island, which will be connected with the 30 MW project. The installation of the cable between the island and mainland is expected to be completed this summer. The wind turbines are scheduled to be installed in the summer of 2016 and the system is expected to be commercially operational by the end of 2016.

- The **State Interagency Hazard Mitigation Committee (SIHMC)** reconvened in September 2015 to begin the update process of the 2019 Rhode Island State Hazard Mitigation Plan Update. The SIHMC will consider climate change in the identification of vulnerabilities and feasible mitigation actions associated with the hazards that face the State of Rhode Island.

- RIEMA works proactively with communities and stakeholders to mitigate the risks of flooding, which are often exacerbated by the effects of climate change. There are currently eight communities participating in the **Community Rating System (CRS),** which is a voluntary incentive program that recognizes and encourages community floodplain management

activities and saves policy holders money on their annual flood insurance premiums. With RIEMA's support, there are a number of additional RI communities developing applications and seeking admission into the program. Since July 2015, RIEMA provided training to approximately 100 realtors through Continuing Education Classes offered by the Rhode Island Association of Realtors. The training provides realtors with an overview of the National Flood Insurance Program (NFIP) as well as specifics on mapping, regulations and insurance implications.

- RIEMA administers the Federal Emergency Management Agency's (FEMA) **Hazard Mitigation Assistance (HMA) programs**. The State is currently overseeing 42 awards totaling over 8 million in federal dollars granted to sub-recipients statewide. Project funding to implement long term mitigation actions is contingent on mitigation planning efforts, and with 18 approved local hazard mitigation plans, the State continues to provide technical assistance to municipalities developing or updating their mitigation plans. Mitigation plans are a core component of municipality's resiliency efforts.

- Formed in 2014, the **Rhode Island ZEV Working Group** is a collaboration between OER, RIDEM, RIDOT and Ocean State Clean Cities (OSCC) to bring together state and quasi-state agencies, private and nonprofit companies, auto dealers, and utility providers to discuss the actions necessary to promote the responsible growth of the ZEV (zero emission vehicle) market in Rhode Island. The working group has been tasked with exploring issues critical to the efficient and effective deployment of ZEV solutions across the policy, regulatory, and business landscapes. Rhode Island is currently finalizing its ZEV Action Plan.

- In early 2016, OER launched the state's first ever electric vehicle rebate program to support adoption of electric vehicles by Ocean State drivers: **Driving Rhode Island to Vehicle Electrification (DRIVE).** The program made $200,000 available for qualified Rhode Island residents interested in purchasing or leasing an electric vehicle (EV) to apply for a financial rebate of up to $2,500, based upon vehicle battery capacity. Modeled closely on existing rebate programs offered in other states, DRIVE offers the potential to increase the total number of EVs on Rhode Island roadways by 20-35%. Between February 1 and May 1, 2016, OER issued or reserved 43 DRIVE rebates, representing a 180 percent increase in EV adoption compared with the same period the previous year. For more information on DRIVE, please visit: www.drive.ri.gov

LEADING BY EXAMPLE

Leading by Example *commonly means our actions influence others to behave and respond in ways that society deems valuable and appropriate. In Rhode Island, Governor Raimondo established a Lead by Example program within the Office of Energy Resources (via Executive Order in Dec. 2015) to coordinate efforts across state agencies to reduce energy consumption and greenhouse gas emissions.*

- As of April 2016, RIDEM has produced about 1.75 Million kWhrs of clean energy and saved the state $332,500 in electricity costs with **a wide array of renewable energy projects** across the state. Currently, RIDEM is replacing 984 old lighting fixtures in 6 RIDEM facilities with new LED fixtures/bulbs. The $246,552.57 project is being funded by National Grid Rebates, a $100,000 Energy Office Grant, and will be paid off in 2.3 years with the avoided cost of the energy savings. After the 2.3 years, all of the savings will go to the state. After the 2.3 year pay-off period, RIDEM estimates the state will save more than $60,000 a year.

- RIDOT recently instituted a new ten-year planning process and released its first Ten Year Plan in October 2015 as the foundation for the **State Transportation Improvement Plan** (STIP) development. This planning process allocates funding for projects by 'pipeline', including a separate drainage pipeline, and shows the allocation of funding for operating and maintenance. The shift to a 10-year plan is critical for the development of projects that are adaptable and consider climate change as part of a long term approach. In addition to this development, the RI Statewide Planning program, acting as the as the State's Metropolitan Planning Organization (MPO), revised the STIP selection process to include climate change resilience criteria. Specifically, a criterion added to the STIP guiding principles states that the project "Improves resiliency to the impacts of climate change." As part of the STIP selection process, the results of Technical Paper 164, "Vulnerability of Transportation Assets to Sea Level Rise" were utilized to check SLR scenarios against all transportation projects listed in RIDOT's 10 Year Strategic Plan and all projects submitted through the STIP solicitation process. RIDOT was alerted to any transportation asset that is likely to be affected by 1, 3 and 5 feet of sea level rise. RIDOT will use this information as it plans for future transportation infrastructure projects, balancing public access and safety with costs and the overall life cycle of the proposed infrastructure.

- By the end of February 2016, RIDOT and OER converted more than 1,000 lights, which replaced all **RIDOT Park & Ride lights as well as some highway corridors** (I-295, Rt. 4, Rt. 403, Rt. 1), and are projected to install an additional 5,200 light conversions in 2016 and

2017. These conversions extend the life of the lights from 2 years to 25 years and result in significant energy savings.

- In December 2015, Governor Gina M. Raimondo signed Executive Order 15-17: "**State Agencies to Lead by Example in Energy Efficiency and Clean Energy"** establishing a "Lead by Example" program within the Office of Energy Resources to oversee and coordinate efforts at State agencies to reduce energy consumption and greenhouse gas emissions. To achieve these goals and advance its agency mission to lead Rhode Island toward a secure, cost-effective, and sustainable energy future, OER is coordinating efforts across State agencies to reduce energy consumption and costs, lower GHG emissions, deploy renewable energy resources, and foster clean transportation solutions. The member agencies of EC4 will continue to collaborate and assist with the implementation of the state's Lead by Example program in 2016 and beyond.

- In an effort to lead by example and reduce its carbon footprint, **RIDEM continues to upgrade its fleet of state vehicles.** RIDEM brought on-board 10 new plug-in electric hybrids in September 2015, and currently has a total of 12 plug-in electric hybrids, with 1 being a fully battery electric vehicle. 25% of RIDEM's on-road light duty vehicles within the Bureau of Environmental Protection are ZEV's. RIDEM has 8 electric vehicle charging ports at Providence office (for state vehicle use). RIDEM also has EV Charging Stations at ten RIDEM facilities (for public use) including Colt State Park; Fort Adams State Park, Pulaski State Park; Blackstone Valley Visitor Center; Burlingame State Campground; Fisherman's Memorial State Park; Salty Brien State Beach; Scarborough State Beach (North); East Matunuck State Beach; and Misquamicut State Beach.

- Many entities represented on the EC4 have taken advantage of funding from the Office of Community and Housing Development (OHCD) for resiliency projects (e.g. Wastewater Infrastructure Vulnerability Assessment, Pawtuxet River Modeling Project, etc.). OHCD has incorporated a climate change risk assessment into the application evaluation criteria for **CDBG Disaster Recovery projects**. The risk assessment covers projected exposure and vulnerability to flooding and sea level rise through 2100. OHCD uses mapping tools developed by CRMC through the Beach SAMP project, as well as other resources, in order to evaluate risks to proposed public facilities and infrastructure projects prior to making funding decisions.

MUNICIPAL COLLABORATION

Municipal Collaboration *refers to the reality that cities and towns are on the front line of addressing the causes and impacts of climate change. Municipalities can play a significant role in implementing greenhouse gas emission strategies and adaptation plans. Identifying ways the state, the planning community, and university/research programs can further collaborate to provide assistance to cities and towns is critical.*

- The State Planning Council approved the **Rhode Island Comprehensive Planning Standards Manual**, which sets forth the requirements for State approval of comprehensive plans, in January of 2016. The standards require comprehensive plans to address climate change and natural hazards. The State Planning council also adopted accompanying guidance handbooks to assist communities in the development of their comprehensive plans. "Guidance Handbook No. 12 – Planning for Natural Hazards and Climate Change" provides guidance to Rhode Island municipalities on how to incorporate goals, policies, and actions that address climate change and natural hazards into their comprehensive plans. In addition, staff from the RI Statewide Planning Program provide technical assistance to municipalities on this topic on an as-needed basis.

- RIDEM and RIEMA continue to partner on the administration of the **State's Dam Safety Program**. RIEMA is responsible for reviewing and approving the dam emergency action plans (EAP) for the high and significant dams statewide identified by the RIDEM. Each plan establishes activation thresholds and identifies threats, impacts as well as the appropriate official(s) to contact in case of a dam failure. In the face of increased precipitation and intense rain events, coordination among RIDEM, RIEMA, dam owners, and municipalities remains a priority for both agency's climate resiliency efforts.

- The Division of Planning is leading efforts to draft a **model ZEV municipal parking ordinance** and charging station accommodations to encourage ZEV use in Rhode Island. As part of this effort, staff reviewed the needs of ZEVs, current parking policies, and drafted a model ordinance for municipalities to accommodate ZEV use. Best practices for the enforcement of ZEV priority parking spaces and charging stations will be recommended through a 'Zero Emission Vehicle Handbook' for municipalities.

- Established under Rhode Island General Laws, Chapter 46-12.2-4.2, the Efficient Buildings Fund (EBF) is a revolving loan fund administered by the Rhode Island Infrastructure Bank (RIIB), in collaboration with OER, to **finance energy efficiency and renewable energy projects for municipally owned buildings and school facilities** as well as quasi-governmental

agency buildings. The purpose of this program is to provide financial assistance to local governmental units for deep energy savings projects where the annual energy savings achieved by the project exceed the annual debt service. RIIB aims to make approximately $20 million to $25 million in financing available to selected applicants in the summer of 2016.

- OER was awarded a 3-year competitive grant from the U.S. Department of Energy to establish the **Rhode Island Public Energy Partnership (RIPEP)**, a precedent-setting collaboration to achieve deep energy savings in municipal, school, and state facilities. Partners included OER, National Grid, the URI Outreach Center, Narragansett Bay Commission, the Energy Efficiency and Resource Management Council, and other key public and private sector representatives. RIPEP has achieved significant results, including: 39 energy audits were performed covering over 1.8 million square feet; Energy data baseline inventories were established for all public facilities, which includes 546 municipal, 331 school and ~ 900 state facilities, for a total of about 1777 facilities; 123 energy efficiency projects were implemented for total energy savings of 28.6%; 10 renewable energy assessments were completed at water and waste water facilities; over $5 million in rebates and on-bill repayment funds were utilized to support project implementation; and barriers to implementing energy efficiency in the public sector were identified.

- In 2015, OER undertook a review of Rhode Island's current **large scale land based wind siting guidelines** to support municipalities interested in wind development with the latest, up-to-date information on siting issues. The review resulted in the drafting of a new document with updated information and recommendations to assist municipalities as they develop their own wind siting ordinances. The guidance document includes information on safety setbacks, noise, shadow flicker, and wind-specific environmental impacts. The final document will be finalized after the conclusion of a public comment period.

- **Middletown, Hopkinton, South Kingstown, Newport, Westerly and Narragansett** have all been able to take advantage of CDBG Disaster Recovery funds (as administered through OHCD) to support a variety of local recovery projects that enhance the resiliency of vulnerable populations, public facilities, and infrastructure:
    - **Westerly** elevated its Old Town Beach Pavilion above the base flood elevation after it sustained major damage during Hurricane Sandy.
    - **Narragansett** will construct a berm to protect the Scarborough wastewater treatment facility from future storm surges.
    - **Middletown, Hopkinton, and South Kingstown** have installed backup generators at their senior centers. Similarly, the MLK Community Center in Newport has added a backup generator to avoid interruptions in services (which include food pantry operations.

ECONOMIC RESILIENCE

Economic Resilience *goes hand in hand with climate resilience. Thinking creatively about ways to persevere and prosper in a changing climate will require combining public and private sector leadership. Engineering, architecture, green infrastructure and renewable energy are just some of the fields that play a role in furthering resiliency.*

- Strong state support for energy efficiency and renewable energy policies have stimulated a robust market for clean energy goods and services, making **Rhode Island home to a new, growing clean energy industry**. In early 2016, OER and the RI Executive Office of Commerce released the second annual Clean Energy Jobs Report, which found that employment in Rhode Island's clean economy increased by a staggering 40% over 2015, far exceeding last year's projected growth of 17%. Clean energy jobs now support about 14,000 workers across the state, representing 3% of statewide employment.

- Recognizing the challenge businesses face in preparing for and adapting to the potential impacts of a changing climate, the U.S. Environmental Protection Agency (EPA) worked with the RI Division of Planning to develop **a framework to help communities assess their economic vulnerability to climate change and improve their economic resilience**. The Planning Framework for a Climate Resilient Economy can be adapted by any community and modified to cover small or large geographic areas and their economies. It can also work in conjunction with local planning efforts to incorporate relevant climate-resilient strategies, or communities can use it as a stand-alone tool to inform land use and economic planning.

- Cumberland, RI was able to take advantage **of CDBG Disaster Recovery funds** to elevate equipment in a manufacturing facility that was inundated by the Blackstone River during the 2010 Floods. This reduced the risk of flooding and helped maintain 250 manufacturing jobs in Rhode Island. CDBG Disaster Recovery funds have been used to repair, improve and relocate infrastructure that supports local businesses throughout the state.

- Chairwoman Lauren H. Carson (D-Dist. 75, Newport) created and chaired the **House Commission on Economic Risk Due to Flooding and Sea Rise**, which was established to provide information and guidance for Rhode Island municipalities, businesses and the investment community. CRMC, Planning, and RIDEM presented to the commission on several topics. The commission was also charged with making recommendations to the General Assembly about further steps to maintain the value of public and private property, define adaptation strategies so as to better understand the cost of inaction.

RESEARCH & ANALYSIS

Research and Analysis *improves knowledge of the health and environmental effects of climate change and helps provide long-term solutions to effectively manage and reduce the impacts of a changing climate. Often times this research is conducted in close collaboration with federal agencies and other states in the region.*

- HEALTH continues to spearhead the **Northeast Regional Heat Collaborative**. The project is a joint research initiative to explore the thresholds for heat/health impacts, as well as health data driven standards for heat warnings and communications. HEALTH's collaboration with Brown University, Maine, New Hampshire, Vermont, the CDC, and the National Weather Service will help to improve heat warnings and messaging systems in RI and throughout New England. In August 2015, Brown University and HEALTH published their local findings in Environmental Health Perspectives, titled "Current and Projected Heat-Related Morbidity and Mortality in Rhode Island."

- The CRMC has teamed with URI Ocean Engineering to develop the **Pawtuxet River Modeling Project**, which will be an operational spatially distributed hydrological/hydraulic model for the Pawtuxet River watershed. The model will allow an analysis of the historical flooding behavior of the watershed-river system and will map the flood inundation extent for the river floodplain during past historic events and for specific scenarios (e.g., 25, 50 and 100-yr events). This riverine model will be linked within the existing web-based STORMTOOLS platform (noted above) to assess the combined flooding impacts of riverine and coastal where rivers discharge into the Bay. The tool can then be used by the state and municipalities to develop planning and mitigation efforts to address flooding impacts.

- RIEMA partnered with the United States Army Corps of Engineers (USACE) and the United States Geological Survey (USGS) for an **inundation modeling project for areas along the Pawtuxet River.** The study and end-user products are being developed by the USGS but RIEMA will support outreach initiatives once the project is complete. The online flood-inundation mapper will provide government officials and residents with a tool to support future planning and mitigation efforts.

- The **Science & Technical Advisory Board (STAB)** to the EC4 was charged in the fall of 2015 to prepare a synopsis of the 'state of knowledge' of the following manifestations of climate change in Rhode Island regarding: 1) sea level rise; 2) warming air temperatures; 3) warming water (marine and fresh) temperatures; 4) storm frequency and intensity; 5) biodiversity (changes in species and habitats); and 6) precipitation & inland flooding. The STAB

completed its research in April 2016, and its annual report to the full EC4 is attached to this report. This information is instrumental to helping state agencies, decision-makers and the public understand the real impacts RI is already experiencing due to a changing climate.

- On October 2, 2015, portions of Kent and Providence County received **revised Flood Insurance Rate Maps** (FIRMs). The updated mapping which utilized 40 years of stream gauge data, new LiDAR data, topographic information and post-2010 high water marks was completed by FEMA and USGS. The revised maps are an important planning tool for municipalities when making land development decisions and to mitigate the potential effects of increased precipitation.

- FEMA and United States Geological Survey (USGS) have successfully completed **modeling along the Pawcatuck River** and developed work maps for the study area. When released, the work maps will provide community officials with the opportunity to review and comment on areas where they believe flooding risks may be inaccurately mapped. RIEMA and other agencies aim to incorporate the findings of this study into other modeling projects focusing on other riverine systems in RI.

LOOKING AHEAD

The Council looks forward to reporting on some specific projects under development in its next Annual Report, including the development of a RI specific website that will serve as comprehensive climate information clearinghouse for use by a variety of end users (by the RI Statewide Planning Program), the production of a climate change public health video (by the Department of Health's Climate program), progress on RI's new Agricultural Energy Grant Program (by RIDEM in partnership with RI RC&D Area Council and OER), and widespread adoption of energy efficiency and renewable energy initiatives by state agencies/offices as part of the OER's Lead by Example program.

With the assistance of its two advisory bodies (the EC4 Advisory Board & EC4 Science and Technical Advisory Board (*STAB*)), the full EC4 continues to lead the charge on adaptation and mitigation priorities alongside our regional and federal partners in ways that will maximize benefits for Rhode Island's environment and economy.

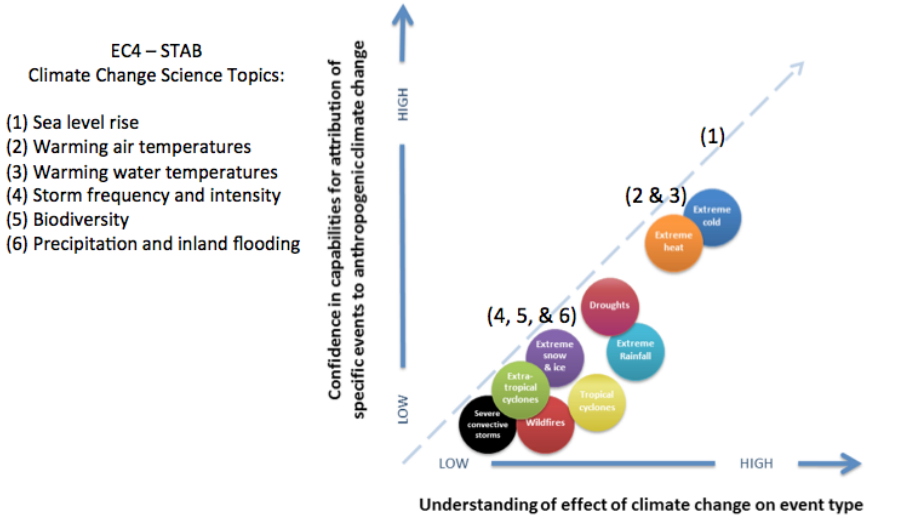
Under the leadership of Governor Raimondo and alongside our partners in the General Assembly, the EC4 will continue to promote strong legislative, policy and budget initiatives that make incorporating resilience into the fabric of RI's government and economy not only the right thing to do, but easier to do with each passing year.

Current State of Climate Science in Rhode Island: A Report From the STAB to the EC4

The EC4 science and technical advisory board (STAB[1]) was charged to prepare a brief synopsis of the state of knowledge of the following manifestations of climate change in Rhode Island.

1. Sea level rise
2. Warming air temperatures
3. Warming water (marine and fresh) temperatures
4. Storm frequency and intensity
5. Biodiversity (changes in species and habitats)
6. Precipitation and inland flooding

For each theme, we were asked to prepare four PowerPoint slides: Slide 1- A concise description of the issue or impact; Slide 2- Hard data supporting the existence of the impact; Slide 3 - The top five to ten ramifications of this manifestation of climate change; and Slide 4: The best methods to assess vulnerability to this impact.



Confidence in attribution is higher for events such as more frequent heat waves and less frequent cold snaps, which are linked to human-caused increases in global temperatures through an understood and robustly simulated physical mechanism. There is less confidence in the attribution of other types of events, such as tropical cyclones, that are related to climate change in more complex and less understood ways.
NAS 2016. Attribution of Extreme Weather Events in the Context of Climate Change

Figure 1. Levels of confidence in the scientific record for various manifestations of climate change. Taken from National Academy of Science Report. 2016. Attribution of Extreme Weather Events in the Context of Climate Change.

[1] *STAB members are: Peter August, URI (Chair); Todd Bianco, PUC; James Boyd, CRMC (Secretary); Kelly Knee, RPS/ASA; Jason Osenkowski, RI DEM; Ronald Pitt, RIC; Timmons Roberts, Brown Univ.; Carol Thornber, URI; Henry Walker, US EPA (Vice-chair)*

STAB members formed working teams to prepare the synopses which were then sent out to scientists in the region for peer review. The PowerPoint collection will be conveyed to the EC4 in May 2016. The major findings for each of the six themes are summarized here.

Our understanding of the effects of climate change, and attribution of changes associated with anthropogenic components of climate change varies in terms of the spatial scale of the effects, and temporal variability. Our understanding of how climate changes resulting from natural and anthropogenic factors affects extreme events (X axis in Figure 1) is greater than our ability to attribute extreme events to human-induced components of climate change (Y axis in Figure 1). There is greater confidence in larger scale patterns of sea level rise and air and water temperature increases. More local manifestations of climate change are less certain (Figure 1). The placement of the STAB climate change themes is based on our understanding of these systems.

(1) Sea Level Rise (SLR)

Global sea level changes are sensitive to climate variation (Lambeck et al. 2002). Sea levels have risen over 9 inches in Rhode Island since 1930 as measured at the Newport tide gauge. The National Oceanic and Atmospheric Administration (NOAA) maintains two (2) long-term tide gauges in RI located at Providence and Newport. The historic rate of sea level rise (SLR) at the Newport tide gauge from 1930 to 2015 is presently 2.72 mm/year or more than an inch per decade. Carey et al. (2015) found that SLR at the Newport tide gauge from 1984-2011 was 4.1mm/year. This rate is similar to the mean annual rate of SLR for Newport of 4.8 mm/year for the period of 1999 to present as determined from the Permanent Service for Mean Sea Level at Newport (http://www.psmsl.org/data/obtaining/stations/351.php). However, caution is advisable when citing short-term data sets (less than 30 years) because of inherently large regression errors and the anomalous sea level increase of about 4 inches during 2009-2010 due to a slowdown in the Atlantic Meridional Overturning Circulation (Goddard et al. 2015). Nevertheless, at these present rates, sea levels will likely increase 1 inch between every 5 or 6 years in Rhode Island.

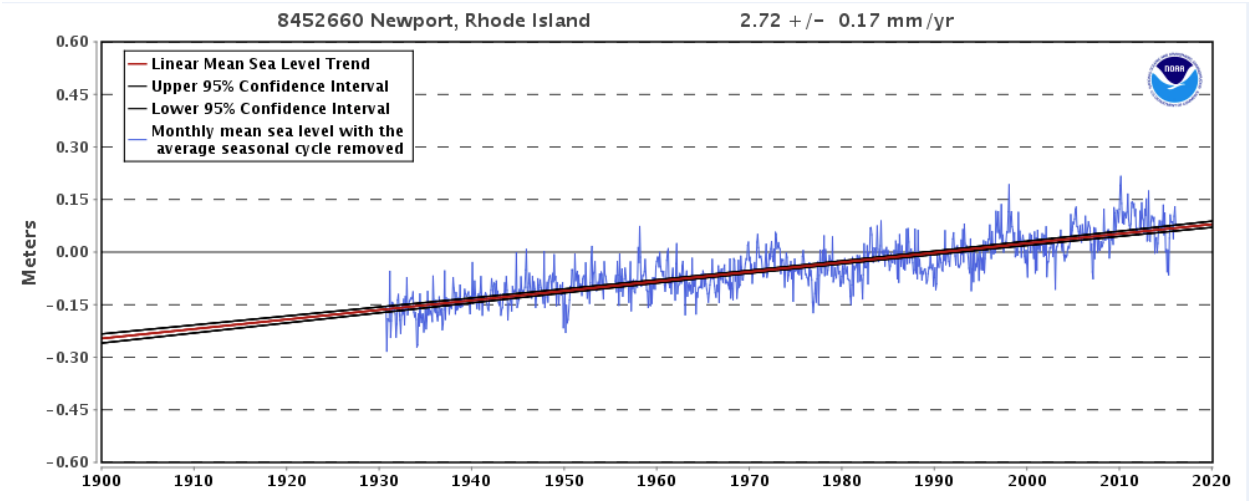


Figure 1.1 Mean sea level trend at Newport, RI tide gauge from 1930 to 2015

A recent analysis of global sea levels, correcting for spatial bias in the tide gauge records, calculates a rate of 1.2 mm/year from 1901-1990 (Hay et al. 2015), but along the U.S. East Coast the rate was 1.8 mm/year during the same period (Engelhart et al. 2009). Sea level rise is accelerating globally and in particular the North American Atlantic coastline north of Cape Hatteras, NC to the Canadian Maritime Provinces. Between 1950–1979 and 1980–2009, the SLR rate increase along this coastline was 3-4 times higher than the global average (Sallenger et al. 2012). Because of this factor, it is likely that this region, which includes Rhode Island, will see an additional 8 to 11+ inches above global average SLR by 2100.

The 20th century increase in the rate of global mean sea level rise is attributed to a combination of natural and anthropogenic radiative forcing (Church et al. 2013). Importantly, SLR has accelerated significantly to 3.3 mm/year since 1993 when analysis began with satellite altimetry http://sealevel.colorado.edu/). NOAA is projecting as much as 6.6 feet of SLR by the end of this century in Rhode Island. In the shorter-term, NOAA predicts upwards of 1 foot by 2035 and 1.9 feet by 2050. This has critical implications for RI, as approximately 6, 13 and 20 square miles of Rhode Island's coastal areas will be permanently flooded with 1, 3 and 5 feet of SLR, respectively, as quantified by Geographic Information System (GIS) analysis.

Rhode Island is now well positioned to conduct state, municipal and private sector vulnerability analyses with new tools to assess the risk for sea level rise and coastal storm surge inundation with the development of STORMTOOLS by the University of Rhode Island on behalf of the Coastal Resources Management Council Shoreline Change Special Area Management Plan. In addition, within a year there will be a more robust monitoring system established for RI that will include more tide gauges, waves and current measurements and high-resolution monitoring of coastal erosion along the entire coast. This monitoring system will be designed to

provide data directly into StormTools, making it an even more powerful analytical tool (http://www.beachsamp.org/resources/stormtools/).

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STORMTOOLS (developed by URI Ocean Engineering for CRMC) map viewer to assess sea level rise and storm inundation - http://www.beachsamp.org/resources/stormtools/

University of Colorado Sea level Research Group 2016 Global Mean Sea Level Time Series http://sealevel.colorado.edu/

(2) Warming Air Temperatures

Carbon dioxide and other greenhouse gases are slowing the radiation of heat back into the atmosphere. This is slowly driving up temperatures, especially nighttime lows, as the blanket of greenhouse gases thickens (IPCC 2013). Current levels of CO_2 equivalents are just over 400 parts per million, above the pre-industrial level of about 280 ppm (in the year 1850 and before). It appears that the late 20th and early 21st centuries are likely the warmest period the Earth has seen in at least 1200 years (NOAA, 2008). The Paris Agreement set a target of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5° C above pre-industrial levels." Current global averages are around 1°C degree above pre-industrial levels, and rising (see Figure 2.1). Global temperature changes are less variable than for the contiguous US or RI where temperature rise and extremes are more apparent. A series of impacts are expected to be significantly worse at 2 degrees global mean temperature rise compared to 1.5 degrees (Schleussner et al. 2016). Much more research in this area is needed, but initial findings have raised debate about whether this threshold (1.5° C) better characterizes the level at which "dangerous" climate change is occurring.

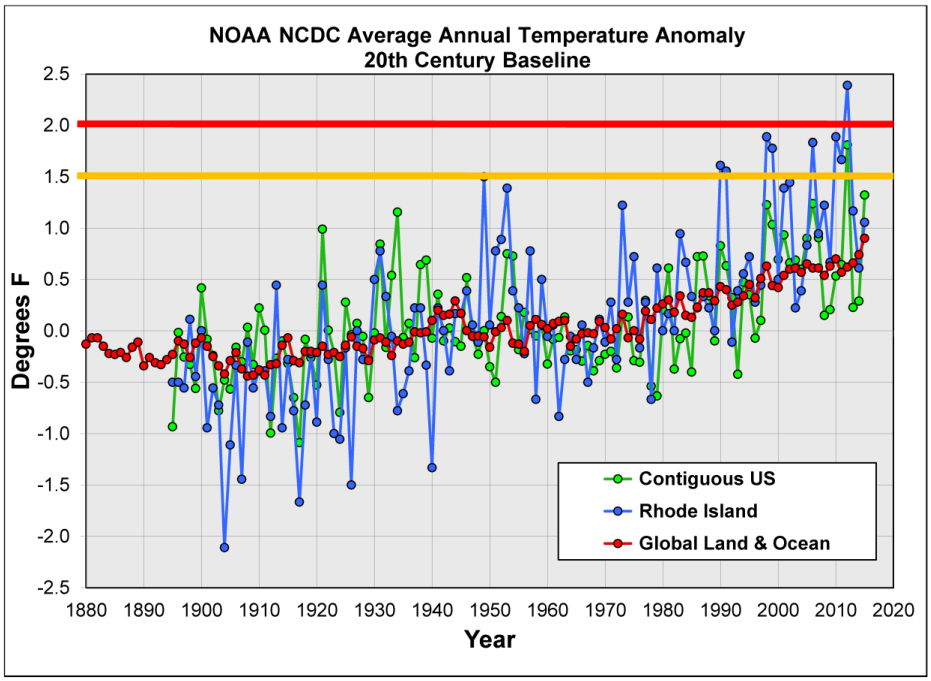

Figure 2.1 The Paris Agreement / goal: staying below 2 degrees C of warming (indicated by red horizontal line). Schleussner et al. (2016) report significant adverse effects can be anticipated with 1.5 degrees C of warming (indicated by orange horizontal line). Data downloaded from NOAA National Climate Data Center. The baseline temperature is the average from 1901 to 2000. The Y axis shows deviations (in degrees F) from this 20th century baseline.

Surface temperatures warm, especially as sunlight hits dark surfaces like asphalt and dark roofing. The Urban Heat Island Effect is marked in Rhode Island. Human health risks rise dramatically in RI with temperatures over 80 degrees F, based on records of emergency room admissions (Kingsley et al. 2015). This is due to asthma events and other heat-related cardio-respiratory problems worsened by ground-level ozone and smog, which are highly temperature sensitive (Kingsley et al 2015). Between 1950 and 2014 the number of days at TF Green Airport over 80 degrees has been increasing (Brown University, 2015).

RI Policy should prioritize vulnerable populations. To identify areas of vulnerable sub-populations, GIS mapping of demographic data to determine areas of expected high risk can be compared to registries and census data, as well as engagement with communities. The elderly, children, immigrants and the poor are most vulnerable, as was seen in Chicago 1995, Paris 2009, and Moscow 2013 heat waves. Rhode Island should engage the public to help identify cost effective and socially equitable solutions

Physical infrastructure is vulnerable, including roads due to increased frequency of freeze-thaw cycles. Electrical grids, power plants, and rail systems are also sensitive to heat as temperatures surpass 90 degrees F (GAO. 2014). Increased electrical demand for cooling, and lower performance in power generation and transmission increase risks of electrical grid failure at high temperatures. RI Policy should prioritize vulnerable sectors, in developing policies to reduce risks to water, waste water, and electric utilities, and engage utility operators like National Grid and ISO-New England (ISO New England, 2015) to help achieve efficient and equitable solutions.

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(3) Warming Water (Marine and Fresh) Temperatures

The water in Narragansett Bay is getting warmer. Over the past 50 years, the surface temperature of the Bay has increased 1.4° to 1.6° C (2.5° to 2.9° F). Winter water temperatures in the Bay have increased even more, from 1.6° to 2.0° C (2.9° to 3.6° F) (Fulweiler et al. 2015). Ocean temperatures are increasing world-wide, but temperature increases in the northwestern Atlantic Ocean are expected to be 2-3 times larger than the global average (Saba et al. 2016).

Warming water temperatures in Narragansett Bay are causing many changes in ecosystem dynamics, fish, invertebrates, and plankton (Smith, Whitehouse, & Oviatt 2010). Winter and spring phytoplankton blooms rarely occur anymore due to more intensive grazing by zooplankton during the winter (Oviatt, Keller & Reed 2002) and this results in benthic (sea floor) organisms no longer receiving carbon and nutrients from the phytoplankton (Nixon et al. 2009).

Warming water temperatures are causing many changes in the marine fisheries of Rhode Island. Cold-water iconic fishery species (cod, winter flounder, hake, lobster) are moving north out of RI waters (e.g., Fogarty et al. 2007) and warm-water southern species are becoming more prevalent (scup, butterfish, squid) (Collie, Wood & Jeffries 2008). The fisheries of Narragansett Bay are changing from being dominated by bottom dwelling fish and invertebrates to being dominated by fish that occur throughout the water column (Gibson, RIDEM, 2016).

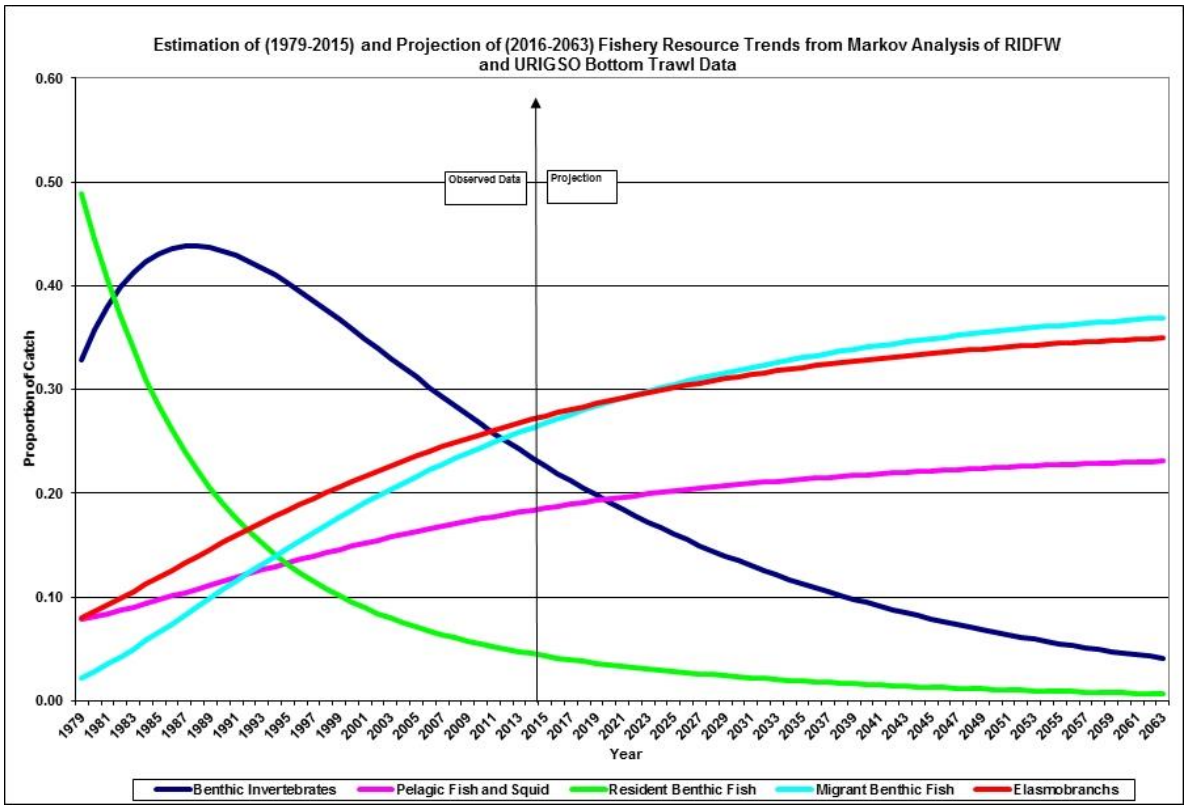

Figure 3.1 Changes in the dominant fisheries of Narragansett Bay. Prepared by Mark Gibson RIDEM.

Besides warming, our marine waters are becoming more acidic due to increasing CO_2. This may cause severe impacts to shellfish, especially in their larval life stages (Talmage & Gobler 2010). A current carbonate chemistry baseline in Narragansett Bay (Wallace et al. 2014) can be used as in monitoring variability and trends in estuarine pH in future years.

Water temperatures in our freshwater ecosystems are warming. This will have a negative impact on species of fish that prefer cold water rivers and streams, especially in the summertime. In 2013, water temperatures in the Wood River exceeded the preferred temperature (<20° C) for native Brook Trout (*Salvelinus fontinalis)* for one full month.

Environmental monitoring allows us to measure long-term changes in our ecosystems. It is imperative that we continue, and expand, the monitoring of fish, shellfish, invertebrates, plankton, and water conditions in Narragansett Bay and our offshore waters. Similarly, we need to continue and expand monitoring of freshwater quality and the fauna of our rivers, streams, and ponds.

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(4) Storm Frequency and Intensity

Records of tropical cyclones impacting the U.S. are too short to assess long term trends (Emanual 2006, Reed et al. 2015). While it is premature to conclude that climate change has had an impact on Atlantic hurricane activity, as yet undetectable changes may be still be occurring (GFDL 2015).

The physics driving the global climate are complicated thus it is hard to be certain how climate change will influence the intensity, frequency, and geographical distribution of hurricanes. Some effects of climate change, like rising sea surface temperatures, are thought to favor hurricane development and intensification. Other meteorological effects (such as increasing upper troposphere temperature and vertical wind shear) of climate change are believed to be unfavorable for hurricane formation (GFDL 2015).

Because neither the observational record nor the governing physics provide a clear indication of how climate change will impact hurricane activity, modeling studies are used to predict the potential impacts. These studies predict a global increase in the intensity of (GFDL 2015), a pole-ward migration in the latitude at which storms reach maximum intensity (Kossin et al. 2013), and increases in tropical rainfall rates (GFDL 2015, IPCC 2012). In the Atlantic basin modeling studies predict a substantial reduction in the number of tropical storms and hurricanes (GFDL 2015, Knutson et al. 2008, 2013), the frequency of intense storms (Category 4 and 5) is likely to increase and possible double by the end of the 21st century (GFDL 2015, Bender et al. 2010, IPCC 2013) (Figure 4.1)

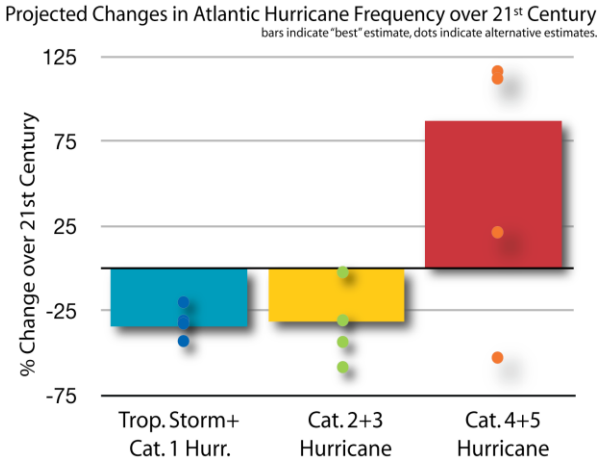

Figure 4.1: Projected Changes in Atlantic Hurricane Frequency over the 21st century.

While not as much research has been conducted on extra-tropical storms, for the U.S. East Coast an increase in both frequency and intensity is expected (IPCC 2013).

The predicted changes in storm activity could change the frequency and intensity of associated storm surges, high winds, and precipitation events, causing serious implications for both coastal and inland communities and infrastructure systems. Important studies on the impacts to water and wastewater infrastructure have already been commissioned by the state. Additional research on impacts to transportation, businesses and homes, and public health should be considered.

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(5) Biodiversity

Climate change is altering the ecology and distribution of plants and animals in Rhode Island. These changes occur in three primary ways: (1) shifts in the use of space and geographic distributions; (2) changes in the timing of fruiting, flowering and leaf-out in plants, and timing of migration and reproduction in animals; and (3) changes in the behavior, ecology, and physiology of individual species (Bellard et al. 2012).

In southern New England, spring is arriving sooner and plants are flowering earlier (one week earlier now when compared to the 1850's; Miller-Rushing and Primack 2008). For every degree of temperature rise in the spring and winter, plants flower 3.3 days earlier. For woody plants, leaf-out is occurring 18 days earlier now than in the 1850's (Polgar and Primack 2011). Changes in the timing of leaf-out, flowering, and fruiting in plants can be very disruptive to plant pollinators and seed dispersers.

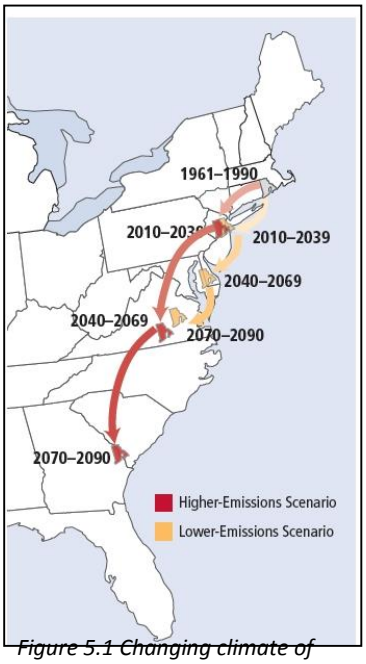

Figure 5.1 Changing climate of RI. From Frumhoff et al. 2007

Changes in the timing of annual cycles has been observed in Rhode Island birds. Based on a 45-year near-continuous record of monitoring fall migration times for passerine birds in Kingston, RI, Smith and Paton (2011) found a 3.0 days/decade delay in the departure time of 14 species of migratory birds.

Sea level rise will cause changes in coastal habitats that are important for biodiversity. For example, salt marshes in Rhode Island, critical habitat for fish and shellfish, will either drown or migrate landward. In Rhode Island, the rate at which salt marshes

increase in elevation through the deposition of organic matter is less than the current rate of seal level rise (Carey et al. 2015).

Warming sea water temperatures are resulting in shifts of the timing of ecologically significant events in Narragansett Bay (Oviatt 2004), such as the winter/spring phytoplankton bloom (Smith et al. 2010). The fish species occurring in Narragansett Bay are changing as waters warm. Bottom-dwelling fish that prefer cold water such as winter flounder are less common and fish that swim in the water column and prefer warmer water, for example butterfish and scup, are becoming more common (Collie et al. 2008).

Increased levels of CO2 and subsequent ocean acidification (Doney et al. 2009), will have both direct and indirect impacts. For example, shell formation and shell growth of mollusks will be negatively impacted by ocean acidification (Talmage & Gobler 2009).

Changes in the abundance and annual cycle of animals is expected to have profound effects on public health. Cyanobacteria blooms, a toxic algae, in aquatic systems are expected to increase as well as the prevalence of vector-borne diseases of humans that are transmitted by ticks and mosquitoes.

Changes in climate and subsequent impacts on biodiversity will manifest itself differently between species. It is expected that some species will be able to adapt well while others may become extirpated because of they lack the evolutionary ability to adapt at the rate of change to the predicted conditions. Furthermore, it is unclear how shifts of species distributions will impact the relationships of flora and fauna (that may remain) this will undoubtedly impact food webs within ecosystems.

It is imperative that we systematically monitor changes in biodiversity, especially 1) sentinel habitats such as salt marshes and rare habitats at the fringe of tidal and freshwater systems, 2) the occurrence of harmful algae or animal vectors of human diseases, and 3) continue long-term assessment of fish in Narragansett Bay and changes in the species abundance and timing of avian migrants at the Block Island and Kingston bird banding stations.

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(6) Precipitation and Inland Flooding

Climate change is expected to result in more frequent heavy rains, affecting stream flow in Northeastern states, with increases in 3-day peak flows contributing to increases in flooding risks (Demara et al. 2015). Climate change may exacerbate drought conditions and reduce river and stream 7-day low flow events (Demara et al. 2015). Southern RI, Block Island, Jamestown, and Aquidneck Island depend on shallow ground-water wells and shallow surface reservoirs, and are vulnerable to drought.

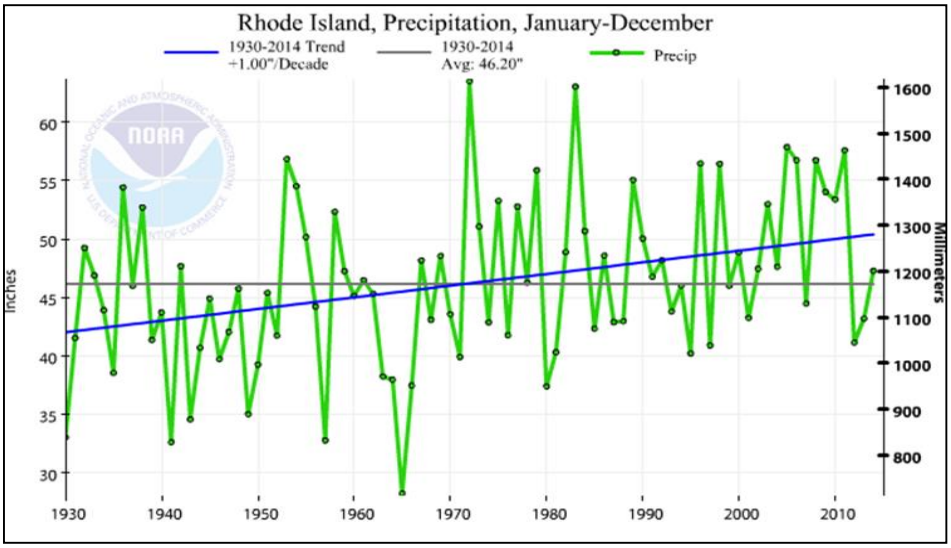

Figure 6.1 Annual precipitation for Rhode Island for the period 1930-2014. Source: http://www.ncdc.noaa.gov/cag

Rhode Island has experienced a significant increase in both flood frequency and flood severity over the past 80 years. RI and throughout most of southern New England has experienced a doubling of the frequency of flooding and an increase in the magnitude of flood events, (Vallee & Giuliano 2014) The NWS tracks flood severity by levels of minor, moderate and major.

Intense rainfall events (heaviest 1% of all daily events from 1901 to 2012 in New England) have increased 71% since 1958 (Walsh et al. 2014). However, this analysis begins with the drought-prone 1960's in New England. Rainfall statistics (1895 to 2015) in Kingston RI, show more interannual and decadal variability in extreme events. The 100 year floods almost always have major" impacts, but are very low frequency.

Multiple climate change models suggest that Green House Gas (GHG) increases will result in increased precipitation in RI (Milley et al. 2008), but observed increases in precipitation in the Northeastern US are greater than models predict (Peterson et al. 2013). Trends of increasing 20th century precipitation may mask risks related to episodic drought.

Land use changes such as increases in impervious surfaces and obstructions to stream flow (culverts and bridges) contribute to flooding. Some RI dams & bridges are at increasing risk of failure during flood events. Climate change increases the costs associated with infrastructure upgrades needed to: 1) protect drinking water, 2) address storm-water risks, and 3) reduce Combined Sewer Overflows

RI should plan to assess vulnerabilities associated with wet and dry extremes. This should include inland flooding risks to: transportation, infrastructure, businesses and homes, public health; and vulnerabilities associated with dry extremes of climate affecting low stream-flow and ground-water supply.

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Rhode Island Executive Climate Change Coordinating Council
Advisory Board

May 11, 2016

Director Janet Coit
Chair, Executive Climate Change Coordinating Council
Rhode Island Department of Environmental Management
235 Promenade Street, Room 425
Providence, RI 02908

Dear Director Coit:

I am respectfully submitting the Annual Report on behalf of the Advisory Board to the Executive Climate Change Coordinating Council (EC4) pursuant to RIGL §42-6.2-4. The following is a report of the Advisory Board's meetings and activities since its inaugural meeting in May 2015.

Under RIGL §46-6.2, the Advisory Board shall meet at least quarterly or at the call of the chairperson of the EC4. It was unanimously decided that the Advisory Board should aspire to meet monthly. The following are the dates on which the Advisory Board convened, and all meetings minutes have been posted on the Secretary of State's website for further reference.

May 27, 2015	December 18, 2016
June 16, 2015	Jan. 15, 2016
Sept. 23, 2015	March 18, 2016
October 16, 2015 (no quorum)	April 15, 2016 (no quorum)
November 20, 2015	

The following is an update on the Advisory Board's progress in relation to the purposes and duties listed in its enabling legislation (RI Resilient Rhode Island Act):

(1) Advise the council on all matters pertaining to the duties and powers of the council, including evaluating and making recommendations regarding plans, programs and strategies relating to climate change mitigation and adaptation;

Progress: The members have divided into four working groups to better organize its purposes and duties. Those working groups include: communications, municipal assistance, economic sector/business relations, and EC4 Action Plan progress tracking. The working groups have made an effort to include interested stakeholders that contribute expertise in the specific areas. The vast range of action items identified in the EC4 Action Plan presents a challenge for creating a cohesive evaluation of the state's progress as well as making formal recommendations regarding climate change plans, programs and strategies.

(2) *Assist the council in improving public access to, and understanding of, the best available, scientific, technical and other information about climate change, mitigation, adaptation, etc., so as to build public support for, and participation in, initiatives to make communities more resilient;*

Progress: The communications working group has been collaborating with staff at several state agencies, including URI and local environmental organizations, to evaluate the current dissemination points for information related to climate change. A report on the group's specific work is below.

(3) *Serve as a conduit for communicating information from the council to communities and constituencies, as well as vice versa, for input from the community level to the council;*

Progress: The municipal assistance group is designing a community/municipal survey in order to establish a baseline understanding of issues related to climate change adaptation and mitigation. Additionally, the economic sector/business relations group has been working to identify opportunities for collaboration with the state's business community. A report on the group's specific work is below.

(4) *Assist the council in meeting its own transparency and accountability obligations;*

Progress: The EC4 Action Plan progress tracking group has started evaluating the most recent updates of the EC4 Action Plan and other EC4 reports to track the state's progress on identified goals and action items. With the volume of action items established in the EC4 Action Plan, tracking all 100+ items is a challenge for the Advisory Board. Identifying a smaller, more focused series of action items for closer evaluation is needed. A report on the group's specific work is below.

(5) *Report to the council at each regular council meeting;*

Progress: A representative of the Advisory Board has reported out to the EC4 at nearly every monthly meeting since May 2015. The Advisory Board also maintains an open line of communication with staff from EC4 agencies such as RIDEM, Statewide Planning and HEALTH.

(6) Prepare an annual report, to be included in the annual report of the council, that specifically addresses the state of public awareness and engagement, the effectiveness of

mitigation, adaptation and public information programs from the community perspective, the ability of the council to attain its goals and objectives, including effective interagency coordination and public-private partnerships, and actions that would further the purposes of the council and this legislation.

Progress: This report is being submitted to the EC4 as part of its annual requirement. The following summarizes the progress of the Advisory Board to date. The Advisory Board will continue to keep the EC4 informed of progress at monthly council meetings.

Communications Working Group:

This group was charged with assisting the full EC4 on issues relating to climate change communications. Staff from RIDEM, HEALTH, Statewide Planning, Commerce, URI's Coastal Resources Center and multiple non-profit environmental organizations are also actively participating.

Guidance was provide by the full EC4 in the form of a memo dated June 16, 2015 in which the Advisory Board was asked to address the following communications questions: "*What information do we need to provide to and get from the public? For what purpose? How to deliver? How to interact?*" The group began by exploring how to effectively design and roll out a larger statewide communication effort around climate change (both mitigation and adaptation). Heavily focused on the use of wed-based resources (both existing and new) and social media, it continues to be a broad goal that the group strives to achieve.

In the spring of 2016, HEALTH began discussions with the working group about assisting with the design and roll-out of an educational video that helps to inform the public and target audiences on how climate change is impacting Rhode Islanders. Through visual narratives, stories, and interviews, the project is being designed to showcase various impacts from our changing climate and use stories to illustrate how positive changes are helping Rhode Island adapt. These stories will help to educate and encourage action on an individual and community level. The working group expects the video, funded through HEALTH's Climate Change Program, to be completed in 2017.

Municipal Working Group:

This group has been focused on identifying the needs of municipalities in dealing with the impacts climate change, both current and into the future. Cities and towns across RI know all too well how climate change can affect its residents, workers and budgets. In the last 10 years, floods, blizzards, microburst, hurricanes and tornadoes have been experienced by many of our communities. The ability of cities and towns to be resilient in the face of these events is critical but often a daunting planning and budgeting task. The municipal group is working with local municipal officials from public works, emergency response, tax assessment, management and others areas to formulate a survey that gets at the heart of what these communities, on the 'front lines', need to adapt, respond and rebound from the

impacts of climate change. The goal is to have the survey ready for distribution in the next 2-3 months and have representatives from each community participate. The data gathered will be compiled into a report to the full EC4 for recommended actions specific to these municipal needs.

Economic Sector/Business Relations Working Group:
This group has begun to identify communication tools that could be helpful to engage the business sector in climate change planning. Such tools could include the development of a climate economic vulnerability analysis that would be instrumental in building asset protection, adaptation and resilience strategies. An economic risk assessment framework holds the possibility to expose revenues at risk of loss due to climate events.

An analysis about Westerly's economic vulnerabilities was presented to the House Study Commission on Economic Risk Due to Sea Level Rise Flooding, led by Rep. Lauren Carson of Newport. A spatial analysis, using the mapping of CRMC STORMTOOLS indicates Westerly has contiguous coastal and riverfront vulnerabilities to sea level rise and flooding in five Resiliency Neighborhood Districts: Downtown, Avondale, Watch Hill, Misquamicut and Weekapaug. Within the boundary areas of each neighborhood district, a compilation of property taxes, hotel, sales and meals tax indicated potential economic risk and opportunity. Analyses such as these can be useful communication tools within municipal and business sectors.

EC4 Action Plan Tracking:
This group has found it quite challenging to effectively track what is a robust and comprehensive EC4 Action Plan. The EC4 members and state agencies are doing a tremendous job in meeting several of the goals and objectives of the plan.

However, the current reporting system provides no metrics or dashboard that easily tracks all of the plan's action items. Without clearly defined metrics, it will continue to be a challenge to track the State's progress to attain its resilience goals and objectives as established in the Action Plan. Listing accomplishments does highlight the great work of Rhode Island's state agencies but it does not provide a comprehensive measurement of the state's progress towards overall increased readiness to climate change.

In the absence of a full-time staff person within the Administration, the Advisory Board relies upon the efforts of its members and other interested stakeholders, all who have primary obligations outside of their work on the Advisory Board. This makes the assigned legislative duties of tracking full transparency and accountability difficult.

The Advisory Board remains committed to fulfilling our obligations as set forth in the Resilient Rhode Island Act. We submit this report as part of those obligations and respectfully make the following recommendations:

- Create a full-time Climate Change Coordinator position within the Administration that would be dedicated to coordinating all state efforts related to climate adaptation and mitigation, including support for the EC4, its advisory boards and the goals and objectives of the Action Plan.
- Establish a method for tracking Action Plan progress that is more transparent and measurable through collaboration among the EC4, the Advisory Board, and the Science & Technical Advisory Board.
- Work with the EC4 to help establish action priorities for the coming year and beyond;
- Establish a framework for EC4 state agency staff engagement with the Advisory Board and the Science & Technical Advisory Board.

We welcome continued input and direction from you and members of the EC4. We appreciate the opportunity to serve as members of the Advisory Board and look forward to continuing our efforts to address climate change mitigation and adaption issues for the State of Rhode Island.

Sincerely,

Frederick Presley, Town Manager West Warwick
Acting Chair, EC4 Advisory Board