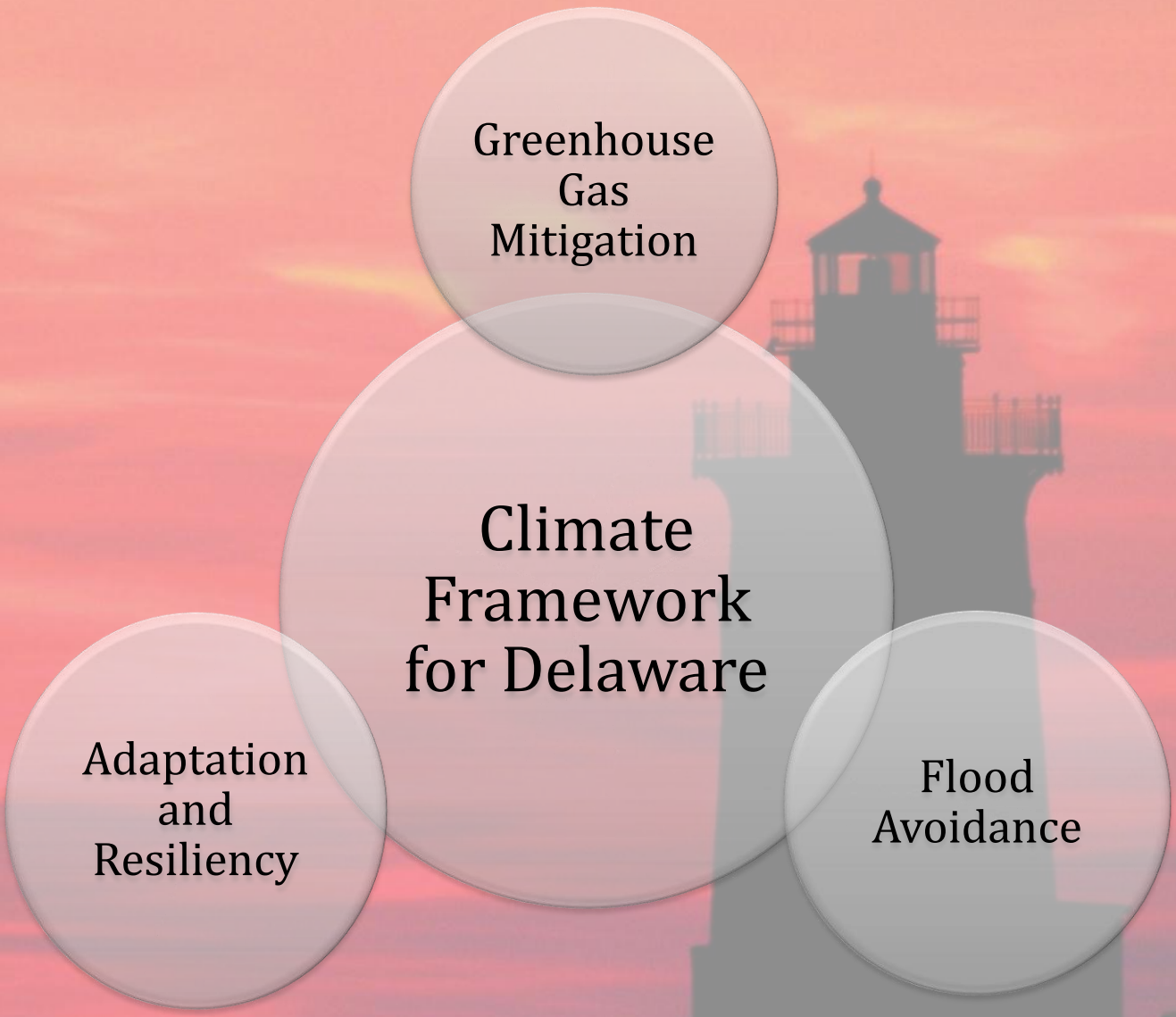
Climate Framework for Delaware



Summary of Recommendations

Prepared under Executive Order 41: ***Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions***

December 31, 2014

Cover photo courtesy of Delaware State Parks

Climate Framework for Delaware

Executive Order 41

Summary of Recommendations

December 31, 2014

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December 31, 2014

The Honorable Jack A. Markell
Governor of Delaware
820 N. French Street
12th Floor
Wilmington, DE 19801

Dear Governor Markell,

On behalf of the Cabinet Committee on Climate and Resilience ("CCoCAR"), I am pleased to submit the final report, "Climate Framework for Delaware" ("Framework") developed pursuant to Executive Order 41: *Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions.*

Executive Order 41 directs the state to address both the causes and consequences of climate change in a coordinated and cost-effective manner by developing recommendations to address three categories of state action:

- Reduce greenhouse gases that contribute to climate change (climate mitigation);
- Increase resilience to climate impacts, including increasing temperatures, changes in precipitation, and sea level rise (climate adaptation); and
- Avoid and minimize flood risks that increase state liability and decrease public safety (flood avoidance).

Consistent with these categories, three workgroups were formed to develop recommendations for actions that state agencies can take to meet the goals of Executive Order 41; Mitigation, Adaptation and Flood Avoidance. The Framework summarizes recommendations from the three workgroups. The CCoCAR met several times over the course of a year and on December 3, 2014, unanimously approved the Framework.

As required by EO 41, and consistent with the Framework, in early 2015, the CCoCAR will take next steps to inform the public about the Framework through a variety of means of outreach

and will begin addressing climate change cost-effectively in state government operations. Agencies will host public discussions on the Framework and EO 41 throughout 2015 and will specifically target local governments for outreach and technical assistance.

Thanks to your leadership, the State of Delaware has taken major strides toward a clean energy economy and a sustainable natural and built environment. This Framework provides a path forward for Delaware to make sound choices and to ensure our State is resilient to the changes we are already experiencing, to prepare for future climate impacts and to reduce emissions of heat-trapping gases that drive climate change.

I want to express my gratitude to the CCoCAR members for their diligent efforts to date and I look forward to working with them in the future to implement the Framework's recommendations. Special acknowledgement goes to the various agency representatives who identified specific issues and opportunities unique to those organizations and coordinated with their colleagues and leadership to develop innovative and realistic approaches to address these challenges.

Should you have any questions concerning the Framework or wish to discuss it in more detail, please let us know.

Sincerely,

David S. Small
Secretary

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Climate Framework for Delaware
Executive Summary

Executive Order 41

On September 12, 2013, Delaware Governor Jack Markell signed Executive Order 41: *Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions*. Executive Order 41 directs agencies to address both the causes and consequences of climate change by developing actionable recommendations to reduce greenhouse gas (GHG) emissions that contribute to climate change, increase resilience to climate impacts, and avoid and minimize flood risks due to sea level rise.

Executive Order 41 calls for the creation of a cabinet-level committee to oversee the development and implementation of recommendations under the order. The Cabinet Committee on Climate and Resiliency (CCoCAR) consists of the secretaries and directors of 11 state agencies and departments. The Secretary of the Department of Natural Resources and Environmental Control serves as the chair of the committee. Under the secretary's direction, three workgroups were formed to develop recommendations for actions that state agencies can take to meet the goals of Executive Order 41.

Climate Framework for Delaware

The Climate Framework for Delaware summarizes the work to date and recommendations from the three workgroups formed under Executive Order 41: Mitigation, Adaptation, and Flood Avoidance. The Climate Framework was approved on December 3, 2014, by the CCoCAR, for submission to the governor by December 31, 2014, as required by the order.

Mitigation Workgroup

Under Executive Order 41, a technical workgroup was established to examine Delaware's greenhouse gas emissions, regulations, programs, and policies that influence greenhouse gas emissions, use the best data available to establish a greenhouse gas mitigation target, and develop an implementation plan to guide Delaware toward its goal.

On December 3, 2014, the CCoCAR approved the recommendation of the Mitigation Workgroup that a mitigation target of 30 percent greenhouse gas reduction from a 2008 baseline by 2030 be adopted for the state of Delaware. The Department of Natural Resources and Environmental Control will develop an implementation plan based on the approved mitigation target. The implementation plan will be developed in 2015.

Adaptation Workgroup

Under Executive Order 41, a workgroup was formed with representatives from 11 state agencies and departments to "develop agency-specific, actionable recommendations for improving Delaware's preparedness and resilience to climate impacts." Delaware's climate impacts include increasing temperatures, more frequent extreme heat events, and increased flooding from extreme precipitation and sea level rise. Adaptation Workgroup members led teams in each of their

agencies to complete a "rapid assessment" of vulnerabilities to climate impacts that may affect their agencies. They developed proposed responses to adapt to and reduce the risk for each of the vulnerabilities they identified. Proposed adaptation responses were evaluated and prioritized based on the severity of the impacts, the urgency of the response, and the feasibility of implementation.

On December 3, 2014, the CCoCAR approved the recommendations of the Adaptation Workgroup. The Climate Framework includes more than 150 recommendations for a wide range of actions that address public health and safety needs, impacts to facilities and infrastructure, and capacity to deliver services to constituents in Delaware. Some of these recommendations—in particular, the "inward-facing" proposals that affect only the internal operations of state government and can be implemented without additional budgetary or legislative authority—are amenable to immediate action. However, many of the "outward-facing" recommendations will require additional discussion and outreach with affected stakeholders and other interested parties.

In 2015, the state agencies represented on the CCoCAR will begin implementation of the "inward-facing" recommendations that can be adopted within their respective departments without additional budgetary or legislative authority. With respect to the "outward-facing" recommendations, stakeholder engagement will be required before final decisions are made. To that end, public outreach and communication events will be launched in 2015 to discuss these recommendations in greater detail. Further opportunities to enhance outreach and technical assistance to local governments will be targeted for action in 2015.

Flood Avoidance Workgroup

Under Executive Order 41, a technical workgroup was established to develop flood avoidance and design guidance to "incorporate measures for adapting to increased flood heights and sea level rise in the siting and design of projects for construction of new structures and reconstruction of substantially damaged structures and infrastructure." The workgroup is developing technical guidance and tools for use by state agencies for the siting and design of structures and infrastructure, with an emphasis on avoidance of current and future flood risk. These tools include a Flood Risk Adaptation Map that depicts flood exposure from a combination of sea level rise and coastal storms. In addition, the workgroup identified existing state programs, policies, and tools that will help ensure compliance with guidelines.

The Flood Avoidance Workgroup will complete the Avoidance and Design Guidance document as a technical guide, and will assist state agencies with implementation in 2015. The Climate Framework includes 11 recommendations that can be used to institutionalize this guidance.

Conclusion

The state of Delaware is committed to moving toward a clean energy economy and a sustainable natural and built environment. Executive Order 41 provides a framework for the state to make choices about how we continue on that path forward. These choices can help make our state more resilient to the changes we are already experiencing, prepare for future climate impacts, and reduce the emissions of heat-trapping gases that are driving climate change.

Delaware's Climate Story

Climate Change in Delaware

Climate change affects people, places, and resources we care about—our homes, neighborhoods, and communities, as well as beaches, wetlands, forests, rivers, and streams. These resources enhance our quality of life and support our economy. Higher temperatures, increasing rainfall, and rising sea levels are already occurring. These changes are expected to continue—and become more serious—in the coming years. Climate change is caused mainly by human activities, particularly the burning of fossil fuels that release heat-trapping gases. This is a global challenge, but we can take actions to lessen the impacts of climate change on our lives, communities, economy, and ecosystems, now and in the future.

Vulnerabilities to Climate Impacts

As a low-lying coastal state with a significant population living along 381 miles of shoreline, Delaware is vulnerable to coastal erosion, storm surge, saltwater intrusion, and tidal wetland losses—all of which will be exacerbated by sea level rise. Intense rainfall and rising sea level also contribute to flood risks across the state that threaten public safety and incur costly damage to homes and businesses. Rising temperatures, and particularly extreme heat events, increase the risk of serious illness, especially for vulnerable citizens—the elderly, young children, outdoor workers, and people with underlying health conditions. Temperature and rainfall extremes pose serious challenges for our agriculture and tourism economies, as well as imposing increasing costs for maintaining and repairing critical infrastructure.

Efforts and Outcomes

Delaware has made significant strides to address both the causes and consequences of climate change. These efforts focus on three key strategies:

- Using the best available science to understand current and future impacts of climate change;
- Reducing greenhouse gas emissions (climate mitigation); and
- Increasing Delaware's resiliency to climate change (climate adaptation).

Using the best available science is a foundation of sound decision making. The state of Delaware has conducted comprehensive assessments of the impacts to Delaware of sea level rise, and changes in temperature and precipitation. Progress to date:

- In May 2012, *Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware* was completed, outlining and gauging the extent to which the state will be affected by sea level rise. This assessment includes an extensive mapping appendix depicting the exposure of thirty-nine resources to sea level rise under three scenarios.
- In February 2014, The *Delaware Climate Change Impact Assessment* was released, which outlines the historic climate trends for the state of Delaware, as well as future projections for

temperatures and precipitation through the end of the century. The impact assessment also analyzes what impact the future changes in temperature, precipitation, and sea level may have on five key sectors in Delaware: public health, water resources, agriculture, ecosystems and wildlife, and infrastructure.

Reducing greenhouse gas emissions has been a key objective for the state of Delaware, using a variety of strategies that promote energy efficiency and shifting to clean, renewable sources of energy. Progress to date:

- Delaware's greenhouse gas emissions have decreased by more than any state in the nation (29.7 percent from 2000 to 2010).
- As a result of programs and policies that support clean, renewable sources of energy, solar photovoltaic capacity in Delaware has grown from 2.3 MW to 59.8 MW since 2008, a 2,500 percent increase in solar generation of electricity.
- In February 2010, Governor Markell issued Executive Order 18 (EO 18), *Leading by Example towards a Clean Energy Economy & Sustainable Natural Environment*, with the goal of making Delaware state government a leader in clean energy and sustainability. EO 18 requires all executive branch state agencies to reduce their environmental impacts and operating expenses through actions in six areas:
    1) Energy conservation and efficiency—As of September 2014 we have a 12.99 percent reduction in energy use over the FY 2008 baseline.
    2) Use of clean, renewable energy—The state's latest reverse energy auction in May 2013 resulted in the purchase of Renewable Energy Credits totaling 30 percent of the state's energy procurement. In September 2014, Delaware ranked #64 on the EPA's Top 100 Green Power Partner list, marking a 5th consecutive quarter in the national top 100.
    3) Recycling—As of September 2014, we have a 32 percent waste diversion rate.
    4) Environmentally sensitive procurement (ESP) - The state's ESP policy was drafted and approved by the EO 18 Sustainability Managers Workgroup, Department of Natural Resources and Environmental Control (DNREC), and Office of Management and Budget (OMB). The policy became a state regulation in April 2013.
    5) Clean transportation—As of September 2014 we have reduced vehicle miles traveled by 31.23 percent and have reduced traditional petroleum usage by 7.06 percent.
    6) Environmentally responsible and energy-conscious construction—DNREC continues to work on the LEED certification project for the Richardson & Robbins Building, resulting in LEED principles being implemented at these sites and being added to existing state contracts, such as for pest control and janitorial services.
- Since 2005, the state of Delaware has been an active member of the Regional Greenhouse Gas Initiative, a market-based program to reduce carbon dioxide emissions in the power sector.
- In 2010, Delaware joined the Transportation Climate Initiative, a regional collaboration of twelve Northeast and Mid-Atlantic jurisdictions that seeks to develop the clean energy economy and reduce greenhouse gas emissions in the transportation sector.

- For 20 years the state of Delaware has been actively engaged in the U.S. Department of Energy's Clean Cities Program, which advances the national economic, environmental, and energy security goals by supporting local actions to reduce petroleum use in transportation.
- The Delaware Department of Transportation has actively recycled construction materials for more than 20 years. DelDOT's history has shown a significant economic benefit, and in-place performance of our pavements and bridges has only reinforced the beneficial use of recycled materials and industrial byproducts. To quantify the state's efforts toward sustainability, DelDOT used an evaluation tool to measure the benefits of its Pavement & Rehabilitation program, which is responsible for pavement preservation through timely maintenance patching, overlays, or other pavement preservation treatments. The Federal Highway Administration's INVEST (Infrastructure Voluntary Evaluation Sustainability Tool) was designed to provide information and techniques to help transportation agencies integrate sustainability best practices into their projects and programs and to provide guidance for practitioners to evaluate the sustainability of their transportation projects and programs. The result of the evaluation was a high score for DelDOT's Pavement & Rehabilitation program—the equivalent of "platinum" in the INVEST scoring criteria.

Increasing Delaware's resiliency to climate change encompasses a wide range of strategies to improve the state's preparedness and ability to adapt to current and future climate impacts. Progress to date:

- To address statewide flooding risks, in 2011 Governor Markell signed into law Senate Bill 64, which established a Floodplain and Drainage Advisory Committee to address the state's vulnerability to ongoing inland and coastal flooding and drainage issues. The committee produced higher flood damage reduction standards for local land use and building code departments to consider adopting. By late 2014 a large percentage of communities have adopted many of these higher standards, which are voluntary. Buildings and developments designed and built to these higher standards get lower-priced flood insurance, are far less likely to be flooded, reduce flooding impacts on adjacent areas, and create less environmental impacts to coastal and river floodplain habitats.
- Recognizing Delaware's vulnerability to sea level rise, in 2013 Delaware Coastal Programs released *Preparing for High Tide: Recommendations for Adapting to Sea Level Rise in Delaware*, based on DNREC's work with a diverse stakeholder group, the Sea Level Rise Advisory Committee. These recent efforts to address the risks of sea level rise build upon DNREC policy, adopted in 2010, to "proactively consider and plan for the potential effects of coastal inundation department-wide using scenarios based on the best available science."
- In 2014, DNREC's Division of Waste and Hazardous Substances completed the *Vulnerability Assessment of Hazardous Materials Installations in Coastal Delaware*. This study was conducted to identify regulated facilities, including tanks, solid waste facilities, and contaminated sites, that are at risk of impacts from sea level rise, storm surge, and coastal flooding. The assessment created an inventory of facilities, including GIS data layers and photos from an aerial survey of identified vulnerable facilities and low-angle aerial photography of selected sites. The project

also identified a high-risk facility, for which an action plan was developed to improve the site's resiliency to climate impacts.

- The Delaware Department of Transportation manages a wide range of technologies for monitoring traffic flow, road conditions, and potential hazards. Transportation engineers are evaluating ways to expand the existing systems by adding sensors that measure water levels, speed, and volumes, as well as reviewing the roadway weather information system parameters and quality data to support climate analysis. By improving data collection and analysis, planners will be able to make better predictions of flooding hazards and precipitation patterns, provide early-warning information to local emergency managers, and prepare for adjustments to traffic flows, such as detours and evacuation routes.
- Increasing resiliency of Delaware's transportation infrastructure is critical to the state's economy and to public safety. The Department of Transportation is working on multiple fronts to apply a risk and resilience management approach to respond to current and upcoming challenges from climate change. This includes improving capacity for data analysis, use of GIS systems, and increasing the use of risk assessment tools. DelDOT provides staff training in the use of HAZUS, a risk assessment tool supported by the Federal Emergency Management Agency. HAZUS is a system that uses models to assess damage and estimate losses from floods, hurricanes, and disasters.
- Delaware's coastal resources are a focus of climate adaptation to increase resiliency of valuable wetland habitats. Working with federal and nongovernmental organization partners, and other Mid-Atlantic states, Delaware is developing an ecological management approach to "climate-smart coastal impoundments." This innovative effort will create new coastal impoundments to shift habitats inland in the face of rapid sea level rise. Two new projects currently underway at the Ted Harvey Wildlife Refuge will replace the habitat functions and values at risk due to projected inundation of existing impoundments. The project is an important component of the Delaware Bayshore Initiative.
- The state is currently developing the 2015 Delaware Wildlife Action Plan, a comprehensive plan that assesses Delaware's wildlife and natural landscape, identifies the challenges they face, and outlines actions for conservation. The plan is updated every ten years, and in the current process, planners and scientists are identifying the effects of climate change and sea level rise on wildlife species and their habitats. The updated plan will include actions that help set the stage for increasing climate change resiliency.

Next Steps

The state of Delaware is already committed to actions that are moving toward a clean energy economy and a sustainable natural environment. These efforts can be further enhanced by coordinated and cost-effective steps to reduce greenhouse gas emissions and address climate change and rising sea levels. Executive Order 41 provides a framework for the state of Delaware to make choices about how we continue on that path forward. These choices can help make our state more resilient to the changes we are already experiencing, prepare for future climate impacts, and reduce the emissions of heat-trapping gases that are driving climate change.

Executive Order 41

Background and Purpose

On September 12, 2013, Delaware Governor Jack Markell signed Executive Order 41: *Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions*. Executive Order 41 directs the state to address both the causes and consequences of climate change by developing recommendations to:

- Reduce greenhouse gases that contribute to climate change (climate mitigation);
- Increase resilience to climate impacts, including increasing temperatures, changes in precipitation, and sea level rise (climate adaptation); and
- Avoid and minimize flood risks that increase state liability and decrease public safety.

Cabinet Committee on Climate and Resiliency

Executive Order 41 calls for the creation of a cabinet-level committee to oversee the development and implementation of recommendations under the order. The Cabinet Committee on Climate and Resiliency (CCoCAR) consists of the Secretaries of the Department of Agriculture (DDA), Department of Education (DOE), Department of Health and Social Services (DHSS), Department of Natural Resources and Environmental Control (DNREC), Department of Safety and Homeland Security (DSHS), Department of State (DOS), and Department of Transportation (DelDOT); and the Directors of the Delaware Economic Development Office (DEDO), Delaware State Housing Authority (DSHA), Office of Management and Budget (OMB), and Office of State Planning Coordination (OSPC).

EO 41 Workgroups

The Cabinet Committee on Climate and Resiliency (CCoCAR) members selected designated representatives—the points of contact (POC)—for each of the 11 member agencies. The POCs serve as liaisons for their respective departments and are responsible for representing the views and priorities of the agency leadership. The POCs also coordinate with their internal agency teams and draw upon agency expertise as needed to inform the development of recommendations.

To begin implementation of EO 41, three workgroups were formed to develop recommendations for the key issues identified in the EO:

- The **Mitigation Workgroup** is responsible for recommending a greenhouse gas mitigation target to *"maintain and build upon Delaware's leadership in responsibly reducing greenhouse gas emissions, including identifying appropriate interim goals"* and to develop an implementation plan to meet those goals. The Mitigation Workgroup is a technical workgroup staffed with selected agency experts from DNREC (including the Divisions of Energy and Climate, Solid and Hazardous Waste, and Air Quality), DDA, DHSS, DelDOT, Delaware Solid Waste Authority (DSWA), DSHA, and OMB.

- The **Adaptation Workgroup** is responsible for developing "*agency-specific actionable recommendations for improving Delaware's preparedness and resilience to climate impacts."* The Adaptation Workgroup is staffed by designated representatives (the points of contact, or POCs) for each of the 11 state agencies.
- The **Flood Avoidance Workgroup** is responsible for developing guidance to "*incorporate measures for adapting to increased flood heights and sea level rise in the siting and design of projects for construction of new structures and reconstruction of substantially damaged structures and infrastructure*." The Flood Avoidance Workgroup is a technical workgroup staffed with selected agency experts from DNREC, DOE, DelDOT, DSHA, OMB, and OSPC.

Climate Framework for Delaware

The Climate Framework for Delaware summarizes the work to date and recommendations from the three workgroups formed under Executive Order 41: Mitigation, Adaptation, and Flood Avoidance. The Climate Framework was approved on December 3, 2014, by the Cabinet Committee on Climate and Resiliency, for submission to the governor by December 31, 2014, as required by the order.

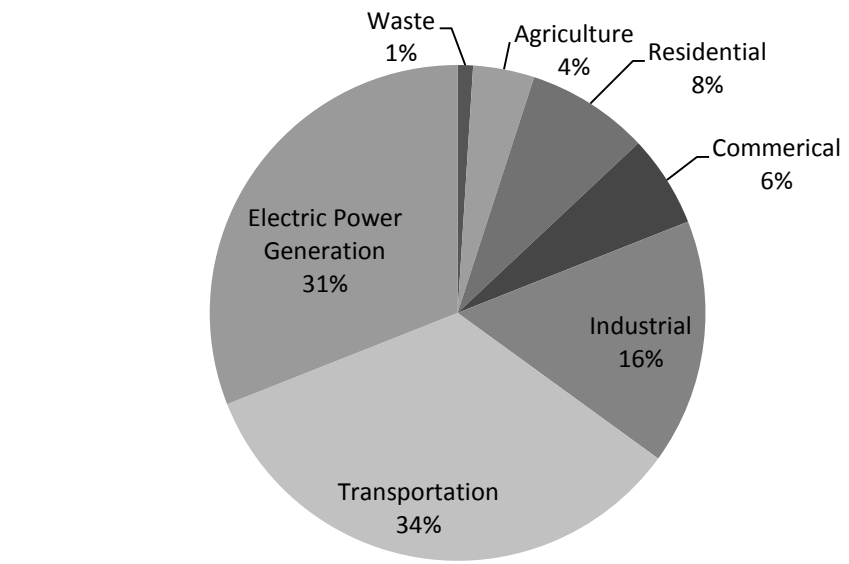
The Cabinet Committee on Climate and Resiliency will manage and track implementation of the recommendations developed under this order. Implementation of the recommendations will begin in 2015 and the committee will leverage the work of leading scientists and subject matter experts, as well as any research, studies, workgroups, advisory councils, and committees as may be required to complete the tasks outlined in the Climate Framework document.

Chapter 1:
Mitigation Recommendations

Background and Introduction

Greenhouse gases, such as carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons, contribute to climate change by allowing our planet to trap more heat radiated by the sun. Human influences, including the burning of fossil fuels, are increasing the rate at which these heat-trapping gases are being released into the atmosphere. As concentrations of greenhouse gases in the earth's atmosphere increase, reducing the amount of greenhouse gases emitted becomes a critical step in mitigating the long-term impacts of climate change.

Delaware's greenhouse gas emissions are released by seven major sectors: electrical power generation, transportation, industrial, commercial, residential, agriculture, and waste. In 2010, these sectors accounted for 12.48 MmtCO2e (million metric tons of carbon dioxide equivalent) of greenhouse gas emissions for the state of Delaware. By way of percentages, the electric power generation and transportation sectors accounted for the majority (65 percent) of Delaware's emissions. The chart below shows Delaware's emissions by sector.



Source: Delaware Greenhouse Gas Inventory, Division of Air Quality, 2014

Since 2008, Delaware has made significant reductions in greenhouse gas emissions. The state of Delaware was one of the first states to join the Regional Greenhouse Gas Initiative. This program, through a "cap and invest" model, has helped to reduce carbon dioxide emissions and increase

deployment of green energy and energy efficiency throughout the region, including Delaware. Emissions in the transportation sector have been reduced and will continue to go down because of the adoption of the federal Corporate Average Fuel Economy (CAFE) standards for both light- and heavy-duty vehicles. Landfill gas collection systems, the universal recycling law, increases in energy efficiency for Delaware households, forested buffers, and other policies and programs are also reducing emissions in the state of Delaware. All of these policies, which Delaware has implemented since 2008, are continuing to drive down emissions throughout the state.

Objective

Under the direction outlined by Executive Order 41, a technical workgroup was established to examine Delaware greenhouse gas emissions, regulations, and policies that influence greenhouse gas emissions, use the best data available to establish a greenhouse gas mitigation target, and develop an implementation plan to guide Delaware toward its goal.

The Mitigation Workgroup and Methodology

Workgroup members include representatives from a wide variety of state agencies and departments, as well as an outside organization. Departments and organizations represented on the workgroup include:

- Delaware Department of Agriculture;
- Delaware Department of Health and Social Services;
- Delaware Department of Natural Resources and Environmental Control;
- Delaware Department of Transportation;
- Delaware Office of Management and Budget;
- Delaware Solid Waste Authority; and
- Delaware State Housing Authority.

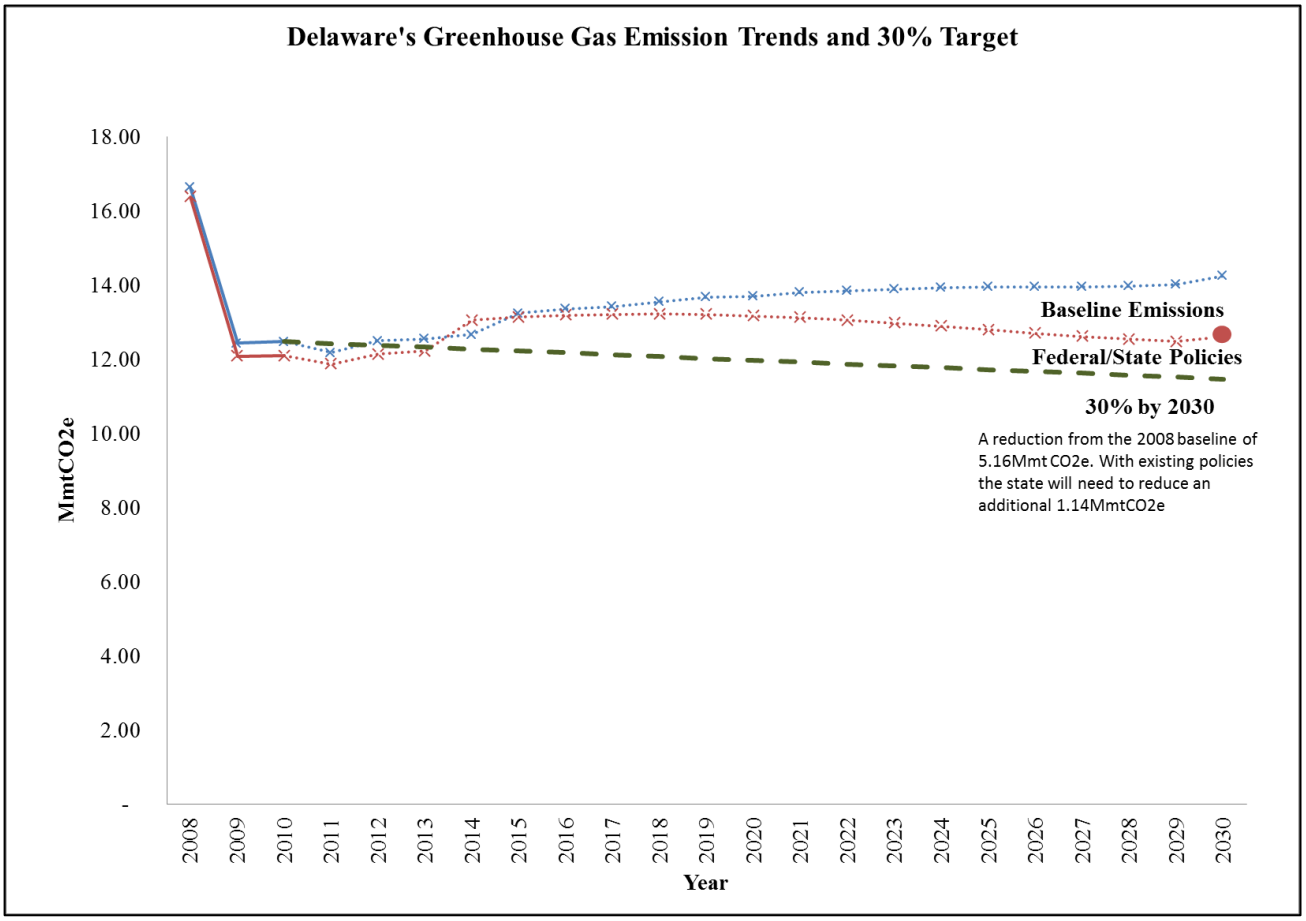
Between April and November 2014, the workgroup has met together nine times, along with multiple one-on-one sector meetings. Workgroup members were asked to provide data associated with programs that they defined with assistance from the DNREC Division of Air Quality and the DNREC Division of Energy and Climate. The Division of Air Quality used the most applicable data provided by the workgroup members and incorporated it into modeling that followed the principles and guidelines as well as protocols for state greenhouse gas emissions inventories established by the U.S. Environmental Protection Agency (EPA) and the International Organization for Standardization (ISO).

Secretary David Small of DNREC, chair of the Cabinet Committee on Climate and Resiliency, asked that the following targets be considered in the goal-setting process:

- A 30 percent greenhouse gas reduction from a 2008 baseline by 2030;
- A 40 percent greenhouse gas reduction from a 2008 baseline by 2030; and
- A 50 percent greenhouse gas reduction from a 2008 baseline by 2030.

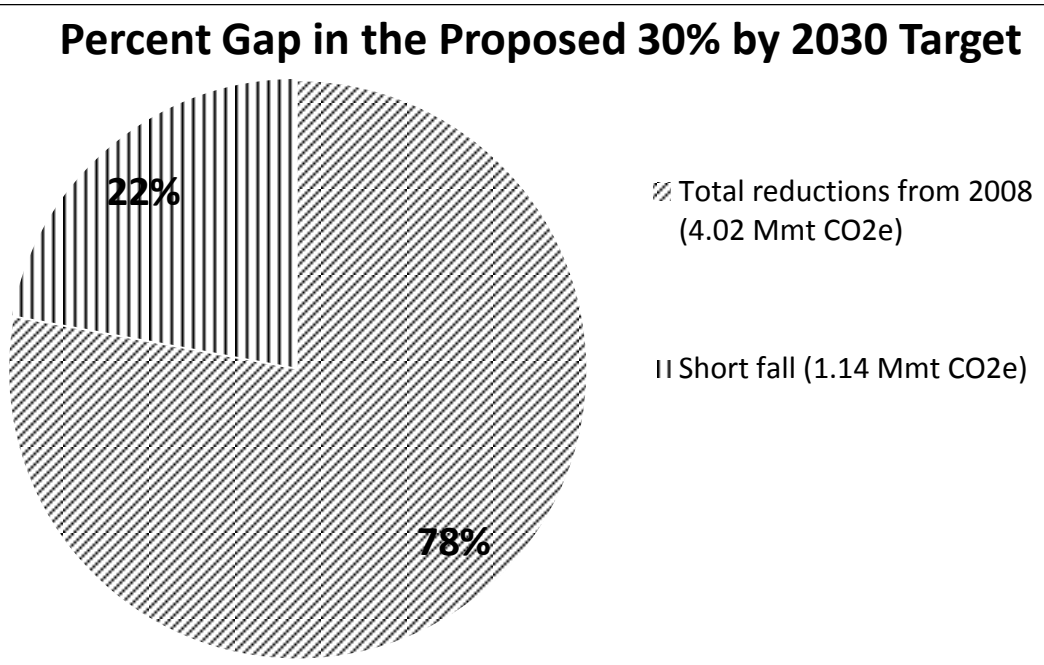
Greenhouse gas reductions from various policies and programs were modeled by the DNREC Division of Air Quality to illustrate a range of reduction pathways, and the results were provided to the workgroup members and EO 41 points of contact. (See Appendix C for additional information.)

The target that has been recommended to the governor for approval is a 30 percent greenhouse gas reduction from a 2008 baseline by 2030. To account for the 2008–2010 economic downturn, the model includes real data for that same time period. This allows the model to better project emissions to 2030. This target assumes that the 2008 baseline starts at 16.64 MmtCO2e (million metric tons of carbon dioxide equivalent), so a 30 percent reduction in 2030 would equal 11.47 MmtCO2e—a difference of 5.17 MmtCO2e. That said, this gap becomes smaller based on emission reduction policies, programs, and fuel switching implemented since 2008. Programs that were included in the federal and state policies include policies such as the Regional Greenhouse Gas Initiative, the Universal Recycling Law, and transportation fuel efficiency standards, to name a few. Staff was unable to model all of the data that were gathered in this process due to inconsistencies in the data, incompatible units, etc. Therefore, the reductions shown in the existing federal and state policies are conservative. When these programs are accounted for (4.02 MmtCO2e), the gap to attain the reduction goal becomes 1.14 MmtCO2e. The graph below illustrates the baseline from 2008 (blue line) overlaid with the existing state and federal policies (red line) and the emissions target of 30 percent in 2030.



Source: EO 41 Mitigation Implementation Plan, Forthcoming

Another way of looking at this graph is through percentages. The pie chart below shows that the total reductions since 2008 have achieved 78 percent of the emissions needed to meet the 30 percent reduction in 2030. The remaining 22 percent would need to be achieved through enhancements to existing policies, creation of new policies, advancements in technologies, and better data collection. The workgroup has already started to investigate how to close the 22 percent gap. Enhancements in policies related to energy efficiency, forestation, and universal recycling, as well as creation and adoption of transportation policies, will significantly close this gap. This 15-year goal also allows for technologies and other advancements in greenhouse gas mitigation and reductions.



Source: EO41 Mitigation Implementation Plan, forthcoming

Recommendation

On December 3, 2014, the Cabinet Committee on Climate and Resiliency approved the recommendation of the Mitigation Workgroup that a mitigation target of 30 percent greenhouse gas reduction from a 2008 baseline by 2030 be adopted for the state of Delaware.

Next Steps

The Department of Natural Resources and Environmental Control will develop an implementation plan based on the approved mitigation target. The implementation plan will be developed over the first two quarters of 2015.

Chapter 2:
Adaptation Recommendations

Background and Introduction

"Climate adaptation" and "resilience" are terms used throughout this Climate Framework document. They are related concepts that highlight the need to identify and reduce vulnerabilities to the current and future impacts of climate change. The Third National Climate Assessment[1] provides these definitions:

> *Adaptation*: Adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.
>
> *Resilience*: A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

Adaptation and mitigation are closely linked. Although mitigation addresses the need to curb greenhouse gas emissions, which are the drivers of climate change, adaptation is also necessary to improve the preparedness and resilience of our communities and resources. Indeed, it is widely recognized that adaptation efforts will be more costly and more difficult if climate mitigation actions are not taken.

In Delaware, many adaptation efforts are already underway to help increase resiliency to climate impacts at both the state and local level. Some communities have begun to incorporate climate change and sea level rise into local planning efforts, including comprehensive plans and local hazard mitigation plans. Some state agencies are conducting vulnerability assessments and using asset management approaches to address impacts to facilities and infrastructure. Improvements to floodplain and drainage standards are widely being adopted. These and other efforts will continue to strengthen resilience to climate change impacts now and in the future.

Objective

Executive Order 41 directs state agencies to "develop agency-specific actionable recommendations for improving Delaware's preparedness and resilience to climate impacts." Recommendations shall include, but not be limited to: (a) actions state agencies can take, both within their departments and with assisting residents, to adapt to and prepare for more extreme storms and projected temperature and precipitation variations; (b) actions local governments can take to improve community resiliency; and (c) outreach strategies to inform and prepare Delaware's residents and businesses about identified risks, vulnerabilities, adaptation strategies, and basics of climate change and its causes, with particular attention to providing strategies to help protect at-risk populations.

[1] Third National Climate Assessment (2014), produced by the U.S. Global Change Research Program, summarizes the impacts of climate change on the United States, now and in the future. To view the report and its findings: http://nca2014.globalchange.gov/

The Adaptation Workgroup and Methodology

To achieve the second directive of Executive Order 41, a workgroup was established to develop agency-specific recommendations for climate adaptation. Within this workgroup were the points of contact (POCs) from each of the 11 agencies and departments involved in implementing Executive Order 41. In early 2014, POCs formed internal teams within their agencies. Between January and November 2014, the POCs met regularly as a workgroup to discuss climate adaptation and develop recommendations. One of the first steps was a series of education sessions, hosted by DNREC, to help state agency staff understand the impacts that climate change could have on state operations, programs, facilities, and resources.

As a first step in the process, the POCs were asked to complete a "rapid assessment" of vulnerabilities that their agencies may have to address in the face of climate change. Several recurring themes identified by the POCs include impacts on their workforce, impacts to their facilities and assets, impacts to services and public safety, economic impacts, and the need for outreach and education. Upon completing the rapid assessment of vulnerabilities, the POCs developed potential responses to adapt and mitigate the risk for each of the vulnerabilities they identified. The POCs then evaluated and prioritized the proposed responses based on the severity of the impacts, the urgency of the response, the feasibility and practicality of implementation, and the co-benefits of the response. Responses that were deemed a high priority were drafted into adaptation recommendations. The recommendations were finalized and vetted through the POCs and are summarized in the next section, "Agency Recommendations Summaries." Full-text recommendations can be found in Appendix D.

The progress to date in the Adaptation Workgroup has focused on agency-specific, "inward-facing" recommendations that affect only the internal operations of state government. With respect to those recommendations that would affect outside stakeholders (*i.e.*, "outward-facing" recommendations), stakeholder engagement will be required before final decisions are made. To that end, further discussion and coordination will be required to discuss these recommendations in greater detail. Implementation strategies for some of the overarching themes of EO 41 are discussed briefly below, and include cross-cutting themes, interagency coordination, support for local governments, and outreach and education to the public.

Cross-Cutting Themes

EO 41 directs state agencies to develop "agency-specific, actionable recommendations" for increasing resiliency and adapting to climate change impacts. Many agencies identified similar or related vulnerabilities to impacts from increasing temperatures, more frequent extreme heat events, and increased flooding from extreme precipitation and sea level rise. In developing recommendations to respond to these impacts, a number of cross-cutting themes emerge that are shared across multiple agencies. Addressing challenges shared across many agencies will require continued coordination and planning to implement adaptation actions in a cost-effective and efficient way.

Impacts to workforce: Worker health and safety is a particular concern for agencies with many outdoor workers, such as the DelDOT, DNREC, and DSHS, which employ maintenance workers, field staff, park rangers, state police, and emergency personnel. Extreme heat is considered a key risk; safe travel and accessibility to work sites is also a concern during extreme precipitation and flooding events. Agencies have identified responses that include specific discussions regarding revised guidelines for safety training, improved protective equipment, alternative work schedules, changes to uniform dress code, and fleet vehicles able to navigate through flood conditions.

Impacts to facilities, including critical infrastructure: Many agencies identified potential impacts to state assets, including buildings, transportation and communication infrastructure, and historic and cultural resources. Damage to state properties can incur significant costs for repair or replacement, as well as lost productivity and interruption of services. Climate impacts can also impose higher costs for operations and maintenance, such as higher energy costs for cooling, and more frequent maintenance due to extreme weather conditions. Many agencies recommended incorporating climate impact considerations into asset management practices and capital planning decision making, as well as improvements in design manuals and building codes.

Impacts to services and public safety: Extreme weather events, including high-heat days and heavy precipitation events, affect state agencies in several ways. Many agencies identified flooding as a key threat to public safety, especially where evacuation routes are impaired or access to emergency facilities and equipment is affected. Office closures due to extreme weather reduce the reliability and efficiency of delivering services to the public. Climate change impacts may increase the demand for services, such as emergency drainage and discharge permits. Existing programs and services can be enhanced to prepare for these changes, with increased investment in planning and building staff capacity.

Interagency Coordination

In addition to identifying cross-cutting themes, many state agencies recognized that their "agency-specific" recommendations for climate adaptation will require coordination with other agencies. Interagency coordination is not new, nor is it unique to addressing the impacts of climate change. However, the implementation of these adaptation recommendations will require continuing or even greater coordination and collaboration. Interagency coordination will continue to be a priority for implementing adaptation measures, and will provide a forum for further discussion of climate resilience issues of statewide concern.

For example, DEDO recommends coordination with DDA and the universities to develop approaches to reduce the impacts of climate change on local farmers, crops, and production facilities, and to expand the use of agriculture technology in Delaware. DelDOT highlights work with DNREC and OSPC to review the state's strategy for stormwater management with an eye to improved resiliency. DelDOT and Homeland Security propose to reevaluate current long-term strategies for response to significant catastrophic events, current short-term evacuation policies, and detour/evacuation route management and implementation.

To support ongoing improvement in interagency coordination, several recommendations reflect the need to determine whether additional data management support and communication technology improvements are appropriate (and when). These efforts not only strengthen coordination among state agencies, but also improve coordination with local governments and other partners.

Support for Local Governments

Building resilience to climate impacts often requires climate adaptation measures to be implemented at the local level. State agencies already have many roles and responsibilities for providing services to the public by working in coordination with local governments. Executive Order 41 calls for the development of recommendations to support "actions local governments can take to improve community resiliency, including assessment of infrastructure vulnerabilities, land use policies, and other adaptation strategies." To date, many of the climate adaptation recommendations included in the Climate Framework reflect the shared responsibility between state and local agencies for protecting public safety, providing services and infrastructure, and supporting residents, visitors, and business communities. Additional opportunities to enhance outreach and technical assistance to local governments will be identified and targeted for action as implementation begins in 2015.

For example, DHSS provides many health and social services throughout Delaware communities. Integrating climate change into local activities will strengthen the capacity to respond to increased demand for services, changing needs in the community, and new health risks. OSPC plays a key role in supporting local governments in updating Comprehensive Plans and providing technical assistance. Local planning that considers future climate impacts can help improve community resiliency to higher temperatures, changes in rainfall, and increasing sea level rise and flooding risks.

State agencies can provide support and assistance in many ways. For example, DelDOT works with OSPC and local governments to develop and share geospatial mapping and infrastructure assessment tools to help inform communities about climate change impacts. DNREC provides technical support to assist local governments with adaptation and climate resilience activities. There are also grant and loan programs available to support local governments, such as planning grants through Delaware Coastal Programs and DNREC's Financial Assistance Branch.

Outreach and Education to the Public

The state of Delaware offers a wide range of education, outreach, and information services to the public—both residents and visitors—to promote economic activities, ensure public safety, and enhance the experience of visitors to the state's public parks, beaches, and wildlife areas. Many state agencies developed recommendations to incorporate information about climate impacts and adaptation into their public outreach efforts. Recognizing that public input is essential to implementation of adaptation strategies, outreach and communication events will be launched in 2015.

For example, DNREC provides education and interpretive programs on its public lands; information related to climate impacts to these natural areas can be important for the safe enjoyment of recreational boating, hunting, fishing, and nature observation. DDA works with landowners and agricultural operators to provide outreach on best practices for crop, livestock, and forestry management; education materials and workshops can also include information to address climate change, such as impacts of sea level rise on farmland and water supplies.

Providing education and outreach to targeted audiences is also integral to many state agencies. For example, DSHA recommends providing information on climate resiliency to homebuyers.

Agency Recommendation Summaries

On December 3, 2014, the Cabinet Committee on Climate and Resiliency approved the recommendations of the Adaptation Workgroup. The Climate Framework includes more than 150 recommendations (see below) for a wide range of actions that address public health and safety needs, impacts to facilities and infrastructure, and capacity to deliver services to Delaware's citizens, businesses, and communities.

Next Steps

The state agencies represented on the Cabinet Committee on Climate and Resiliency will begin implementation of adaptation recommendations in 2015. Next steps include:

- With respect to the "inward-facing" recommendations that affect only the internal operations of state government, the state agencies represented in the Cabinet Committee on Climate and Resiliency will begin implementation in 2015. To the extent implementation would have material budgetary impacts or would require legislation, agencies will quantify such impacts and/or determine what legislative or regulatory changes are needed.
- With respect to "outward-facing" recommendations that could affect stakeholders outside of state government, stakeholder engagement will be required before final decisions are made. To that end, public outreach and communication events will be launched in 2015 to discuss these recommendations in greater detail.
- Recommendations developed to date and additional opportunities to enhance outreach and technical assistance to local governments will be targeted for action. Improving community resiliency will build upon ongoing coordination with the Office of State Planning Coordination and each agency's programs that support local governments.
- Interagency coordination will continue to be a priority for implementing adaptation measures, and will provide a forum for further discussion of climate resilience issues of statewide concern.

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Agency Recommendations for Climate Adaptation: **Delaware Department of Agriculture**

Agency mission

The mission of the Delaware Department of Agriculture (DDA) is to sustain and promote the viability of food, fiber, and agricultural industries in Delaware through quality services that protect and enhance the environment, health, and welfare of the general public.

Climate impacts to agency

Changes in temperature and precipitation affect the management of forest lands and crop lands. Water quality may be affected by fluctuations in total precipitation amounts and frequency. Plant health and soil quality conditions may be affected, which in turn can influence water quality through increased nutrients in runoff, as well as total runoff amounts. Sea level rise may lead to loss of farmland and/or soil productivity. Changing temperatures may affect plant and animal health with increasing risks of harmful insects, fungi, and molds. Climate change also poses economic impacts to the agricultural sector, including costs related to increasing energy demands for cooling/heating and irrigation.

Adaptation responses

DDA identified internal policies that should be evaluated to consider climate impacts. Outreach and education is also an important role for DDA, in coordination with the University of Delaware Cooperative Extension and the U.S. Department of Agriculture.

Agency recommendations

The Delaware Department of Agriculture should:

- Evaluate response to increased susceptibility to forest wildfires by evaluating policies related to risk management, fire prevention, and fire management.
- Evaluate policies related to nutrient management, pesticide application, risk assessment, and cropping practices that may be affected by potential increases in the number of hot, dry days per year.
- Educate landowners and agricultural operators to address and mitigate loss of land due to sea level rise.
- Educate landowners and agricultural operators on the effects of saltwater intrusion resulting from sea level rise.

Agency Recommendations for Climate Adaptation: **Delaware Department of Education**

Agency mission

The mission of the Department of Education is to promote the highest quality education for every Delaware student by providing visionary leadership and superior service.

Climate impacts to agency

Increasing risks of flooding due to extreme rainfall events and sea level rise pose threats to the safety of students and faculty, and may increase frequency of school closures when safe access to schools is impaired. Flooding can also increase costs for repair and maintenance of school buildings and infrastructure. Increasing temperatures are expected to increase energy demands and costs for school facilities. School transportation systems may also need upgrading to meet higher fuel efficiency standards and decrease greenhouse gas emissions.

Adaptation responses

Responses to climate impacts include addressing the siting and design of school buildings and infrastructure, and ensuring that energy efficiency and climate resiliency are incorporated into new structures and renovations of existing structures.

Agency recommendations

The Delaware Department of Education should:

- Work with school districts, the Office of State Planning, and the Office of Management and Budget to ensure that schools are not built on sites subject to flooding or sea level rise.
- Work with Facilities Management (OMB) and the school districts to encourage LEED certification (Leadership in Energy and Environmental Design), Green Ribbon standards, or other standards to promote the most efficient design and construction for school buildings to reduce their environmental footprint.
- Continue to replace school buses with cleaner buses meeting the most recent EPA requirements.

Agency Recommendations for Climate Adaptation: **Delaware Department of Health and Social Services—Division of Public Health**

Agency mission

The mission of the Delaware Department of Health and Social Services (DHSS) is to improve the quality of life for Delaware's citizens by promoting health and well-being, fostering self-sufficiency, and protecting vulnerable populations.

Climate impacts to agency

The impacts of climate change pose serious threats to human health and thus the services that the agency provides. Increasing temperatures not only increase the susceptibility of citizens to heat-related diseases, but may also result in rising incidence of certain infectious diseases and outbreaks of new diseases not currently endemic to Delaware. Increased temperatures, paired with increased production of ozone and other particulate matter, places citizens at increased risk of respiratory illnesses. Extreme weather events and flooding also have detrimental impacts on human health, especially for vulnerable populations.

Adaptation responses

Responses to climate impacts include improving the monitoring and surveillance capabilities of the department to account for health-related impacts, expansion of data capabilities and storage on health-related impacts, and outreach and education to localities on the potential health impacts that may be induced by climate change.

Agency recommendations—Division of Public Health

The Delaware Department of Health and Social Services—Division of Public Health recommendations fall into the following categories:

- To develop new or improve existing monitoring and surveillance, the department should:
    - Advocate for an expansion of vector surveillance programs to identify new vectors and monitor the size of vector populations.
    - Support monitoring of new and emerging diseases resulting from climate change.
    - Evaluate the specific benefits and costs of developing and maintaining an Environmental Public Health Tracking System for the ongoing collection, integration, analysis, interpretation, and dissemination of data from environmental hazard monitoring, and from human exposure and health effects surveillance.
    - Evaluate the feasibility of monitoring private well water quality in coastal areas for saltwater intrusion and investigate the potential to connect to a public water source.

    - Examine ways to track new and emerging diseases related to climate change, such as Chikungunya fever, to respond to the influence that global climate change may have on infectious disease dynamics.
    - Expand the list of reportable conditions to include those related to extreme or adverse weather conditions (e.g., heat stroke and heat stress).

- To enhance current data management practices, the department should evaluate the specific benefits and costs of:
    - Expanding and updating infrastructure and resources for data collection and analysis to include climate change impacts.
    - Developing geographic information system (GIS) mapping of vulnerable populations and disease patterns to help identify specific populations and health outcomes affected by climate change–related events.
    - Consolidating DPH databases so climate change impacts to DPH can be tracked and monitored.

- To assist in outreach and education, the department should:
    - Incorporate information on climate change impacts on health in DPH outreach materials (web-based and printed materials).
    - Update and develop new materials on climate change and health for outreach.
    - Provide internal outreach, education, and training for the DPH staff on climate change impacts and risks to health.

- To accomplish other priorities, the department should:
    - Review and update their programs to include climate change impacts.
    - Develop a Health Impact Assessment (HIA) and other tools for assessing the health of a community.
    - Advocate for integrating climate change with local activities around sustainability and mitigation to deal with water issues, heat island effects, land use and infrastructure planning, building codes, promotion of green energy, and mass transit.
    - Support and advocate expanding the air quality monitoring program of the Department of Natural Resources and Environmental Control (DNREC).
    - Identify and share possible climate change funding opportunities related to health issues.

Agency Recommendations for Climate Adaptation: **Delaware Department of Health and Social Services—Social Service Divisions**

Agency mission

The mission of the Delaware Department of Health and Social Services (DHSS) is to improve the quality of life for Delaware's citizens by promoting health and well-being, fostering self-sufficiency, and protecting vulnerable populations.

Climate impacts to agency

The impacts of climate change pose serious threats to human health and thus the services that the agency provides. Increasing temperatures, extreme weather events and flooding have detrimental impacts on human health, especially for vulnerable populations. Access to and continued availability of social services can also be affected during extreme weather events, adding to the vulnerability of DHSS clients.

Adaptation responses

Responses to climate impacts include improvements to communication systems, actions to prepare for emergencies and extreme weather events, and outreach and education to DHSS clients on adapting to changing climate conditions.

Agency recommendations—Social Service Divisions

The Department of Health and Social Services—Social Service Divisions should:

- Establish communication link to Division of Developmental Disability clients who live on their own, particularly those requiring respiratory assistance that will be particularly vulnerable during a heat wave or power outage.
- Expand the refill window of certain medications (e.g., psychotropic medicine) for clients to ensure availability of medications during emergency evacuations or extreme weather events.
- Implement a statewide Smart-911 system.
- Discuss with managed care organizations the feasibility of requiring contingency plans for extreme weather.
- Remove potential hazards from low-lying areas near DHSS facilities to prevent damage during flood events.
- Advocate for additional resources for Low-Income Home Energy Assistance Program (LIHEAP) and increased flexibility in guidelines on how to use funds.
- Create a statewide education campaign to engage DHSS clients on climate change, resiliency, and adaptation initiatives.
- Consider creating mobile State Service Centers to provide services to clients who are relocated during emergency evacuations or extreme weather events.

- Designate State Service Centers as critical facilities and provide the necessary infrastructure (e.g., generators) to ensure continued availability of services during extreme weather events and during power outages.
- Provide training and education on climate preparedness and adaptation.
- Identify sites to be used as designated cooling and heating centers during extreme weather events.

Agency Recommendations for Climate Adaptation: **Delaware Department of Natural Resources and Environmental Control**

Agency mission

The mission of the Delaware Department of Natural Resources and Environmental Control (DNREC) is to protect and manage the state's vital natural resources, protect public health and safety, provide quality outdoor recreation, and to serve and educate the citizens of the First State about the wise use, conservation, and enhancement of Delaware's environment.

Climate impacts to agency

Climate change impacts the lands, waters, and resources that DNREC is responsible for managing and protecting. Lands that DNREC manages and regulates, such as state parks and wildlife areas, are affected by increasing temperatures, changing precipitation, and sea level rise. Public safety and access and opportunities for public use and educational programs may be limited by increased flooding. Delaware's natural habitats, flora, and fauna will be affected by extreme temperatures and precipitation. Sea level rise will affect beaches, dunes, and tidal streams by increased erosion and changes in salinity and water temperature. The agency's regulatory and permitting programs may face increasing demands for service, and the agency will need to evaluate and modify current programs to address changing environmental conditions.

Adaptation responses

DNREC's responses to climate impacts fall into a number of department-wide priorities that address managing resources and assets, supporting local governments, and integrating climate change into operational and capital budget planning.

Agency recommendations

The Delaware Department of Natural Resources and Environmental Control recommendations fall into the following categories:

- To incorporate climate change into land management and stewardship decisions for DNREC-owned lands, the department should:
    - Design and implement restoration activities to slow the current loss of coastal beach, marsh, and forest habitats.
    - Discuss the expansion of invasive species control and consider establishing early-detection and rapid management response teams in coordination with other land management agencies and partners.
    - Prepare to restore riparian buffers on wildlife areas, fishing and boating access areas, and private lands through voluntary incentive programs.

- Prepare to restore adequate buffers around unique ephemeral wetlands, including coastal plain seasonal ponds and vernal pools.
- Prepare to manage a different group of important fish and wildlife species and habitat, as geographic distributions shift with climate.
- Evaluate strategies for increasing native pollinator habitat on state wildlife areas and private lands.
- Evaluate the need for revisions to technical specifications for vegetative practices, in consideration of sea level rise and saltwater intrusion.
- Incorporate climate change into land stewardship decisions at the Delaware National Estuarine Research Reserve (DNERR).
- Increase climate change–focused research and monitoring on DNERR land.

- To incorporate climate change into asset management for hard and natural infrastructure, the department should:
  - Develop new standards for DNREC buildings in response to changing threats.
  - Consider relocating Fish and Wildlife facilities, including offices, education centers, boat ramps and equipment storage areas, and redesign or relocate facility access roads already at risk from flooding and storm surge.
  - Develop a climate change adaptation plan for the two DNERR properties in the state.
  - Adapt coastal impoundments and ponds by stabilizing and increasing the resilience of levees, water-control structures and dams, and implement water-level management and restoration activities that will improve accretion and vegetative growth.
  - Evaluate need for revisions to technical standards and specifications for stormwater management.

- To provide technical assistance to local governments, communities, and businesses, the department should:
  - Provide technical guidance and funding to encourage communities to plan for and implement appropriate climate adaptation measures.
  - Study how to prioritize funding to give preference to projects in areas that have taken steps to adopt best practices and meaningful standards for drainage and floodplain management.
  - Provide technical support to local governments to enhance focus on climate impacts and long-term sustainability in the Comprehensive Plan and in local ordinances.
  - Work with county, municipal, and local governments to ensure the uniform training, compliance, and enforcement of energy codes.
  - Develop a model building code that could be adopted at the state or local level.
  - Develop a model ordinance for local governments to use to require that home heating oil tanks be secured to prevent detachment and release during a flooding event.
  - Assist local governments in developing strategies to protect wastewater treatment facilities from flooding.
  - Assist suppliers of drinking water from surface water sources to develop strategies to protect water intakes from flooding and salt water.

    - Assist suppliers of drinking water from groundwater sources to develop strategies for the protection of wells from flooding and salt water.

- To integrate climate impacts into scientific study, regulation, and permitting decisions, the department should:
    - Evaluate the need for improving spill containment requirements for aboveground storage tanks and hazardous waste storage areas, which are vulnerable to flooding and storm surge impacts.
    - Incorporate Executive Order 41 into the Federal Consistency Program's enforceable coastal management policies.
    - Evaluate need for revisions to stormwater regulation.
    - Evaluate potential changes to the methods of placement of wetland and water quality monitoring stations and methods of research and data collection.
    - Evaluate design specifications and maintenance practices to ensure that rain gardens and other stormwater systems on state lands remain functional with increases in extreme precipitation.
    - Evaluate the adequacy of drainage infrastructure to address changes in precipitation and sea level rise.
    - Ensure that Delaware emissions of the precursors of ground-level ozone (SO_2, NO_x, and VOCs) remain well controlled.
    - Consider incorporating equipment siting requirements into the air permitting process.

- To incorporate adaptation into operational budget and capital planning processes, the department should:
    - Increase involvement and activities associated with energy emergency planning.
    - Increase support for shoreline management and protection for living shorelines.
    - Plan for increasing needs, costs, and potential regulatory changes for shoreline management and beach preservation.
    - Evaluate needs for channel maintenance to maintain current levels of navigable waterways, recreational boating and fishing amenities, and park use.
    - Prepare to control mosquito populations nearly year-round to address increased complaints and to reduce transmission of mosquito-borne diseases.
    - Prepare to address an increase in nuisance wildlife complaints by increasing outreach about best practices and services available.
    - Prepare to handle an increased number of fish kills and harmful algal blooms.

- To ensure protection of public health and safety, the department should:
    - Develop a plan to provide alternative evacuation routes, access roads and trails, and to ensure communication is available for emergency response.
    - Issue emergency waivers for repairs to infrastructure, environmental resources, and property resulting from storms and flooding events.
    - Support the update of requirements in the Debris Management Section of the State Emergency Operations Plan and ensure their implementation.

- To improve data and information available to the public, the department should:
    - Update floodplain maps with consideration of climate change dynamics.
    - Coordinate on the use of updated floodplain maps to assist with floodplain mitigation activities.
    - Update mapping of tidal wetland jurisdictional boundaries.
    - Increase climate change content in educational and outreach programs.
    - Develop educational materials on vector-borne diseases, prevention and treatment of heat stroke and dehydration, and emergency response in extreme weather events.
    - Build capacity to conduct air quality modeling to evaluate the impact of temperature change on ozone levels and fine particulate matter.
    - Increase climate change–focused research and modeling.
- To address other department-wide priorities, the department should:
    - Develop resiliency criteria for distribution of grant and contract funds based on the flexibility and intent of the funding source.
    - Support climate mitigation and adaptation policy in coordination with the Governor's Committee on Climate and Resiliency, convened under Executive Order 41.

Agency Recommendations for Climate Adaptation: **Delaware Department of Safety and Homeland Security**

Agency mission

The mission of the Delaware Department of Safety and Homeland Security is to promote and protect the safety of people and property in Delaware.

Climate impacts to agency

Increasing temperatures and extreme heat events/prolonged heat waves pose a significant threat to the Department of Safety and Homeland Security, primarily due to the high number of outdoor workers the agency employs. These high temperatures also place a burden on vehicles and facilities. Increased levels of precipitation, paired with sea level rise, pose serious risks of flooding, which can damage critical infrastructure, including facilities and roadways. This has the potential to not only place agency employees at risk, but also the citizens that they seek to protect.

Adaptation responses

Responses to climate impacts include addressing the siting and design of facilities, ensuring the safety of outdoor workers under scenarios of high heat, assessing the effects of climate change to agency assets, and altering a number of policies to integrate climate adaptation and resilience into agency operations.

Agency recommendations

The Delaware Department of Safety and Homeland Security should:

- Develop operational plans to address the potential impacts of sea level rise.
- Consider alterations to policies regarding worker safety in an increased temperature environment.
- Conduct additional research to provide accurate information on the effects of increased temperatures and increased precipitation on buildings and vehicles, including the effects on existing structures and vehicles.
- Make programmatic adjustments to adapt to increasing levels of precipitation, flooding, and sea level rise.

Agency Recommendations for Climate Adaptation: **Delaware Department of State**

Agency Mission

The Secretary of State (DOS) oversees an extremely diverse department with responsibilities in virtually every aspect of state government: economic development, finance, transportation, housing, education, culture, and quality-of-life issues. The Department's mission is to:

- Promote Delaware's economy and generate state revenue;
- Manage and facilitate citizen access to governmental, educational and recreational information;
- Preserve and promote Delaware history, art and culture;
- Assist and provide direct services to Delaware veterans and their families;
- Promote equal opportunity and protection for all persons;
- Provide regulatory, licensing, investigative and consumer services to protect the public's health, safety and economic welfare; and
- Administer the state's public and merit employment relations laws and government ethics laws.
- Regulate investor-owned public utilities to ensure safe, reliable and reasonably priced cable, electric, natural gas, wastewater, water and telecommunications services for Delaware consumers.

Climate impacts to agency

Extreme temperatures, flooding and storms will impact workforce availability and health, particularly for outdoor workers. Sea level rise and localized flooding pose direct threats to historic properties and structures. Increasing temperatures and heavy precipitation will require more frequent maintenance cycles due to increased wear and tear on buildings and equipment.

Adaptation responses

Climate change requires responses that reduce greenhouse gas emissions as well as increase preparedness to climate impacts. Climate mitigation measures and climate adaptation recommendations are identified as priorities for the Department of State.

Agency recommendations

The Delaware Department of State recommendations fall into the following categories:

- To identify and support policy initiatives that reduce greenhouse gas emissions (climate mitigation), the Department should:
    - Review Public Service Commission options to help reduce greenhouse gases and mitigate climate change.
    - Broaden utility review of climate change initiatives to include non-regulated entities.
    - Review utility tariff approaches to minimizing greenhouse gases.
- To enhance utility infrastructure to ensure reliability of service, the Department should:
    - Review potential for infrastructure enhancements that can help mitigate climate change exposure.
    - Consider a review of storm response procedures with all regulated utilities.

- To incorporate climate change into asset management and protection of historic and cultural resources, the Department should:
    - Increase preparedness for climate change events by completing mapping of all cultural resources in the Cultural and Historical Resources Information System (CHRIS), a GIS-based system.
    - Conduct vulnerability assessments and scenario planning, to include evacuation and triage procedures.
    - Ensure preparedness for threatened sites.
    - Evaluate the specific costs and benefits of creating a category of historic preservation tax credits to offset the costs of adaptation and protection measures.
    - Publish cultural resource management plans.
- To incorporate climate change into asset management, the Department should:
    - Identify all work locations vulnerable to flooding and mitigate impacts through maintenance planning.
    - Create baseline energy efficiency standards for all leased sites in the department.
    - Create baseline energy efficiency for all office equipment and promote use of Energy Star equipment where appropriate.
    - Ensure all new Department of State buildings are in compliance with Executive Order #18 for energy conservation and efficiency; use of clean, renewable energy; and environmentally responsible construction.
    - Ensure that all new buildings receiving funding from the state of Delaware through the Department of State, are in compliance with Executive Order 18 for energy conservation and efficiency; use of clean, renewable energy; and environmentally responsible construction.
- To ensure workforce safety and capacity to provide services, the Department should:
    - Evaluate the need for increasing the number of technical staff to address the potential increase in call volumes and more complex hearings.
    - Develop a staff training program to promote personal energy use awareness.
    - Establish protocols to protect employees working outside from adverse effects of extreme temperature days.
    - Evaluate specific workplace options for employees, such as video-conferencing capability, ride-sharing, and flexible work schedules.
- To ensure consumer protection, the Department should:
    - Evaluate the need for alternate utility rate structures, with approval by the Public Services Commission.
    - Assess financial impact of any new rates in consideration of utility consumer interests.
    - Enhance outreach to utility consumers on issues of climate change, mitigation, energy efficiency, and any potential rate changes.
    - Include protected classes and undocumented communities in outreach efforts to ensure fairness and equity.

Agency Recommendations for Climate Adaptation: **Delaware Department of Transportation**

Agency mission

The mission of the Delaware Department of Transportation (DelDOT) is to ensure excellence in transportation by striving to make every trip in Delaware safe, reliable, and convenient for people and commerce, and by providing safe choices for travelers in Delaware to access roads, rails, buses, airways, waterways, bike trails, and walking paths.

Climate impacts to agency

The long-term investments of transportation infrastructure will be affected by climate change in many ways. Sea level rise, temperature extremes, flooding, and heavy precipitation will affect the condition, operability, and life cycle of transportation assets. Impacts include damage to asphalt, corrosion, contraction, and expansion of materials. Maintenance of stormwater management and vegetation along roadways will also be affected. Design and construction of bridges, roadways, and other structures may need to be revised, through updates to design manuals and to specific project designs.

Adaptation responses

DelDOT's responses to climate impacts focus on improving asset management practices by incorporating climate resiliency into design, materials, and siting guidelines for transportation infrastructure. Coordination with other state agencies is also identified as key to addressing emergency management and land use planning issues. Climate change requires responses that reduce greenhouse gas emissions as well as increase preparedness to climate impacts. Climate mitigation measures and climate adaptation recommendations are identified as priorities for the Department of Transportation.

Agency recommendations

The Delaware Department of Transportation recommendations fall into the following categories:

- To incorporate climate change into asset management, the department should:
    - Continue development of geospatial data sets that can help identify vulnerable areas and help estimate the impact of reasonably anticipated events (such as a Category 3 hurricane).
    - Conduct a comprehensive analysis of the state's roadways, bridges, and other infrastructure to identify critical infrastructure that may be vulnerable to climate impacts.
    - Integrate climate resiliency into its bridge and highway design manuals strategies to address climate impacts, including sea level rise, for short-term, medium-term, and long-term anticipated effects.
    - Build transportation enhancements (pathways, trails, roadscapes, etc.) to accommodate impacts of climate change.

    - Identify and assess existing chronic flooding and erosion problems that affect transportation infrastructure.
    - Evaluate and qualify materials used to reduce the impacts of stormwater runoff.
    - Reevaluate stormwater management approaches for improved resiliency.
    - Evaluate new technologies in asphalt and concrete pavement composition to mitigate melting of road surfaces or other damage.
    - Incorporate climate impacts into cost-effective investment in infrastructure.
    - Evaluate whether to obtain insurance to assist in recovery from catastrophic events.

- To ensure workforce and public health and safety, the department should:
    - Evaluate, and as necessary adjust, worker safety guidelines and train workers to identify risks of exposure to high heat, extreme temperatures, and impacts to roadway and project site conditions.
    - Train workers utilizing materials for roadway maintenance to apply more resilient materials in responsible ways.
    - Evaluate the costs, benefits, and feasibility of driving restrictions for air quality events.
    - Develop revised maintenance schedules in response to air quality.
    - Adjust emergency response strategies to provide transit as necessary without endangering drivers or passengers.
    - Coordinate with the Department of Safety and Homeland Security on long-term strategies for significant catastrophic events and in the determination of short-term abandonment policies and evacuation routes.

- To support climate resiliency in local communities, the department should:
    - Work with local governments, in conjunction with the Office of State Planning Coordination, on the development of geospatial mapping and infrastructure assessment tools to help inform the municipalities and counties.

- To identify and support policy initiatives that reduce greenhouse gas emissions (climate mitigation), the department should:
    - Purchase and deploy lower-emission light-duty vehicles as 10 percent of its fleet by 2020.
    - Consider the deployment of more alternative energy technologies, namely energy efficiency, and wind and solar technology in its administrative and operational buildings.

Agency Recommendations for Climate Adaptation: **Delaware Economic Development Office**

Agency mission

The mission of the Delaware Economic Development Office (DEDO) is to be responsible for attracting new investors and business to the state, for promoting the expansion of existing industry, for assisting small and minority-owned businesses, for promoting and developing tourism, and for creating new and improved employment opportunities for all citizens in Delaware.

Climate impacts to agency

Climate change has the potential to disrupt significantly the economic integrity of the state of Delaware. Increasing temperatures and alterations in precipitation can negatively affect the output of the agriculture industry. Extreme weather events, sea level rise, and flooding place the Delaware coastline, and therefore the tourism economy, at extreme risk.

Adaptation responses

Because DEDO does not have regulatory or enforcement or programmatic responsibilities that could be modified to mitigate the impacts of climate change directly, the agency's role in climate adaptation is primarily one of collaboration with other agencies. In doing so, DEDO will strive toward maintaining the economic integrity of the state while seeking ways to stimulate the economy through sustainable practices and fostering resilience.

Agency recommendations

The Delaware Economic Development Office should:

- Position itself as an advocate for the adoption of the state's recommendations for climate change adaptation to the business and tourism communities.
- Evaluate the possibility of establishing a joint marketing effort by state agencies working in partnership to instill a deeper awareness of the public transportation services capable of transporting travelers to Delaware's attractions.
- Focus a Delaware Tourism Office outreach effort on realtors and rental agents at the Delaware beaches to create awareness of the benefits of changing the current standard of what constitutes a "weekly rental" of beach properties.
- Target growth and expansion of clean/light industry statewide to the areas most resilient to the impacts of climate change.
- Work with the Department of Agriculture and universities to develop approaches to reduce the impacts of climate change on local farmers, crops, and production facilities and to expand the use of agricultural technology in Delaware.

- Utilize existing Business Retention Outreach efforts to educate existing business and industry on the risks of climate change to their Delaware location(s) and develop approaches to mitigate that risk.
- Advocate for the reuse of existing industrial brownfield sites and support infrastructure statewide to reduce the use of greenfield sites and the construction of new, duplicate infrastructure.

Agency Recommendations for Climate Adaptation: **Delaware State Housing Authority**

Agency mission

The mission of the Delaware State Housing Authority (DSHA) is to efficiently provide, and assist others to provide, quality, affordable housing opportunities and appropriate supportive services to low- and moderate-income Delawareans.

Climate impacts to agency

Increasing temperatures result in an increased need for energy for cooling of housing structures. Flooding as a result of increased precipitation and sea level rise can place housing structures at risk to physical damage, while also impairing access. Impacts will be felt most severely in low income and other vulnerable populations unless steps to proactively improve resiliency are taken.

Adaptation responses

Responses to climate impacts are targeted toward improving resilience in the housing sector through improvements in energy efficiency and the siting and design of housing structures. Another important component of the responses captures the need for outreach and education to constituents.

Agency recommendations

The Delaware State Housing Authority should:

- Evaluate energy efficiency standards of the Low Income Housing Tax Credit program.
- Explore partnering on grants that address resiliency, such as the U.S. Department of Housing and Urban Development's National Disaster Resilience Competition.
- Consider sea level rise impacts in its programs that facilitate new construction and or rehabilitation.
- Work with the 11 housing counseling agencies to incorporate awareness on sea level rise into their prepurchase counseling.
- Promote sustainable building practices in the Downtown Development District grant program.

Agency Recommendations for Climate Adaptation: **Delaware Office of Management and Budget**

Agency mission

The mission of the Delaware Office of Management and Budget (OMB) is to provide leadership, partnerships, policy development, planning, and objective analysis to maximize the value of state assets, including people, facilities, land, and financial resources.

Climate impacts to agency

The impacts of climate change, including increased temperatures, precipitation, and sea level rise, pose risks to state facilities, the workers that the state employs, and all Delaware citizens.

Adaptation responses

Responses to climate impacts require actions to mitigate greenhouse gas emissions and to promote preparedness. OMB has identified responses that achieve both goals, through such areas as the management of state facilities, state procurement, and human resource management.

Agency recommendations

The Office of Management and Budget should:

- Advocate for changes to state building design practices and policies to promote environmentally friendly design considerations for state facilities to minimize environmental impact.
- Improve the resilience of state facilities and equipment to climate impacts.
- Develop comprehensive guidelines to site state facilities that account for sea level rise and flooding due to extreme rain events.
- Review and revise Life Cycle Costing Analysis procedures to account for potential increased precipitation, sea level rise, and extreme temperatures.
- Evaluate maintenance schedules of buildings and grounds for potential climate change effects to ensure acceptable performance during extreme events.
- Investigate alternate work schedules as appropriate for outdoor workers.
- Incorporate resilience into Government Support Services contracting by building heating/cooling and weather-resistance requirements into contract specifications as necessary.
- Incorporate resilience into messenger services to maintain contingency plans.
- Offer employees training on the potential impacts that climate change may have on their employment and their homes.

Agency Recommendations for Climate Adaptation: **Delaware Office of State Planning Coordination**

Agency mission

The mission of the Delaware Office of State Planning Coordination (OSPC) is the continuous improvement of the coordination and effectiveness of land use decisions made by state, county, and municipal governments while building and maintaining a high quality of life in the state of Delaware.

Climate impacts to agency

The impacts of climate change will be felt most significantly at the local level in communities. Many communities within the state are extremely prone to flooding and sea level rise in the coming years, placing citizens, infrastructure, and other resources at risk.

Adaptation responses

The Office of State Planning Coordination has identified responses that primarily deal with assisting local governments and municipalities in proactively reducing their vulnerability to climate impacts through incorporation of climate resilience in Comprehensive Plans.

Agency recommendations

The Office of State Planning Coordination should:

- Revise the PLUS checklist used by local governments for preparation of their Comprehensive Plans to “strongly encourage” the consideration of future climate impacts.
- Examine ways to incorporate climate change and sea level rise impacts in the PLUS application used by project applicants.
- Provide technical support to local government to address climate change impacts in their Comprehensive Plans and local ordinances.
- Provide technical assistance to support integration of climate impacts and to reduce greenhouse gas emissions through adaptation and mitigation at the local level.
- Examine ways to incorporate climate change and sea level rise as factors in the next update to State Strategies for Policies and Spending.
- Establish and maintain GIS layers related to climate change and sea level rise impacts (i.e., FirstMap).

Chapter 3:
Flood Avoidance Recommendations

Background and Introduction

Increasing frequency and intensity of flood events is a primary impact of climate change and one that is particularly significant for the state of Delaware. The state's low average elevation, population density, and dependence upon coastal and riverine resources for jobs, tourism, and recreation make it particularly vulnerable to the impacts of flooding. Flood impacts will be exacerbated by climate change in two primary ways: increased frequency of extreme precipitation events and sea level rise.

Historic weather data and climate change projections both show trends toward an increase in precipitation falling in heavy downpours.[2] Heavy rain events often result in local flooding and, when combined with high tides, can overwhelm the capacity of stormwater and wastewater systems and cause extensive damage to homes and infrastructure.

Rising sea levels will also increase the likelihood of flooding and damage during coastal storm events. Sea level rise can be defined as an increase in average tide levels over time and is caused by a combination of subsidence of land and global climate change. The sea level trend as measured by the tide gauge in Lewes operated by the National Oceanic and Atmospheric Administration has recently been revised upward from 3.20 to 3.39 millimeters per year. This is equivalent to a change of 1.11 feet (0.34 meter) over 100 years.[3] The existing rate of sea level rise is increasing and expected to accelerate in the coming decades as a result of climate change. The state of Delaware is currently planning for an increase in average sea level of 1.5 to 4.9 feet (0.5–1.5 meters) by the year 2100.

Increased frequency and severity of flooding impacts are already being seen and felt today in Delaware's coastal communities. These effects have been substantiated by a recent National Oceanic and Atmospheric Administration report showing that the number of nuisance flooding events has increased 300 percent since the 1950s.[4] Impacts include temporary flooding or permanent inundation of wetlands and dry land, saltwater intrusion into freshwater supplies, and rising water tables. The impacts of flooding are felt statewide, and sea level rise will increase these impacts in coastal areas.

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[2] National Climate Assessment (http://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing)
[3] National Oceanic and Atmospheric Administration – tide gauge data for Lewes, DE (http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8557380).
[4] National Oceanic and Atmospheric Administration, Technical Report NOS CO-OPS 073 (http://tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_073.pdf)

Objective

Executive Order 41 directs state agencies to "incorporate measures for adapting to increased flood heights and sea level rise in the siting and design of projects for construction of new structures and reconstruction of substantially damaged structures and infrastructure." It calls for avoidance of new structures in flood-prone areas and special design standards for structures where avoidance is not practicable.

The Flood Avoidance Workgroup and Methodology

Under the direction of Executive Order 41, a technical workgroup was established to develop flood avoidance guidance for state agencies. The Flood Avoidance Workgroup (FAW) is led jointly by the DNREC Division of Watershed Stewardship and the Delaware Coastal Programs Office. Departments represented in the workgroup include:

- Delaware Department of Education
- Delaware Department of Natural Resources and Environmental Control
- Delaware Department of Transportation
- Delaware Office of Management and Budget
- Delaware Office of State Planning Coordination
- Delaware State Housing Authority

The FAW met regularly between April and November 2014 to pursue the completion of five tasks:

1. Develop a new set of maps and tools for use by state agencies in implementing the guidance.
2. Develop guidance for use by state agencies for the siting and design of structures and infrastructures, with an emphasis on avoidance of current and future flood risk.
3. Identify the programs and processes that will help ensure compliance with guidelines. Work with them as needed to incorporate guidance into their policies/checklists.
4. Develop guidance for the use of natural systems and green infrastructure in state projects.
5. Coordinate development of tools and guidance with other EO 41 groups, including the points of contact and the Cabinet Committee on Climate and Resiliency.

Maps

The Flood Insurance Rate Maps produced by the Federal Emergency Management Agency (FEMA) are the most frequently used mapping tool to estimate potential flood risk on a particular parcel of land. However, these maps do not take future sea levels and precipitation patterns into consideration; they utilize historic data and current conditions to depict flood risk, while flood risks are increasing over time.

Maps depicting potential areas of inundation from sea level rise were developed by the DNREC Delaware Coastal Programs Office in 2009 and are widely used to understand potential impacts of sea level rise. However, these maps depict only where the higher mean high tide line could be in the future and do not depict the additional impact of either storm surge or rainfall.

Because of the shortcomings of the existing mapping products available for decision making, the Division of Watershed Stewardship contracted with a consulting firm to develop a statewide map that depicts the *combined* risk of sea level rise and coastal storms. This combined map, the Flood Risk Adaptation Map, depicts the extent of flooding that could occur during a 1 percent-chance flood event[5] if mean sea levels are 3 feet (0.9 meter) higher than they are today. Only one sea level rise scenario (a 3-foot increase in mean sea levels) was modeled due to funding limitations. This selection was recommended by the FAW technical experts as a reasonable compromise that allows users to visualize storm impacts late century at moderate levels of sea level rise, and mid-century should sea levels rise at a more rapid rate (closer to the high scenario of 4.9 feet [1.5-meters]). These maps do not depict increased risks associated with changes in coastal landforms, increased wave heights associated with deeper coastal flooding, and other secondary hazards.

The Flood Risk Adaptation Map will be made available to state agencies as a GIS layer through the state's FirstMap system. If funding and resources can be obtained, the map can also be used to create an interactive and easy-to-use tool for all state agencies to quickly and easily understand whether their project could be subject to the flood avoidance and design provisions of EO 41.

Flood Avoidance and Design Guidance

To accompany the Flood Risk Adaptation Map, a Flood Avoidance and Design Guidance document is under development. The guidance document is envisioned to be an easy-to-use resource for all state agency employees involved in a capital project, from site-selection to construction. It will step users through the process of using the Flood Risk Adaptation Map to avoid construction of new structures and infrastructure in flood-prone areas. If avoidance is not feasible, the guidance document also helps a user find and select the appropriate flood level and adaptation strategies. The guidance is currently in draft form and under review and discussion by FAW members. It is on track to be completed during the first quarter of 2015.

Programs and Processes (Recommendations)

In addition to the mapping and guidance tools, the FAW has begun to identify those programs and policies that are essential to ensuring widespread adoption and compliance with the flooding and sea level rise provisions of EO 41. The FAW has developed a list of 11 recommendations for institutionalizing the EO 41 Flood Avoidance and Design Guidance. These recommendations were developed by FAW members specifically to capture programs and policies most likely to help ensure that other programs throughout the state are incorporating EO 41 into their capital projects. They were developed separately from the recommendations developed through the Adaptation Workgroup, but should be implemented similarly.

The FAW recommendations for institutionalizing the flooding and sea level rise provisions of EO 41 by agency are as follows:

[5] The 1% annual exceedance probability (AEP) flood is the basis for the National Flood Insurance Program. This level of flood risk has a 1-in-100 chance of being equaled or exceeded in any given year, and is often referred to as the "100-year flood," (http://pubs.usgs.gov/gip/106/).

Department of Natural Resources and Environmental Control Recommendations

- Modify the Preliminary Engineering Report Guidance Document required for Water Pollution Control Revolving Fund applications to incorporate the provisions of EO 41.
- Modify the Water Pollution Control Revolving Fund Project Priority List criteria to incorporate the provisions of EO 41.
- Modify Delaware Coastal Management Policies to incorporate the provisions of EO 41.

Department of Transportation Recommendations

- Modify the DelDOT Development Coordination Manual to incorporate the provisions of EO 41.
- Modify the DelDOT Bridge Design Manual to incorporate the provisions of EO 41.
- Modify the DelDOT Road Design Manual to incorporate the provisions of EO 41.

Office of Management and Budget Recommendations

- Modify the final design review checklist used by Facilities Management to incorporate the provisions of EO 41.
- Modify the Preliminary Review Checklist for State Clearinghouse to incorporate the provisions of EO 41.
- Consider carrying flood insurance for critical state properties in areas identified through the Flood Risk Adaptation Map.

Office of State Planning Coordination Recommendations

- Modify the Preliminary Land Use Service Applicant Checklist to incorporate questions regarding sea level rise and combined flooding impacts.
- Modify the Strategies for State Policies and Spending to incorporate the Flood Risk Adaptation Map.

Green Infrastructure Guidance

Executive Order 41 calls for measures to improve resiliency to flooding by "using natural systems or green infrastructure to improve resiliency wherever practical and effective." The Flood Avoidance Workgroup has begun background research to develop a guidance document to help define green infrastructure and provide examples of where these practices can be used to reduce flood impacts.

Coordination

Throughout the process, FAW members have coordinated on the development of tools and guidance with the points of contact and attended POC meetings to share information and progress. Coordination with the Adaptation Workgroup has also been important to the process, as flood avoidance is closely linked to many of the adaptation recommendations.

Next Steps

The Flood Avoidance Workgroup will complete the Flood Avoidance and Design Guidance document as a technical guide, and will assist state agencies with implementation in 2015. The Climate Framework includes 11 recommendations that can be used to institutionalize the Flood Avoidance and Design Guidance. Successful incorporation of the Flood Risk Adaptation Map and

Flood Avoidance and Design Guidance into state agency procedures and processes will take additional coordination and technical assistance. Next steps include:

- The Flood Avoidance Workgroup will complete the Flood Avoidance and Design Guidance document as a technical guide to assist state agencies in implementing Executive Order 41. The document is expected to be completed during the first quarter of 2015.
- The Flood Risk Adaptation Map will be made available to state agencies as a GIS layer through the state's FirstMap system during the first quarter of 2015.
- The Flood Avoidance Workgroup proposes to establish a Flood Risk Adaptation Technical Team composed of experts from a variety of state agencies to provide assistance to state agencies in meeting the requirements of EO 41.
- The Flood Avoidance Workgroup also proposes to develop a web mapping application for use by state agencies that would provide quick and simple access to the Flood Risk Adaptation Map to determine whether a project requires an additional level of design consideration.

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Climate Framework for Delaware

Executive Order 41
Appendices

December 31, 2014

Appendix A: Executive Order 41

Appendix B: Executive Order 41 Workgroup Members

Appendix C: Executive Order 41 GHG Mitigation Quantifications and Assumptions

Appendix D: Executive Order 41 Agency Adaptation Recommendations

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Climate Framework for Delaware

Appendix A
Executive Order 41

December 31, 2014

STATE OF DELAWARE

EXECUTIVE DEPARTMENT
DOVER

EXECUTIVE ORDER
NUMBER FORTY-ONE

TO: HEADS OF ALL STATE DEPARTMENTS AND AGENCIES

RE: PREPARING DELAWARE FOR EMERGING CLIMATE IMPACTS AND SEIZING ECONOMIC OPPORTUNITIES FROM REDUCING EMISSIONS

WHEREAS**,** burning fossil fuels causes the release of heat-trapping greenhouse gases that contribute to a changing climate, which presents both economic opportunities for new jobs and industries, as well as challenges to protecting public health and safety, supporting a vibrant economy, and conserving natural resources; and

WHEREAS, Delaware's greenhouse gas emissions have decreased by more than any state in the nation (29.7% from 2000 to 2010) and recent investments to modernize our energy system and efforts by several of Delaware's major employers and institutions of higher learning will result in significant additional reduction, however more must be done; and

WHEREAS, initiatives to responsibly reduce greenhouse gas emissions and prepare Delaware for climate impacts present significant economic development and employment opportunities in infrastructure construction, energy efficiency, clean energy, and advanced transportation; and

WHEREAS, as a low-lying coastal state with the lowest average land elevation in the United States and significant population living along 381 miles of shoreline, Delaware is vulnerable to coastal erosion, storm surge, flooding, saltwater intrusion, and tidal wetland losses, all of which will be exacerbated by sea-level rise; and

WHEREAS**,** Delaware's critical infrastructure, including roads, bridges, dams, dikes, impoundments, energy distribution systems, emergency services, outdoor recreation facilities, drinking water and wastewater treatment facilities, industrial sites, and landfills are at-risk to climate change impacts; and

WHEREAS, Delaware's Bayshore and Inland Bays communities have experienced saltwater intrusion into drinking water supplies and irrigation systems, and climate impacts could negatively affect the availability and reliability of the groundwater aquifers that provide water to many municipalities, residents, and farmers; and

WHEREAS, agriculture in Delaware is an $8 billion industry which could be significantly impacted by increasingly variable temperatures, precipitation, extreme weather events, and droughts; and

WHEREAS, tourism in Delaware is an $6 billion industry supported by world-class beaches, parks, wildlife areas, cultural assets, and recreational waterways, all of which are vulnerable to more extreme storms and sea-level rise; and

WHEREAS, the State of Delaware was an original signatory to the Regional Greenhouse Gas Initiative and is working in collaboration with other states to reduce regional greenhouse gas emissions from power plants by more than 30% compared to 2008; and

WHEREAS, to coordinate the efforts of state agencies to create a clean energy economy and a sustainable natural environment, I signed Executive Order No. 18 on February 17, 2010; and

WHEREAS, under Executive Order No. 18, the State of Delaware, under the direction of and coordination by the Cabinet Committee on Energy, has reduced the number of state vehicle miles traveled by 25%; has increased its use of clean, renewable energy to 30% of its overall annual electric energy demand; and has taken important steps to reduce energy consumption, lower gas consumption and emissions from state vehicles, increase recycling, and implement environmentally-friendly procurement and building practices, resulting in millions of dollars of savings; and

WHEREAS, the State of Delaware, through the Department of Natural Resources and Environmental Control (DNREC), has developed a sea level rise adaptation policy that serves as a pilot for further statewide application; and

WHEREAS, a variety of entities—including, among others, the Floodplain and Drainage Advisory Committee, the Bay Beaches Working Group, the Wetlands Advisory Committee, the State Sea Level Rise Advisory Committee, and the Delaware Climate Change Steering Committee—have developed or are developing policies and recommendations to address various discrete issues related to our changing climate and rising sea levels; and

WHEREAS, it is important for the State of Delaware to continue to reduce greenhouse gas emissions cost-effectively, while preparing for current and emerging climate risks; and

WHEREAS, it is in the best interest of the State of Delaware to address climate change and rising sea levels in a coordinated and cost-effective manner, at the highest levels of government, using a structure similar to the one that has been employed so successfully in connection with Executive Order No. 18.

NOW THEREFORE, I, JACK A. MARKELL, by virtue of the authority vested in me as Governor of the State of Delaware, do hereby DECLARE and ORDER the following

1. There is hereby created a Governor's Committee on Climate and Resiliency (the "Committee"), which shall be comprised of the following members:

a. Each of the members of the Cabinet Committee on Energy as set forth in 29 *Del.C.* § 8054, including the Secretaries of the Department of Natural Resources and Environmental Control, Department of Agriculture, Department of Transportation, Department of Health and Social Services, Department of Safety and Homeland Security, and Department of State; the Director of the Delaware Economic Development Office; and the Director of the Office of Management and Budget;

b. The Director of the Delaware State Housing Authority;

c. The Director of the Office of State Planning Coordination; and

d. Such other persons as the Governor may from time to time appoint.

2. The Committee shall oversee development of an implementation plan to maintain and build upon Delaware's leadership in responsibly reducing greenhouse gas emissions, including identifying appropriate interim goals. The plan shall ensure that efforts have a positive effect on the State's economy, including advancing the strategy of securing cleaner, cheaper, and more reliable energy, improving public health outcomes, increasing employment in Delaware, strengthening Delaware's manufacturing capabilities, and enhancing Delaware's overall competitiveness. The Committee shall report to the Governor on the completed plan by December 31, 2014, and annually thereafter.

3. The Committee shall develop agency-specific actionable recommendations for improving Delaware's preparedness and resiliency to climate impacts on public health and safety, public infrastructure and facilities, water resources, natural ecosystems, agriculture, tourism, and other industries. The recommendations shall prioritize the use of natural systems or green infrastructure as the preferred means to improve resiliency. Recommendations shall be submitted to the Governor by December 31, 2014 and shall include, but not be limited to:

a. Actions state agencies can take both within their departments and with assisting residents to adapt to and prepare for more extreme storms and projected temperature and precipitation variations expected over the next several decades, based upon research conducted through the Delaware Climate Change Steering Committee;

b. Actions local governments can take to improve community resiliency, including assessment of infrastructure vulnerabilities, land use policies, and other adaptation strategies that may be integrated into Comprehensive Land Use Plans in coordination with the Office of State Planning Coordination; and

c. Outreach strategies to inform and prepare Delaware's residents and businesses about identified risks, vulnerabilities, adaptation strategies, and basics of climate change and its causes, with particular attention to providing strategies to help protect at-risk populations.

4. In addition to the foregoing, all state agencies shall adhere to the following requirements related to flood hazard mitigation and sea level rise:

a. All state agencies shall incorporate measures for adapting to increased flood heights and sea level rise in the siting and design of projects for construction of new structures and reconstruction of substantially damaged structures and infrastructure. Such projects shall be sited to avoid and minimize flood risks that would unnecessarily increase state liability and

decrease public safety. Construction projects shall also incorporate measures to improve resiliency to flood heights, erosion, and sea level rise using natural systems or green infrastructure to improve resiliency wherever practical and effective;

b. Where avoidance is not practicable, structures within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area shall be designed and constructed with habitable space at least 18 inches above current base flood elevation on a foundation appropriate for anticipated flood risk factors. If the structures are within an area mapped by DNREC as vulnerable to sea level rise inundation the projects shall be designed and constructed to account for sea level changes anticipated during the lifespan of the structure, in addition to FEMA flood levels; and

c. All state agencies shall consider and incorporate the sea level rise scenarios set forth by the DNREC Sea Level Rise Technical Committee into appropriate long-range plans for infrastructure, facilities, land management, land-use, and capital spending. DNREC shall periodically update the scenarios with the best scientific data available and distribute new guidance to state agencies.

5. The Secretary of Natural Resources and Environmental Control shall serve as chair of the Committee and, with the cooperation of other state agencies, is responsible for managing and tracking implementation of this Order. In connection therewith, the chair and the Committee shall leverage the work of leading scientists and subject matter experts, as well as any research, studies, work groups, advisory councils, and committees as may be required to complete the tasks outlined herein. DNREC shall provide support to state agencies to meet the requirements of this Order, including the development of maps illustrating areas of combined flooding and sea level rise.

6. No provision of this Order shall create any individual right or cause of action that does not currently exist under state or federal law.

APPROVED this 12 day of September, 2013

Jack Markell

Governor

ATTEST:

Secretary of State

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Climate Framework for Delaware

Appendix B
Executive Order 41 Workgroup Members

December 31, 2014

Executive Order 41
Committee and Workgroup Members

Cabinet Committee on Climate and Resiliency (CCoCAR)

Delaware Department of Agriculture – Secretary Edwin Kee

Delaware Department of Education – Secretary Mark Murphy

Delaware Department of Health and Social Services – Secretary Rita Landgraf

Delaware Department of Natural Resources and Environmental Control – Secretary David Small

Delaware Department of Safety and Homeland Security – Secretary Lewis Schiliro

Delaware Department of State – Secretary Jeffrey Bullock

Delaware Department of Transportation – Secretary Shailen Bhatt

Delaware Economic Development Office –Director Alan Levin

Delaware State Housing Authority –Director Anas Ben Addi

Office of Management and Budget –Director Ann Visalli

Office of State Planning Coordination – Director Connie Holland

Points of Contact (Representatives of the CCoCAR Members)

Delaware Department of Agriculture – Mark Davis

Delaware Department of Education – Karen Field Rogers

Delaware Department of Health and Social Services – Stephen King and Richard Perkins

Delaware Department of Natural Resources and Environmental Control – Neelam Patel

Delaware Department of Safety and Homeland Security – Terry Pepper

Delaware Department of State – Timothy Slavin

Delaware Department of Transportation – Brett Taylor

Delaware Economic Development Office – Jeff Stone

Delaware State Housing Authority – Karen Horton

Office of Management and Budget –Robert Scoglietti

Office of State Planning Coordination – Connie Holland

Mitigation Workgroup

Delaware Department of Natural Resources and Environmental Control – Morgan Ellis, Valerie Gray, Devin Gladden, Tunde Asere, Bryan Ashby, Lindsay Hall, Bill Miller, Brad Richardson, Ed Synoski, Bahareh Van Boekhold

Delaware Department of Agriculture – Mark Davis, Lauren Torres, Michael Valenti

Delaware Department of Health and Social Services – Stephen King

Delaware Department of Transportation – Michael Kirkpatrick, Jim Pappas, Ralph Reeb, Brett Taylor, Anne Brown, Mike DuRoss

Delaware Economic Development Office – Jeff Stone

Delaware State Housing Authority – Matt Heckles

Delaware Solid Waste Authority – Angela Marconi, Logan Miller, Mike Parkowski

Office of Management and Budget – Mark DeVore, Ruth Jones, Beth Neeman

Adaptation Workgroup

Members are the Points of Contact

Flood Avoidance Workgroup

Delaware Department of Natural Resources and Environmental Control – Susan Love, Michael Powell (co-leads), Molly Ellwood, Greg Pope, Matthew Chesser, Jennifer de Mooy

Delaware Department of Education – Despina Wilson

Delaware Department of Transportation – Barry Benton, Jason Hastings, Mark Tudor, Michael Balbierer, Mike Simmons, Brian McIlvaine

Delaware State Housing Authority – Karen Horton

Office of Management and Budget – Mark DeVore, Vicki Ford

Office of State Planning Coordination – Steve Bayer

EO41 Coordination – DNREC Division of Energy and Climate

Phil Cherry, Neelam Patel, Morgan Ellis, Jennifer de Mooy, Ryan Gergely, Devin Gladden

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Climate Framework for Delaware

Appendix C
Executive Order 41 GHG Mitigation Quantifications and Assumptions

December 31, 2014

FINAL SUMMARY OF EO 41 GHG MITIGATION QUANTIFICATIONS AND ASSUMPTIONS

PREPARED BY:

DIVISION OF AIR QUALITY

NOVEMBER 2014

1.0 PURPOSE

Delaware's Executive Order 41 (EO 41), which was signed by Governor Jack Markell, required that mitigation strategies for reducing greenhouse gas (GHG) emissions be developed for the state. The executive order states, "… *it is important for the State of Delaware to continue to reduce greenhouse gas emissions cost-effectively, while preparing for current and emerging climate risks."*

In line with this directive, the Division of Air Quality (DAQ) has quantified current and potential GHG emission reductions as a result of existing federal, regional, and state policies. DAQ collected GHG-related data from respective state agencies regarding policies that guide their organizational objectives and activities. The analyses presented in this report were instrumental in the selection of a GHG mitigation target, as well as strategies that will be employed to achieve the target.

Using DAQ-approved methods and modeling, the collected data was used to estimate annual GHG emission reductions in conjunction with Delaware's 2010 GHG emissions inventory, which provided baseline emissions from 1990 through 2030 for the purpose of comparing achievable reductions. To analyze potential reduction targets, 2008 GHG emissions were used as reference points for comparing the quantified GHG emission reductions and defining potential reduction targets. Existing policies were categorized into two types:

- *federal/regional policies*
- *state policies*.

Baseline emissions, as well as achievable GHG reductions due to existing policies, are summarized in the following sections.

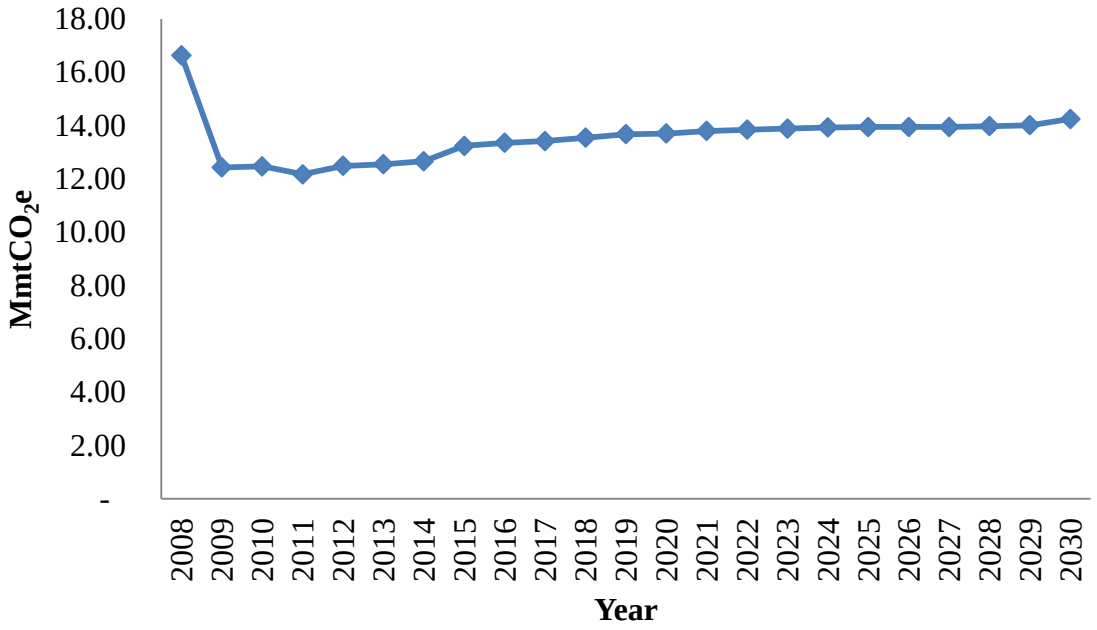
2.0 BASELINE EMISSIONS

Delaware's GHG emissions from the 2010 GHG inventory[6] were used as baseline for the emission reduction because they represent Delaware's latest GHG emission profile. The baseline emissions in the 2010 GHG inventory were developed using EPA's State Inventory Tool, which

[6] DNREC-DAQ 2014. Delaware's 2010 GHG Emissions Inventory Report:http://www.dnrec.delaware.gov/Air/Documents/2010%20GHG_Inventory%20Final%20Report.pdf

projected GHG emissions to 2030. The projections were based on the Energy Information Administration (EIA)'s Annual Energy Outlook 2009 (AEO2009). Emissions data was collected from all sources of GHGs and categorized into the economic sectors of Delaware. The total annual GHG emissions from each sector were added together to estimate total GHG emissions for the state. Figure 1 summarizes projected baseline emissions (in $MmtCO_2e$) for GHG from 2008 to 2030.

FIGURE 1. DELAWARE'S BASELINE GHG EMISSIONS FROM 2008 TO 2030



The GHG emissions presented in Figure 1 are based on both actual and projected data. Emissions from 2008 to 2010 were estimated based on actual data from all GHG sources of Delaware's economic sectors. Projected GHG emissions from 2011 to 2030 were estimated mainly from the energy outlook information provided by the AEO2009. As Figure 1 shows, one key factor that drives growth in both total energy consumption and GHG emissions is the rate of overall economic growth. As Delaware's economy declined between 2008 and 2009, GHG emissions also declined significantly from the 2008 reference point of 16.64 $MmtCO_2e$ to 12.43 $MmtCO_2e$ in 2009.

However, GHG emissions slightly increased to 12.48 $MmtCO_2e$ in 2010, as Figure 1 shows, and are projected to increase steadily to 14.25 $MmtCO_2e$ by 2030.[7] Delaware's per-capita GHG emissions are projected to increase from 13.89 metric tons in 2010 to 15.18 metric tons in 2030.

Key Assumptions: Several assumptions were factored into the development of the baseline emissions. Historical GHG emissions were developed mostly from a top-down approach. Primary sources of data for this approach were activities that involved energy consumption, industrial processes, waste management, and agricultural activities. The emissions were calculated by multiplying energy or fuel consumed by emissions factors. Emissions from other activities, including biogenic and chemical processes, were also quantified using various methodologies, and the results were included in the baseline emissions.

To develop projections, the impact of existing regulations and policies had to be defined. Those impacts were then used in the modeling of future emissions. The National Emissions Modeling System (NEMS) was the tool used by the EPA to project emissions up to 2030. The NEMS utilized assumptions derived from the AEO2009 report. However, for the purpose of summarizing the EO 41 quantifications, this report used the following key assumptions and policies to develop Delaware's baseline GHG emissions:

- *Slower Growth in Overall Energy Consumption/Demand:* The combination of recently enacted energy efficiency policies and rising energy prices in the AEO2009 report slows the growth of future energy consumption relative to history. When slower demand growth is combined with increased use of renewables and a reduction in additions of new coal-fired conventional power plants, growth in energy-related GHG emission also declines. Energy-related GHG emissions in Delaware is projected to grow at approximately 0.7% per year from 2009 to 2030, which is higher than the national growth rate of 0.3% per year for the same period according to the AEO2009 report.

[7]DNREC-DAQ 2014. Delaware's 2010 GHG Emissions Inventory Report:http://www.dnrec.delaware.gov/Air/Documents/2010%20GHG_Inventory%20Final%20Report.pdf

- *National Highway Traffic Safety Administration (NHTSA) CAFE standard*: The CAFE standards are federal standard first enacted by the U.S. Congress in 1975, intended to improve the average fuel economy of cars and light trucks (trucks, vans, and sport utility vehicles) sold in the United States. In 2009, NHTSA proposed a revised CAFE standard to raise the minimum fuel economy requirements for passenger cars and light trucks for model year (MY) 2012–2016.[8] This proposal was included in the Energy Independence and Security Act of 2007 (EIAS2007), and the path forward for implementing the CAFE standard was represented in the AEO2009 in terms of fuel consumption in Delaware.

- *Renewable Portfolio Standard (RPS)*: Delaware's RPS requires that the electricity mix sold in Delaware consist of 25% renewable generation by compliance year 2025. In addition, a minimum technology requirement that 3.5% solar generation be achieved by compliance year 2025 was included in the RPS. The AEO2009 included RPS requirements in the projections for energy consumption in Delaware.

- *Regional Greenhouse Gas Initiative (RGGI):* Regulation 1147 establishes Delaware's portion of a multistate CO_2 cap-and-trade program developed by the Regional Greenhouse Gas Initiative (RGGI), which is a cooperative effort among a number of northeastern and Mid-Atlantic states. RGGI states include Delaware, Connecticut, Maine, New Hampshire, New York, Vermont, Maryland, Massachusetts, and Rhode Island.. The program was designed to reduce carbon dioxide (CO_2) emissions from power plants in the region. RGGI was accounted for in the AEO2009. However, the effect was minimal in the early years, given the over allocation of CO_2 allowances in the first control period, which began in 2009.[9]

3.0 FEDERAL/REGIONAL POLICIES

Some relevant policies were implemented on a national or regional scale, with GHG reduction impacts beyond Delaware's borders. The following section summarizes the achievable GHG emission reductions due to existing policies.

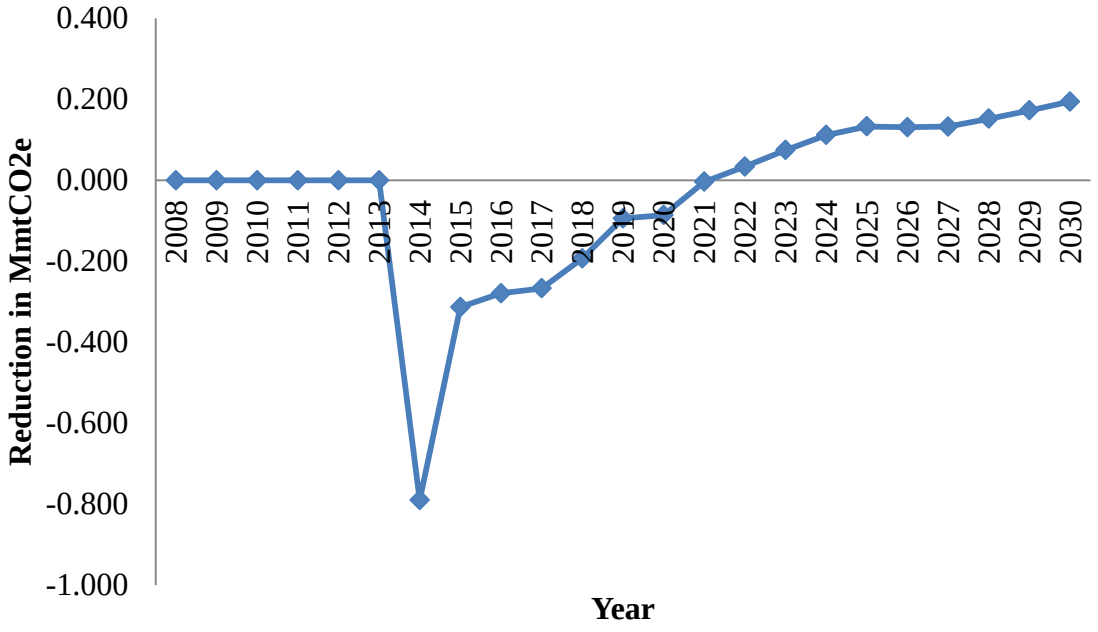
[8] The impact of the new CAFE rule for model years 2017 to 2025 was not included in the AEO2009.
[9] The impact of the change in the CO_2 allowance cap from 165 million to 91 million was not included in the AEO2009.

3.1 REGIONAL GREENHOUSE GAS INITIATIVE MODIFICATIONS

In 2012 a program review was performed with the aim of strengthening RGGI by modifying key elements of the program. The outcomes of the program review process included a reduction in the CO_2 allowance cap from 165 million to 91 million starting in 2014. This report includes the impact of the cap change on GHG reductions in Delaware's power sector.

Figure 2 presents achievable GHG reductions in Delaware due to RGGI modifications. As the chart shows, GHG reductions from 2008 to 2013 were zero because the cap change started in 2014. This analysis presents GHG reductions due only to the cap change. Figure 2 also shows that achievable reductions are projected to be negative between 2014 and 2021. This indicates that the estimated power-sector emissions due to the RGGI cap change will exceed the baseline emissions. This is because the baseline emissions were projected from 2010 based on modeling assumptions that may not reflect reality. Achievable reductions are expected to increase from 0.004 $MmtCO_2e$ in 2021 to 0.194 $MmtCO_2e$ in 2030. This will be an increase of approximately 4,750%.

FIGURE 2. ACHIEVABLE GHG REDUCTION FROM RGGI



Key Assumptions: The latest GHG inventory shows that GHG emission from Delaware's power plants totaled 3.81 $MmtCO_2e$ in 2011. Based on best professional judgment, DAQ believes that the RGGI program, in conjunction with other factors such as fuel switching and the retirement of existing power plants, will maintain power-sector GHG emissions at 3.81 $MmtCO_2e$ going forward through 2030.

3.2 THE NEW CORPORATE AVERAGE FUEL ECONOMY STANDARD

The EO 41 quantifications included the analysis of two new CAFE rules as they apply to Delaware's transportation sector emissions:

- Light-duty vehicle (LDV), which includes passenger cars and light-duty trucks for MYs 2017–2025. In 2011, the Obama administration announced an agreement with the auto industry to increase fuel economy to 54.5 miles per gallon for cars and light-duty trucks by model year 2025. The agreement resulted in new CAFE regulations, which were finalized in 2012.

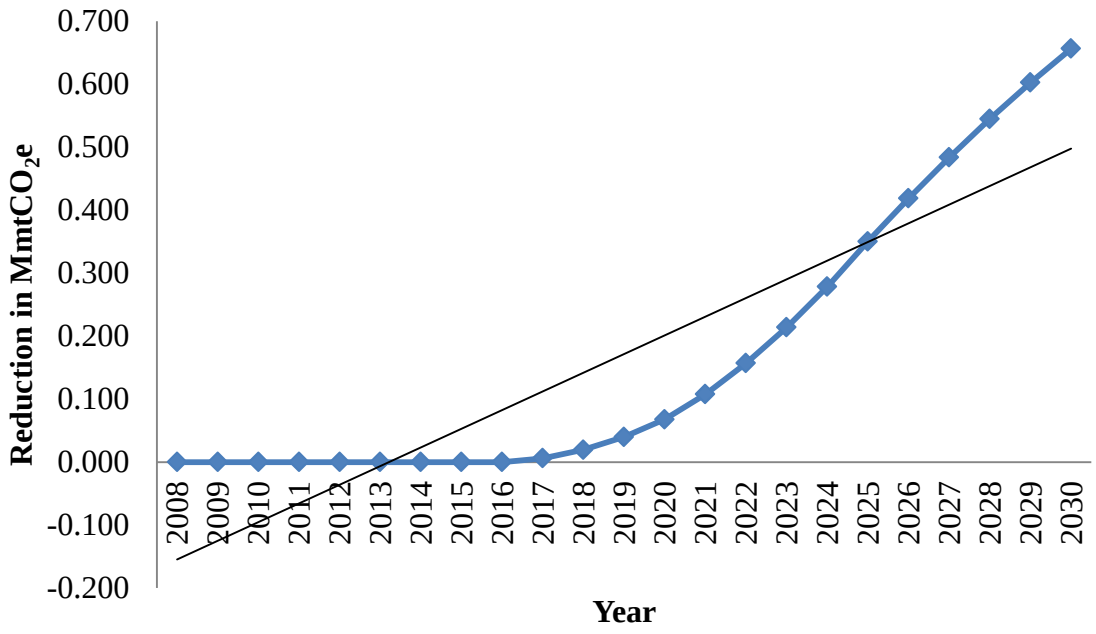
- Heavy-duty vehicle (HDV), which includes all heavy-duty trucks for MYs 2014–2018. This rule was jointly developed by the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA). The NHTSA developed fuel consumption standards under the authority of the 2007 Energy Independence and Security Act (EISA), while the EPA developed a GHG emissions program under the Clean Air Act. The GHG program includes CO_2 emission standards, as well as emission standards for N_2O and CH_4, and provisions to control hydro fluorocarbon leaks from air conditioning systems.

Achievable GHG reductions from the new LDV and HDV CAFE rules were estimated by distributing Delaware's portion of projected national GHG emission savings from both rules over the lifetime of the respective MYs of the vehicles. For MYs 2017–2025, the new LDV CAFE rule is projected to save approximately 4 billion barrels of oil and

reduce GHG emissions by 2 billion metric tons, based on EPA's regulatory announcement.[10] The new HDV rule affecting MYs 2014–2018 is expected to save 530 million barrels of fuel and reduce GHG emissions by 270 million metric tons over the lifetime of the model years, based on EPA's regulatory announcement[11].

Figure 3 presents achievable GHG reductions as a result of the LDV CAFE rule. Annual reductions in GHG emissions are expected to increase into the future. Starting in 2017, annual GHG emission reduction in Delaware is projected to be 0.006 $MmtCO_2e$. The reductions are expected to increase annually to 0.656 $MmtCO_2e$ in 2030 at a rate of 0.0297 $MmtCO_2e$ per year. There are no reductions between 2008 and 2016 because the implementation of the rule occurs in 2017.

FIGURE 3. POTENTIAL GHG REDUCTIONS FROM LDV CAFE RULE

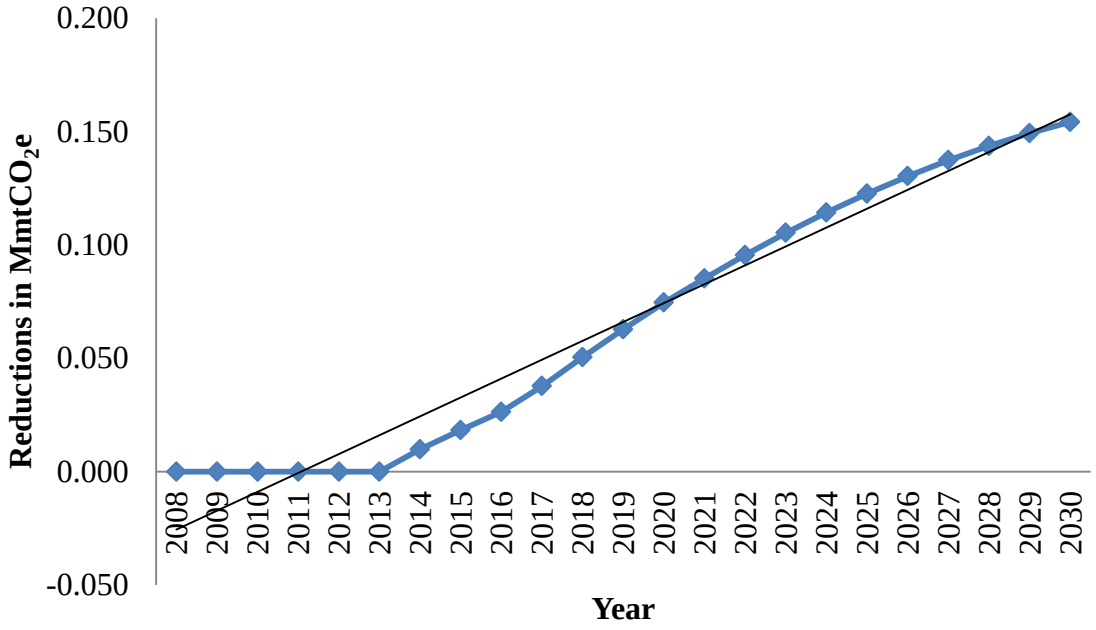


[10] EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017–2025 Cars and Light Trucks: http://www.epa.gov/otaq/climate/documents/420f12051.pdf

[11] EPA and NHTSA Adopt First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium-and Heavy-Duty Vehicles: http://www.epa.gov/otaq/climate/documents/420f11031.pdf

Figure 4 presents projected potential GHG emissions reduction as a result of the new HDV CAFE rule. GHG reductions are observed in the implementation year of 2014 (0.010 $MmtCO_2e$). Reductions grow annually to 0.154 $MmtCO_2e$ at a rate of 0.0083 $MmtCO_2e$ per year.

FIGURE 4. POTENTIAL GHG REDUCTIONS FROM HDV CAFE RULE



Key Assumptions: Achievable GHG reductions from the new LDV and HDV CAFE rules were estimated by distributing projected GHG emissions reductions over the lifetime of the vehicles. Delaware's portion of national GHG emissions was estimated to be approximated 0.25%. We assumed that estimate is maintained and calculated Delaware's GHG savings by multiplying the percentage by the national GHG savings. The result was then multiplied by annual distribution factors for each MY. The distribution factors were based on the EPA's Regulatory Impact Assessment[12] for the new CAFE rules, using

[12] Proposed Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; http://www.epa.gov/otaq/climate/regs-light-duty.htm.
Proposed Rulemaking for 2017–2025 Heavy-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards: http://www.epa.gov/otaq/climate/regs-heavy-duty.htm.

projected vehicle miles traveled and age distribution of each of the MYs over their lifetime.

3.3 LANDFILL GAS COLLECTION SYSTEMS

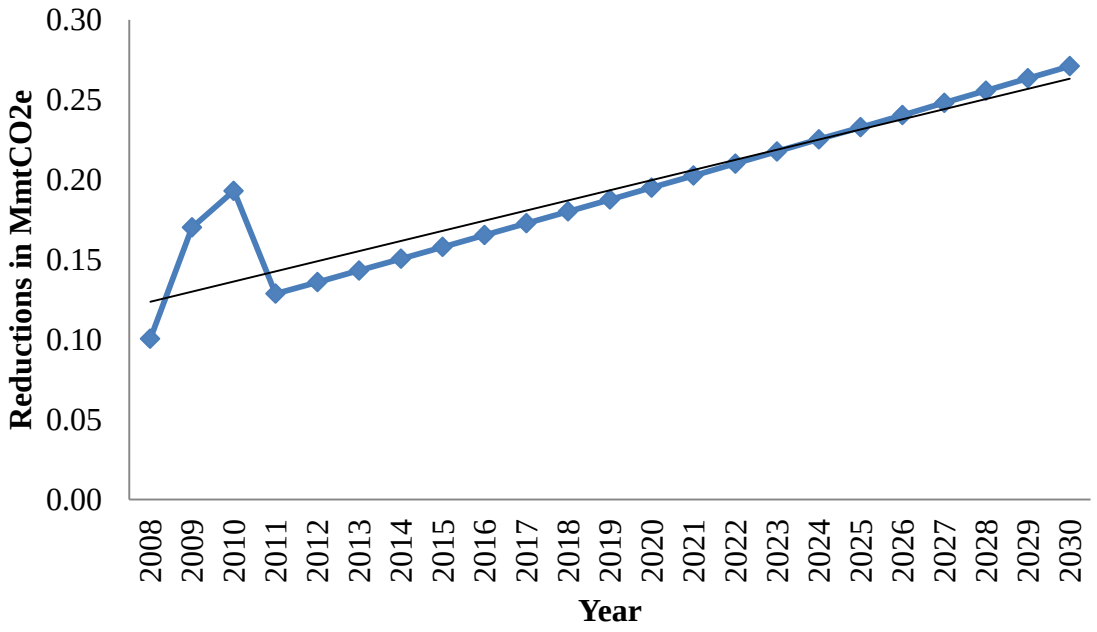
Landfill gas (LFG) collection systems in Delaware are located at three active landfills in New Castle (Cherry Island Landfill), Kent (Central Solid Waste Management Center), and Sussex (Southern Solid Waste Management Center) Counties. LFG is made up of 50% methane (CH_4), which is a GHG. The recovery of CH_4 through LFG collection systems is done in two ways:

- Flaring
- Landfill gas conversion to energy (LFGTE)

LFGTE projects are present at the three active municipal landfills in Delaware. These projects have been successful in supplying green power either to the grid or to industrial end users. The use of landfill gas from Delaware Solid Waste Authority (DSWA) facilities has displaced electricity generated by coal, oil, and natural gas. The emissions reductions realized from Delaware's LFGTE projects are included in the baseline emissions. Flaring has also led to reduction in CH_4 emissions because the LFG is destroyed in the process. However, there is a potential to further increase Delaware's LFGTE by flaring less LFG and converting most of the LFG to energy. Achievable GHG reductions from LFG systems were estimated by multiplying tons of flared LFG by EPA's emission factors.

Figure 5 present's potential GHG reductions from LFG systems derived from EPA's State Inventory Tool estimates, which were based in Delaware on LFG flaring data from DSWA. Reductions are projected to increase from 0.13 $MmtCO_2e$ in 2011 to 0.27 $MmtCO_2e$ at the rate of 0.0063 $mmtCO_2e$ per year. This will be an increase of approximately 107%. The potential reductions from 2011 to 2030 indicate projected GHG reductions that are achievable as a result of converting flared landfill gas to LFGTE.

FIGURE 5. ACHIEVABLE GHG REDUCTIONS FROM LANDFILL GAS COLLECTION SYSTEMS



Key Assumptions: Based on the assumption that (i) Delaware's LFG collection systems will continue to expand in the future as population grows and (ii) waste steam composition remains the same, more of Delaware's LFG is projected to be converted for beneficial use. The LFG conversions will displace more fossil fuel–fired generation in the power sector, with resulting GHG reductions.

The projected GHG reductions from annual LFGTE were based on Delaware's GHG emissions from the 2010 GHG inventory. Based on historical data, LFG collection at DSWA facilities is predicted to increase over time, which will contribute to increasing LFGTE. This trend was further supported by projected increases in Delaware's population, which is directly proportional to increasing waste disposal and subsequently LFG collection. Based on this information, DAQ is confident that the achievable GHG emission reductions from LFGTE presented in this section are realistic.

4.0 STATE POLICIES

Below we summarize relevant policies that were signed into law by the governor and implemented on the state level.

4.1 UNIVERSAL RECYCLING LAW

Achievable GHG reductions from Delaware's waste management sector were estimated from data provided in the 2012 Recycling Public Advisory Council (RPAC) report.[13] The RPAC report was mandated by Delaware's Universal Recycling Law, and provided data from 2008 to 2012. The achievable reductions were estimated by categorizing two types of recyclable waste streams:

- *Organic waste* included food-related materials and yard waste. These waste materials are diverted to composting facilities, thereby displacing potential CH_4 emissions at the landfills due to decomposition over time.

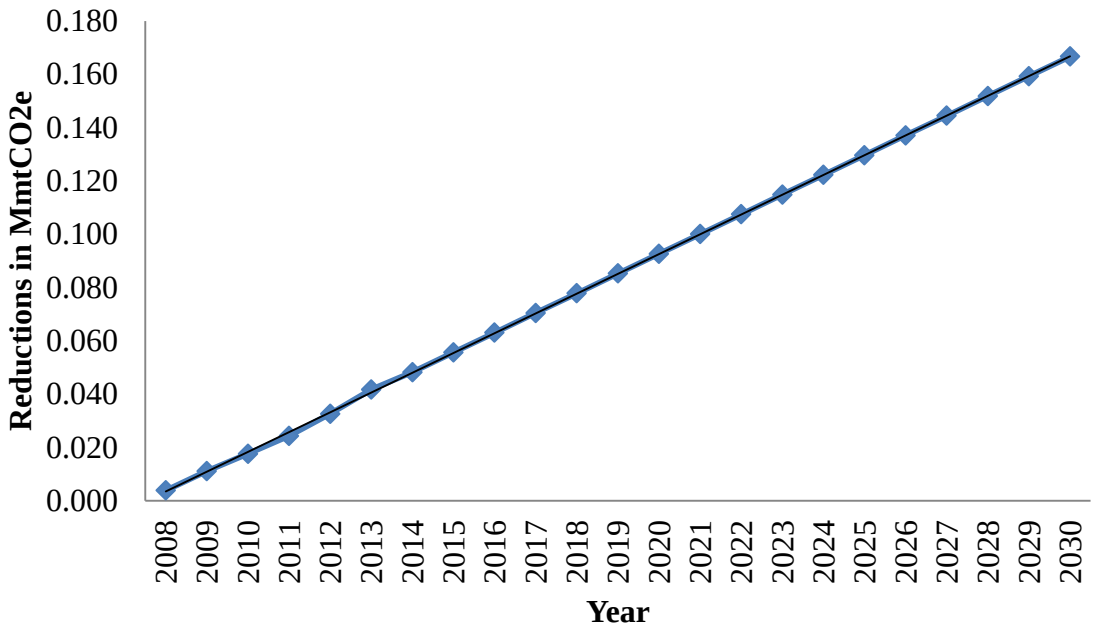
- *Mixed recyclables* included plastics, paper, glass, and metals. These waste materials are diverted to recycling facilities, thereby displacing potential GHG emissions due to their carbon footprint at the landfills.

The results of the achievable GHG reductions from the mixed recycling categories were added to the achievable GHG reductions due to organic waste recycling. Figure 6 summarizes the results. Achievable GHG reductions are projected to increase from 0.004 $MmtCO_2e$ in 2008 to 0.167 $MmtCO_2e$ in 2030 at the rate of 0.007 $MmtCO_2e$ per year.

Achievable GHG reductions from the mixed materials waste recycling were developed by multiplying the tons of recyclables by EPA's emissions factor[14]. The results indicated a linear trend in achievable reduction. Based on the observed linear trend, achievable GHG reductions were projected to 2030.

[13] DNREC 2013.State of Delaware Assessment of Municipal Solid Waste Recycling for Calendar Year 2012 report.
[14] U.S EPA, Calculations and references: http://www.epa.gov/cleanenergy/energy-resources/refs.html

FIGURE 6. ACHIEVABLE GHG REDUCTION FROM RECYCLABLES



Key Assumptions: DAQ assumed that the avoided CH_4 emissions due to organic waste diversion were equal in amount to the potential CH_4 emissions that would be generated if the organic waste were disposed at the landfill. Potential CH_4 emissions generated were estimated using EPA's first-order decay formula[15], and the results were set equal to achievable GHG reductions. The first-order decay formula estimated achievable reductions for CH_4 from 2008 to 2030.

4.2 ENERGY EFFICIENCY INVESTMENT FUND

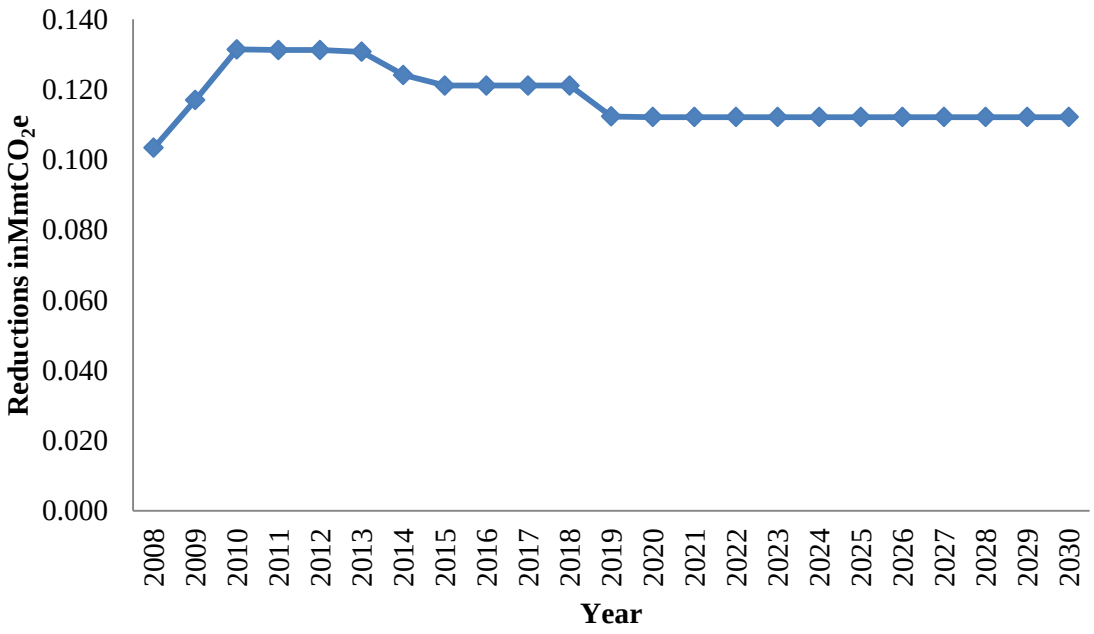
The Energy Efficiency Investment Fund (EEIF) was designed to improve energy efficiency in the commercial and industrial sector by replacing aging, inefficient equipment and systems with energy-efficient alternatives. GHG reductions from the EEIF were developed by analyzing the GHG emission savings data submitted by the DNREC Division of Energy and Climate (DEC). DEC provided a spreadsheet with

[15]U.S.EPA 2012. USER'S GUIDE FOR ESTIMATING EMISSIONS FROM MUNICIPAL SOLID WASTE USING THE STATE INVENTORY TOOL: http://epa.gov/statelocalclimate/resources/tool.html

all the completed EEIF projects from 2012 to 2014, and their respective GHG reductions per year. The projects were categorized mainly into lighting; heating, ventilating, and air conditioning (HVAC); combined heat and power (CHP); windows; and building envelope.

Figure 7 shows the achievable GHG reductions from the EEIF program. Based on the lifespan of each project, achievable GHG reductions are expected to stay flat at 0.112 $MmtCO_2e$ from 2019 to 2030, while most of the achievable reductions appear to be realized in the early years of the program. This is because shorter lifespan projects, such as lighting, stop achieving GHG reductions in the early years of the time frame, while longer lifespan projects, such as HVAC, continue to achieve GHG reductions in the long-term. However, GHG reductions are expected to increase as more EEIF projects are completed.

FIGURE 7. POTENTIAL GHG REDUCTIONS FROM THE EEIF PROGRAM.



Key Assumptions: Each project had an approximate life span in terms of energy savings:

- Lighting–5 years
- HVAC–20 years
- Heating–20 years

- CHP–20 years
- Window film–10 years
- Building envelope–8 to 10 years

Each project was categorized by life span, and the annual GHG emissions savings was distributed across the lifetime of the project. The resulting achievable reductions were then added together.

4.3 SENATE BILL 160

Senate Bill 160, Delmarva Poultry Industry, was signed in 2012. It was designed to increase the gross vehicle weight of poultry trucks. The poultry industry will have less of a carbon footprint in Delaware if the number of trips live-haul trucks make to and from the plant and farm is reduced. The senate bill was projected to reduce fuel consumption by 160,000 gallons annually. This is equivalent to 1.422 metric tons of CO_2e.

Key Assumptions: The estimated 1.422 mtCO_2e in GHG reduction was held constant from 2012 to 2030.

4.4 FOREST BUFFERS

Support for establishing or protecting forest buffers is included in reforestation programs of the Delaware Department of Agriculture (DDA). These programs, including forest stewardship as well as urban and community reforestation programs are based on voluntary participation and cost sharing. The pine and yellow-poplar tree conservation and reforestation (Title 3, Chapter 10, subchapter V) program requires that if a harvest of pine or yellow-poplar occurs on land that will remain forested, the landowner must ensure adequate regeneration of these species.

Through the process of photosynthesis, trees remove CO_2 from the atmosphere and store it as cellulose and other compounds. The rate of accumulation is equal to growth minus removals (i.e., harvest for the production of paper and wood) minus decomposition.

DDA provided DAQ with data on the number and acreage of trees planted from 2008 to 2014 in Delaware as a result of the reforestation programs.

Figure 8 presents GHG emissions reductions from 2008 to 2030 attributable to the DDA reforestation programs. GHG reductions are projected to grow from 0.001MmtCO_2e in 2008 to 0.01 in 2030 MmtCO_2e with a linear trend. Achievable GHG reductions from DDA's reforestation programs will grow at the rate of 0.0004 MmtCO_2e per year.

Key Assumptions: The reforestation data used in this analysis were based on new trees planted in Delaware. It does not consider trees planted to replace harvested trees. The replacement of harvested trees was factored into the baseline emissions derived from the 2010 GHG emissions inventory. The forest buffer analysis also disregards the difference between natural and manmade forest regeneration. It simply focuses on new trees planted as a result of Delaware's reforestation programs. GHG reductions were estimated by multiplying total acres of trees planted as a result of Delaware's reforestation programs by EPA's carbon sequestration factor of 1.22 metric tons per acres per year for an average U.S. forest. The EPA determined the sequestration factor[16] by determining the annual net change in carbon stocks per acre. This was estimated by dividing the carbon stock change in U.S. forests by the total area of U.S. forests.. Overall change in forest carbon stocks takes into consideration changes in number of trees. In most U.S. forests, growth exceeds removals and decomposition, so the amount of carbon stored nationally is increasing overall.

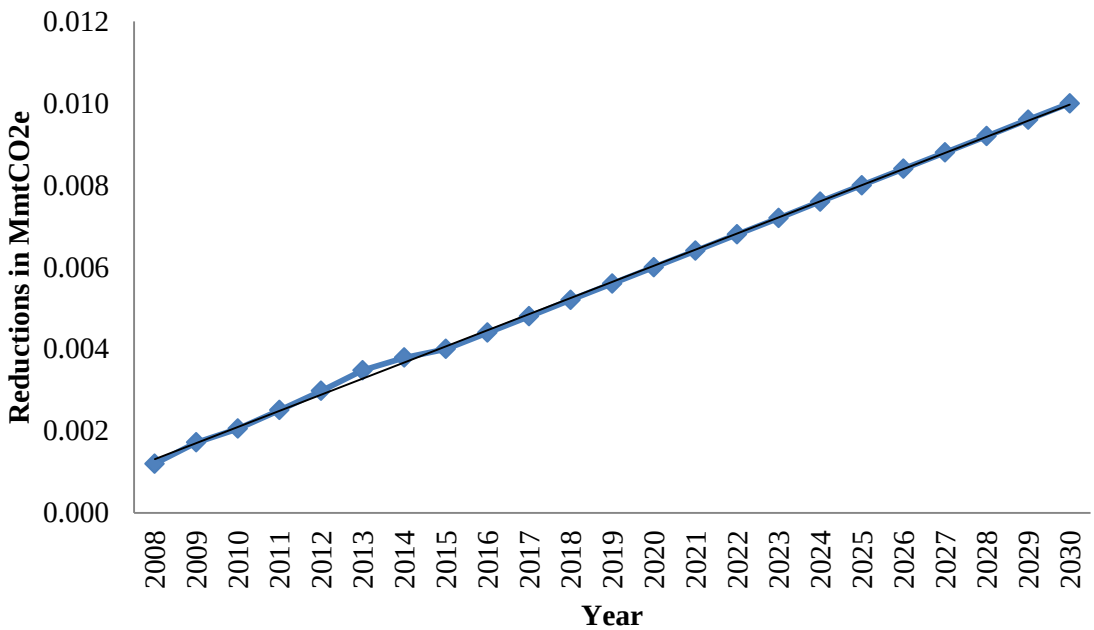
Applying these calculations to data developed by the USDA Forest Service for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010*[17] yields a result of 150 metric tons of carbon per hectare (or 61 metric tons of carbon per acre) for the carbon stock density of U.S. forests in 2010, with an annual net change in carbon stock per area in 2010 of 0.82 metric tons of carbon sequestered per hectare per year (or 0.33

[16] U.S EPA, Calculations and references: http://www.epa.gov/cleanenergy/energy-resources/refs.html
[17] U.S. EPA 2012, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010, EPA 430-R-12-001: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf

metric tons of carbon sequestered per acre per year). The 0.33 metric tons of carbon was then multiplied by a factor of 44 units of CO_2/12 units of C to convert it to 1.22 metric tons of CO_2 sequestered per acre per year by an average U.S. forest.

To estimate potential CO_2 sequestration by Delaware's reforestation program, DAQ multiplied EPA's sequestration factor by the cumulative acres of trees planted each year, assuming the number of trees planted have a high growth and survival rate.

FIGURE 8. POTENTIAL GHG REDUCTIONS FROM DDA'S REFORESTATION PROGRAMS



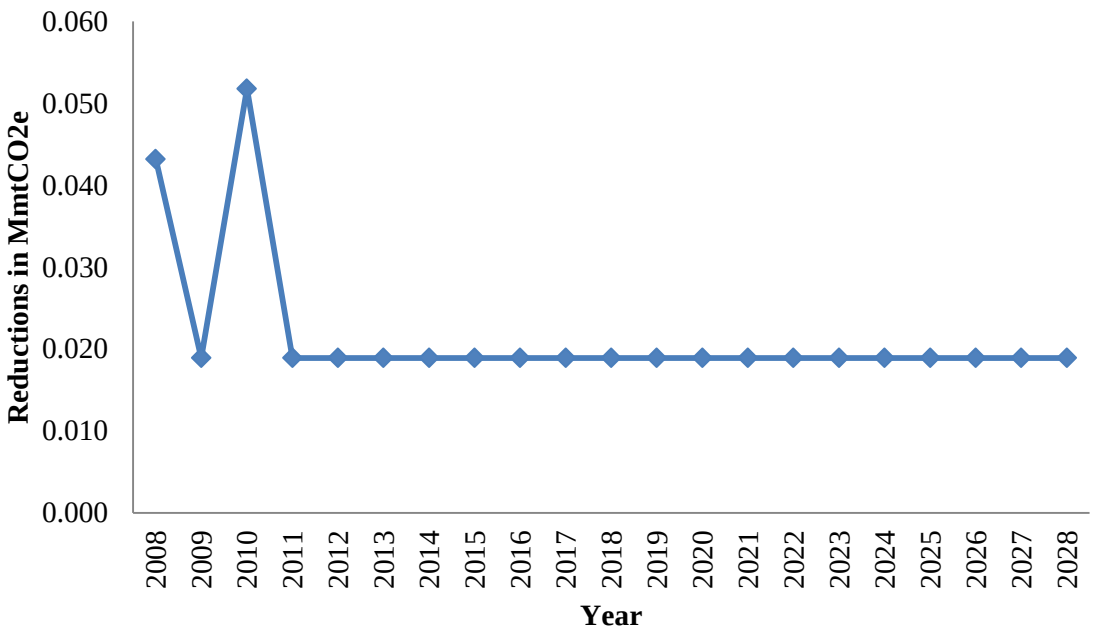
4.5 CROP MANAGEMENT

Crop management in relation to GHG reduction includes farming practices such as cover crop planting, crop rotation, and no-till. Due to the availability of data, the GHG reduction analysis focused on cover crops. Cover crops are planted primarily to manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, and biodiversity. Cover crops play a role in sustainability by helping to fix the nitrogen in the soil, thereby preventing it from volatilizing into N_2O.

Figure 9 presents achievable GHG reductions due to cover crops. GHG reductions fluctuated from 0.04 $MmtCO_2e$ in 2008 to 0.02 $MmtCO_2e$ in 2011, with a peak of 0.05 $MmtCO_2e$ in 2010. In our model, the reductions remain flat at 0.02 $MmtCO_2e$ from 2011 to 2030.

Key Assumption: Data were available from 2008 to 2011. GHG reductions from 2012 were kept constant at 0.02 $MmtCO_2e$ (2011) based on DDA's professional judgment.

FIGURE 9. GHG REDUCTIONS FROM COVER CROPS



4.6 SUSTAINABLE ENERGY UTILITY

The DNREC Division of Energy and Climate submitted data consisting of completed sustainable energy utility (SEU) projects in 2013 and their corresponding GHG savings. Delaware's GHG savings as a result of SEU projects totaled 52,354 metric tons in 2013.

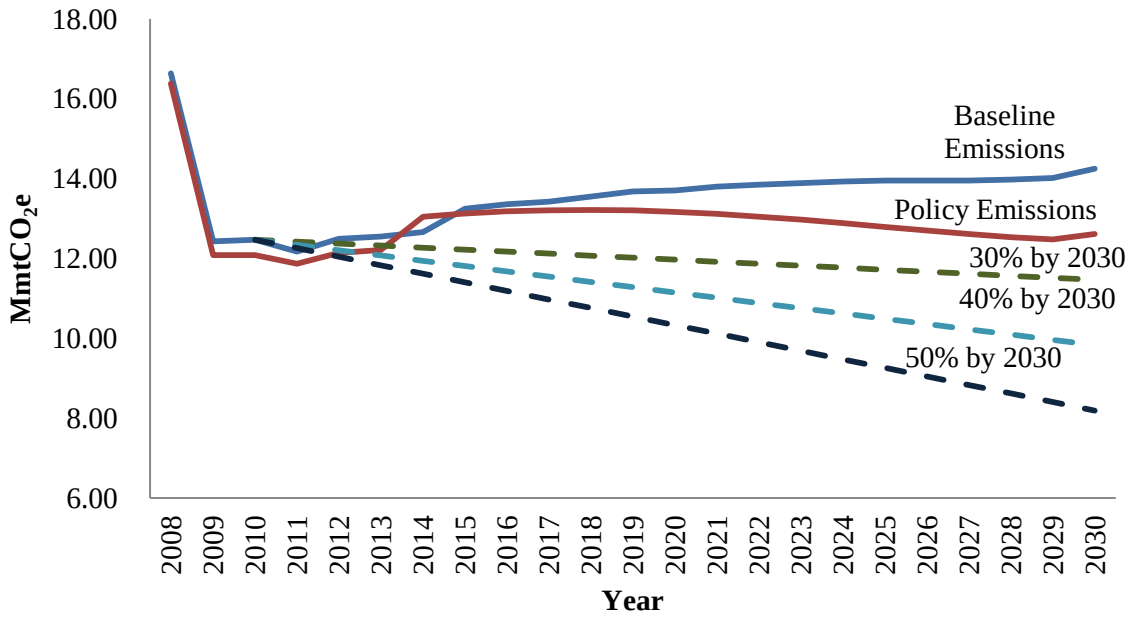
Key Assumption: The 2013 GHG reduction estimate was kept constant from 2013 to 2030.

5.0 GHG EMISSION TRENDS AND TARGETS

As a result of the above GHG reduction analyses, DAQ was able to develop a policy-driven GHG emission trend for Delaware. The "policy emissions" takes into account existing federal, regional, and state policies that contribute to GHG reductions in the state, as summarized in sections 3.0 and 4.0. In addition, DAQ developed potential mitigation targets for GHG emissions.

Figure 10 presents the results of the analyses. The baseline emission trend is based on the 2010 GHG emissions inventory. Baseline emissions are discussed in section 2.0. The policy emissions describes Delaware's GHG emissions outlook if the existing policies achieve their GHG reduction potential.

FIGURE 10. GHG EMISSION TRENDS AND TARGETS



As observed in Figure 10, in the early years of the time frame, the policy emissions are slightly less than baseline emissions. However, in 2014, the policy emission (13.05 $MmtCO_2e$) is projected to be higher than the baseline emission (12.66 $MmtCO_2$). This can be attributed to the DAQ's assumption that power-sector emissions are expected to be stagnant at the 2011 level of

3.81 $MmtCO_2e$, based on RGGI and other factors limiting GHG emissions in the power sector. However, the projected baseline emission for 2011 was lower than the policy emission in 2014, leading to a negative GHG reduction.

The difference between the two trends is expected to widen from 2015 to 2030, as observed in Figure 10. Baseline emission is projected to be 14.25 $MmtCO_2$ in 2030, , with a rate of increase of approximately 0.0543 $MmtCO_2e$ per year from 2015. The policy emission is projected to be 12.61 $MmtCO_2e$, with a rate of decrease of approximately 0.0529 $MmtCO_2e$ per year from 2015.

The dashed lines in Figure 10 indicate potential targets for mitigation strategies. The goal is to present a list of potential targets based on their varying degree of achievability. The percentages indicate reductions from the reference point of 2008, which helps to define the reduction target by 2030. A 30% by 2030 target indicates that a 30 percent reduction from the 2008 baseline emission of 16.64 $MmtCO_2e$ will be achieved by 2030. The analyses presented in this report demonstrate that the 30% reduction by 2030 is the most achievable potential target, followed by 40% and 50%.

Based on the results of the EO 41 mitigation quantifications, a GHG reduction target of 30% by 2030 was selected. The next step in the process is to develop mitigation strategies that incorporate existing and future policies in order to achieve the selected target.

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DNREC-DAQ 2014. Delaware's 2010 GHG Emissions Inventory Report: http://www.dnrec.delaware.gov/Air/Documents/2010%20GHG_Inventory%20Final%20Report.pdf

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U.S. EPA Regulatory Announcement: EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017–2025 Cars and Light Trucks: http://www.epa.gov/otaq/climate/documents/420f12051.pdf

U.S. EPA 2012, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010, EPA 430-R-12-001: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf

U.S. EPA Proposed Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards: http://www.epa.gov/otaq/climate/regs-light-duty.htm.

U.S EPA Calculations and references: http://www.epa.gov/cleanenergy/energy-resources/refs.html

Climate Framework for Delaware

Appendix D
Executive Order 41 Agency Adaptation Recommendations

December 31, 2014

The adaptation recommendations from each agency can be found on the following pages:

- Delaware Department of Agriculture .....Page D2
- Delaware Department of Education .....Page D3
- Delaware Department of Health and Social Services—Division of Public Health .....Pages D4-D6
- Delaware Department of Health and Social Services—Social Service Divisions.....Pages D7-D8
- Delaware Department of Natural Resources and Environmental Control .....Pages D9-D16
- Delaware Department of Safety and Homeland Security.....Page D17
- Delaware Department of State .....Page D18-D19
- Delaware Department of Transportation .....Page D20-D22
- Delaware Economic Development Office .....Page D23
- Delaware State Housing Authority .....Page D24
- Office of Management and Budget .....Page D25
- Office of State Planning Coordination .....Page D26

Delaware Department of Agriculture - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Evaluate response to increased susceptibility of forest wildfires	The Department of Agriculture should evaluate adjustments to internal policies related to risk management, fire prevention, and management for forests. In partnership with Extension Service/USDA/Dept. of Interior, DDA would develop and distribute educational materials related to risk management and fire prevention. This recommendation anticipates increased potential government cost to prevent/mitigate/respond to drought and increased local temperatures. Will require collaboration with DEDO, DNREC, and USDA.
Evaluate nutrient management, pesticide application, risk assessment, fire prevention and management, and cropping practices policies that may be impacted by potential increases in the number of hot dry days per year	The Department of Agriculture should evaluate adjustments to internal policies related to nutrient management, pesticide application, risk management, fire prevention and management, and cropping practices. In partnership with Extension Service, DDA would develop and distribute educational materials related to risk management. This recommendation anticipates increased potential government cost to prevent/mitigate/respond to drought and increased local temperatures. Will require collaboration with DEDO, DNREC, and USDA.
Educate landowners and agricultural operators on the possibility of, and how best to address and mitigate, loss of land due to sea level rise	The Department of Agriculture should create and distribute educational materials concerning effects of sea level rise, conduct workshops with producers in possible affected areas, and work closely with Extension Service on education/outreach, as well as research efforts. Will require collaboration with DNREC and OSPC.
Educate landowners and agricultural operators on the effects of salt water intrusion through sea level rise	The Department of Agriculture should create and distribute educational materials concerning effects of sea level rise, conduct workshops with producers in possible affected areas, and work closely with Extension Service on education/outreach, as well as research efforts. Will require collaboration with DNREC and OSPC.

Delaware Department of Education - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Improve guidelines for siting of school facilities	DOE should work with the districts, State Planning Office, and the Office of Management and Budget under its authority as part of Title 29 §7525 to ensure that new school buildings are not built on sites subject to flooding by sea level rise. DOE's approval of siting new buildings complements the state's PLUS process. By reducing the risk for flooding at new school buildings, they may be used as shelters, if needed.
Promote LEED certification or Green Ribbon school designs	DOE should work with Facilities Management/OMB and the districts to encourage LEED certification, Green Ribbon standards, or any other standards to promote the most efficient design and construction for school buildings that reduces the environmental footprint. The state approves all major capital school plans and will support the use of third-party standards that guide design for capital school projects.
Promote the incorporation of cleaner school buses	DOE, when it purchases new buses, should continue to replace buses with cleaner buses meeting the most recent EPA requirements. DOE will also promote a pilot program for alternative fuel buses that produce fewer emissions, subject to the availability of alternative fueling locations, as well as a network of service providers to work on these vehicles.

Delaware Department of Health and Social Services - Division of Public Health - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
To develop new or improve existing monitoring and surveillance:	
Advocate for an expansion of vector surveillance programs	The DHSS Division of Public Health should advocate for an expansion of vector surveillance programs to identify new vectors and monitor the size of vector populations (e.g., ticks and mosquitoes). Increasing temperatures and rainfall may increase the incidence of vector-borne diseases. DPH will assist DNREC in determining the vectors of interest. This response could change the existing programs at DNREC, in particular the mosquito control program. It may require the establishment of a tick surveillance program. DNREC is or would be the lead agency for these surveillance programs with assistance from DPH.
Monitor new and emerging diseases related to climate change	The DHSS Division of Public Health should support monitoring new and emerging diseases resulting from climate change. The proposed response would require periodic meetings between DPH and DNREC to keep abreast of zoonotic, waterborne, and vector-borne diseases resulting from climate change. The information could be used to update surveillance programs to account for the new diseases. This response would require interaction between DPH and DNREC to cooperate and meet periodically to discuss new and emerging diseases due to climate change.
Evaluate benefits and costs of developing environmental public health tracking system	The DHSS Division of Public Health should evaluate the specific benefits and costs of developing and maintaining an environmental public health tracking system for the ongoing collection, integration, analysis, interpretation, and dissemination of data from environmental hazard monitoring, and from human exposure and health effects surveillance. Climate change–related data will be included in the tracking network database. The desired outcome from this response will be an environmental tracking network that is easily accessible by DPH staff, other state agencies, and the public. The adaptation response will require existing public health programs to collaborate with the Data and Informatics and Health Systems Protection sections. At this time it is believed that existing staff will be able to handle the increased workload; however, it may require full time staff to support the program. DNREC's involvement would be needed to provide environmental data, such as air quality, sea level rise, or mosquito populations to support the tracking network. The Department of Agriculture may also have environmental data (e.g., pesticide use data) that could be useful for environmental tracking.
Evaluate feasibility of monitoring private coastal drinking water wells for salt water intrusion	The DHSS Division of Public Health should evaluate the feasibility of monitoring private well water quality in coastal areas for salt water intrusion and investigate the potential to connect to a public water source. Salt water intrusion into drinking well water may result from sea level rise caused by climate change. This response would require changes to the Office of Drinking Water's policies and may require legislative changes to the Delaware Code. Collaboration with DNREC may be necessary. DPH would be the lead agency with assistance from DNREC. Working with local public water utilities may also be needed.
Examine ways to track new and emerging diseases	The DHSS Division of Public Health should examine ways to track new and emerging diseases related to climate change, such as Chikungunya fever, to respond to the influence that global climate change may have on infectious disease dynamics. Tracking of these diseases will provide evidence as to whether changes in disease patterns are occurring. Monitoring diseases is an important part of protecting the health of the public. The adaptation response may require public health program(s) to make changes to its existing program(s) to include the influence of global climate change on infectious disease dynamics. The reporting of new diseases may require policy and/or legislative changes. The Public Health laboratory may need to develop new protocols to identify new causative agents.
Expand List of Reportable Conditions	The DHSS Division of Public Health should expand the list of reportable conditions to include those related to extreme or adverse weather conditions, for example, heat stroke and heat stress. The reportable list should also be updated to include diseases related to climate change. The adaptation response may require public health program(s) to make changes to its existing program(s) to include conditions related to extreme or adverse weather events. At this time, it is believed that existing staff will be able to handle the increased workload.

To enhance current data management practices:	
Evaluate public health infrastructure and resources for data collection and analysis	The DHSS Division of Public Health should evaluate the specific costs and benefits of expanding and updating infrastructure and resources for data collection and analysis to include climate change impacts. The updated DPH databases should allow DPH climate change impacts to be included. The Data and Informatics section will take the lead. The desired outcome from this response will be a DPH database that is easily accessible by DPH staff and other state agency staff. The adaptation response will require existing public health programs to collaborate with the Data and Informatics section to expand and update the public health infrastructure and resources for data collection and analysis.
Evaluate GIS mapping of vulnerable populations and disease patterns	The DHSS Division of Public Health should evaluate the specific costs and benefits of developing geographic information system (GIS) mapping of vulnerable populations and disease patterns to help identify specific populations and health outcomes impacted by climate change–related events. This would improve DPH's ability to locate areas impacted by climate change and to assist the vulnerable populations. The GIS maps would be made available to the general public. GIS mapping of vulnerable populations and disease patterns in response to climate change–related events will require modest changes to existing programs within DPH. At this time, it is believed that existing staff will be able to handle the increased workload. The possible involvement of DNREC would be to provide environmental data, such as air quality, sea level rise, or mosquito populations, to support the GIS mapping. The Department of Agriculture may also have data (e.g., pesticide use data) that could be useful for GIS mapping.
Evaluate integration of DPH data sources	The DHSS Division of Public Health should evaluate the specific costs and benefits of consolidating DPH databases so climate change impacts to DPH can be tracked and monitored. The Data and Informatics section will take the lead. The desired outcome from this response will be a DPH database that is easily accessible by DPH staff and other state agency staff. The adaptation response will require existing public health programs to collaborate with the Data and Informatics section.
To assist in outreach and education:	
Incorporate climate change impacts information in DPH outreach materials	The DHSS Division of Public Health should incorporate information on climate change impacts on health in DPH outreach materials (web-based and printed materials). The inclusion of climate change information will assist in educating the public on the health impacts caused by global climate changes. The adaptation response will require public health programs to make changes to existing outreach materials to include climate change impact on health.
Develop outreach materials on climate change and health	The DHSS Division of Public Health should update and develop new materials on climate change and health for outreach. The response will include printed materials, web-based materials, and media communications. The initial foci could be on heat-related issues, vector-borne diseases, vulnerable populations, and mental health impacts related to climate change. An educated public is an informed public, and this is the goal of this adaption recommendation. The response will require DPH programs to include climate change information in their outreach materials. It may also require the development of new media communication and materials for public education.
Provide training for DPH staff on climate change impacts and risks to health	The DHSS Division of Public Health should provide internal outreach, education, and training for the DPH staff on climate change impacts and risks to health. This response's desired outcome is to have a well-educated DPH staff pertaining to the impacts and risks of climate change on the health of the public. This response will require a new DPH training program on climate change impacts to health to be presented to DPH staff.
To accomplish other Department priorities:	
Review and update DPH programs for climate change impacts	The DHSS Division of Public Health should review and update their programs to include climate change impacts. The DPH adaptation response will include reviewing and improving methods and response plans to protect vulnerable population from extreme weather events, heat events, and other climate emergencies. DPH will also review and develop communication strategies for at-risk groups. Additionally, DPH will review and improve planning for response capacity, for those with chronic health conditions such as transportation to cooling centers.
Develop health impact assessment tools	The DHSS Division of Public Health should develop a health impact assessment (HIA) and other tools for assessing the health of a community. HIA is a process that helps evaluate the potential health effects of a plan, project, or policy before it is built or implemented. An HIA can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. HIA brings potential public health impacts and considerations to the decision-making process for plans, projects, and policies that fall outside the traditional public health arenas, such as transportation and land use.

Advocate integrating climate change with local activities	The DHSS Division of Public Health should advocate integrating climate change with local activities around sustainability and mitigation to deal with water issues, heat island effects, land use and infrastructure planning, building codes, and promotion of green energy and mass transit. This response would require the director's office to take an active role advocating for integrating potential climate change impacts into planning, codes, land use, etc. This adaptation response would require assistance and collaboration between DPH and other jurisdictions. The jurisdiction with regulatory authority would take the lead; however, DPH would support and advocate for changes in response to climate change impacts.
Advocate for an expansion of air quality monitoring	The DHSS Division of Public Health should support and advocate expanding DNREC's air quality monitoring program. DNREC is lead agency for air quality monitoring in the state of Delaware. Because of the potential for increased air pollution as a result of climate change, DPH will support and advocate for the expansion monitoring of air quality by the Department of Natural Resources and Environmental Control. This adaptation response would require changes to the DNREC air quality program by expanding the monitoring.
Identify funding opportunities for climate change and public health	The DHSS Division of Public Health should identify and share possible climate change funding opportunities related to health issues. Funds could be used for the development of a variety of program needs, such as an environmental public health tracking network, updating data infrastructure, GIS mapping, etc. The adaptation response would require existing public health programs to identify and share possible climate change funding opportunities with the rest of DPH.

Delaware Department of Health and Social Services – Social Service Divisions – FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Establish communication link to DDDS clients who live on their own	DHSS should establish a communication link to Division of Developmental Disabilities Services (DDDS) clients who live on their own, particularly those requiring respiratory assistance, who will be vulnerable during a heat wave or power outage. DDDS currently has a way to communicate to provider agencies about possible heat waves or power outages to see if assistance with clients is needed. However, there is no link established for reaching out or providing warnings to those families or individuals supported who live on their own. Social media networks are a possible option.
Expand medicine refill window	DHSS should expand the medicine refill window to ensure availability of medications during emergency evacuations or extreme weather events. Current law prohibits the refill of certain medications (psychotropic) to within three days of expiration. This 3-day window is sometimes not enough for a client to get a refill ahead of an extreme weather event. If an area of the state is forced into evacuation ahead of an event, it could be several days before a client is allowed to return, which could be after their medication runs out. The Division of Medicaid and Medical Assistance (DMMA) currently regulates the 3-day window.
Implement a statewide Smart-911 system	DHSS should implement a statewide Smart-911 system. Climate change will have an effect on the amount of calls in to first responders. First responders do not always have the details on the place or people they are responding to. A statewide Smart-911 system would contain all the relevant details first responders would need when responding.
Discuss feasibility of requiring contingency plans from managed care organizations (MCOs)	DHSS should discuss with managed care organizations (MCOs) the feasibility of requiring contingency plans for extreme weather. MCOs are the main point of contact for individuals who receive assistance from DMMA. MCOs should be responsible for developing contingency plans for the clients they serve. These individuals are more vulnerable to the effects of climate change than the average citizen in the state.
Remove potential hazards from low-lying areas prior to a major event	DHSS should remove potential hazards from low-lying areas near DHSS facilities to prevent damage during flood events. Vehicles and other objects in parking lots (e.g., dumpsters) and on building grounds can become buoyant and damage buildings during periods of extreme precipitation. These objects should either be moved to higher ground or secured in place.
Advocate for additional resources for Low-Income Home Energy Assistance Program (LIHEAP)	DHSS should advocate for additional resources for the Low-Income Home Energy Assistance Program (LIHEAP). LIHEAP provides outreach activities and assistance to low-income households in meeting their home energy costs, particularly to those with the lowest incomes that pay a high portion of household income for home energy. Low-income individuals spend a larger share of their budgets on energy costs and are more likely to be living in poorly insulated homes with older, less energy-efficient appliances. The State of Delaware should advocate for an increase in LIHEAP funds as part of their climate resiliency and adaptation strategy, because this federal grant reaches millions of households that are vulnerable to potential higher costs arising from climate change. The State of Delaware should advocate for additional flexibility to utilize LIHEAP funds to not only provide low-income clients with assistance in energy costs associated with their current household/dwelling, but also additional benefit assistance and education around other consumer-related costs impacted by climate change.
Create a statewide climate resiliency educational campaign	DHSS should create a statewide educational campaign to engage DHSS clients on climate change, resiliency, and adaptation initiatives. DHSS clients and vulnerable populations may not be prepared or have easy access to adaptation tools and strategies that mitigate the effects of climate change. Community Services Block Grant, LIHEAP, United Way 211, and other public and private stakeholders could work together to implement an educational campaign focused on engaging consumers/clients on climate change and adaptation initiatives.
Consider creating mobile State Service Centers	DHSS should consider creating mobile State Service Centers to provide access to services to clients during emergency evacuations or extreme weather events. For the purposes of climate adaptation and emergency preparedness, mobile State Service Centers can be developed and equipped with private offices, desks, computer system, kitchen, restrooms, and more to effectively engage, connect, and serve Delaware communities in place. These mobile centers could be utilized during winter storms, periods of extreme heat, or as alternative sites in the event of coastal storms that may force clients to relocate (evacuate) on a temporary or permanent basis. By creating mobile service centers, the division can bring the services to clients. Best case scenario for this recommendation would be to fund the purchase of 3 service center vehicles (one per county) and retrofit the vehicles with the equipment, office supplies, and wireless technology needed to access DHSS benefit systems and records and by so doing provide site-specific/community-based services.

Designate State Service Centers as critical facilities	DHSS should designate State Service Centers as critical facilities to ensure continued availability of services during extreme weather events and during power outages. DHSS, through its Division of State Service Centers, oversees 15 multiservice facilities in which over 160 health and social service–related public and private agencies and/or programs are co-located. The goal of the centers is to promote convenient access to Delaware's health and human services system. The effects of climate change combined with the steady increase in Delaware's population could result in increased client flow to these centers due to increased demand for socioeconomic resources from our already vulnerable populations. In the event of weather-related emergencies (e.g., floods), high demand on the electrical grid during a heat wave, and/or other extreme weather event, the clients of the programs housed in the State Service Centers could be unable to receive the critical assistance on which they depend. By designating these Centers as critical and providing the necessary infrastructure (e.g., emergency generators), the Centers can continue to function at all times.
Provide training and education on climate preparedness and adaptation	DHSS should convene health and social service providers from multiple sectors, including state and local agencies, and experts who are developing mitigation and adaptation strategies and other information, to train/educate the state on best practices for community climate resiliency. As part of training, DHSS agencies and partners representing the health and social services sector could use these opportunities to review current climate preparedness, assess additional risks to services and clients, identify strategies, and establish guidance necessary to become more prepared and resilient to climate change. There is a clear need for better communication of information to support different groups, especially the disadvantaged, to adapt effectively to current and impending impacts of climate change. Knowledge, tools, and strategies that aid in preparedness and behavioral change are important for individuals, families, and communities to adapt to and combat the effects of climate change.
Identify sites to be used as designated cooling and heating centers	DHSS should identify sites to be used as designated cooling and heating centers. Climate change is expected to increase the frequency of extreme events, which includes high heat days and low temperature days. This may place a higher need for and demand on social net programs. Consequently, this would negatively affect vulnerable populations, who may not have adequate resources to cool or heat themselves within their environs during the hottest and coldest hours of the day. During stretches of extreme high heat or extreme cold days/nights, when many of the vulnerable populations have no means to heat or cool their homes, DHSS along with the Division of State Service Centers can work with the Delaware Emergency Management Agency (DEMA), local governments, faith-based, and other community partners to ensure that the state has adequate shelters and other resources for the homeless and other vulnerable populations. With additional resources, partnerships, and support, additional cooling or heating centers could be developed.

Delaware Department of Natural Resources and Environmental Control - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
To incorporate climate change into land management and stewardship decisions:	
DNREC should incorporate the expected impacts from climate change into our management and stewardship plans for DNREC-owned lands, making cost-effective decisions for climate resilient management of all such property. DNREC owns or manages over 100,000 acres of land through simple ownership, through conservation easements, and other means, largely through our Divisions of Parks and Recreation and Fish and Wildlife and the Delaware Coastal Program office. Sea level rise, flooding, invasive species, species extinction and migration, and other impacts from climate change will all impact how we manage public lands into the future, and DNREC must begin planning for those eventualities now.	
Design and implement restoration activities to slow loss of coastal habitats	DNREC (Division of Fish and Wildlife) should design and plan to implement restoration activities to slow the current loss of coastal beach, marsh, and forest habitats in the near term; identify and secure opportunities for beach and marsh transgression and afforestation in the mid- to long-term; and begin on-the-ground restoration actions to replace future loss of coastal habitat. Extensive loss of coastal habitats will result in loss of revenue from hunting, angling, boating, wildlife viewing, and tourism, as well as impacts to farmland from increased inundation and salinity.
Discuss expansion of invasive species control	DNREC (Division of Fish and Wildlife) should prepare to discuss expansion of invasive species control work and consider establishing early-detection and rapid management response teams in coordination with other land management agencies and partners. Problems with existing invasive species are expected to worsen, and the introduction of new and more aggressive species is anticipated. Revisions of regulations or flexibility provisions in regulations may be needed to support rapid response for controlling emerging invasive species problems.
Prepare to restore riparian buffers	DNREC (Division of Fish and Wildlife) should prepare to restore riparian buffers on wildlife areas, fishing and boating-access areas, and on private lands by planting native vegetation buffers and developing incentive programs for private landowners. Highest priority restoration sites and improved incentives for private landowners will need to be identified.
Prepare to restore ecological integrity of unique ephemeral wetlands	DNREC (Division of Fish and Wildlife) should prepare to restore adequate buffers around coastal plain seasonal ponds and other vernal pools, remove invasive vegetation in and around these freshwater wetlands, and evaluate the impact of groundwater withdrawals on these habitats on state wildlife areas and in cooperation with other land-managing agencies and partners, as well as with private landowners. Changing drought periods affecting these unique freshwater habitats will impact plant, invertebrate and amphibian species adapted to current average annual rainfall and drying periods. Incentive programs may need to be re-evaluated to entice private landowners to participate in restoration. In order to do so, the Division may need additional resources for analysis to identify highest priority restoration sites and for improved incentives for private landowners.
Prepare to manage different fish and wildlife species and habitat	DNREC (Division of Fish and Wildlife) should prepare to manage a different group of important fish and wildlife species and habitats (e.g., a northward shift of some fish species that support important commercial and recreational fisheries, a northward shift in more southern pine forest habitat). More specific guidance regarding species and habitats expected to shift ranges will be provided by the updated Delaware Wildlife Action Plan. Technical assistance and training will be needed with biologists and managers across the southeastern U.S. to help adapt local practices. Changes in species populations that are hunted, trapped, fished, and viewed may result in increased complaints from user groups and constituents who may not understand lasting climate change impacts and adaptation needs. Additional resources may be needed, as well as outreach to help the public understand lasting changes to local habitats and species and agency adaptation responses.
Evaluate strategies for increasing native pollinator habitat on public and private lands	DNREC (Division of Fish and Wildlife) should evaluate strategies for increasing native pollinator habitat on state wildlife areas and private lands, minimize use of insecticide use on wildlife areas, and encourage private landowners to minimize insecticide use. Increasing temperatures and longer growing seasons may impact pollinator species that are critical for native plant species and agricultural crops.
Evaluate need for revisions to technical specifications for vegetative practices	DNREC (Division of Watershed Stewardship) should evaluate the need for revisions to technical specifications for vegetative practices in consideration of sea level rise and saltwater intrusion. Sea level rise impacts may also affect maintenance schedules as existing management facilities are subjected to changes in salinity. Some of these vegetative practices are developed by NRCS and other technical recommendations not initiated at the state level.

Incorporate climate change into land stewardship decisions at the Delaware National Estuarine Research Reserve	DNREC (Delaware Coastal Programs) should incorporate climate change into land stewardship decisions at the Delaware National Estuarine Research Reserve properties. The DNERR Stewardship Program provides long-term protection of natural resources associated with the Reserve and serves to model responsible management practices to other organizations and individuals in nearby coastal communities. The Stewardship Program works on land acquisition, habitat mapping, ecological restoration, invasive species monitoring, and creating demonstration areas. Climate change adaptations should be incorporated into all aspects of the Stewardship Program, including but not limited to new management techniques, mapping needs, demonstration areas, and land acquisition.
Increase climate change–focused research and monitoring on DNERR land	DNREC (Delaware Coastal Programs) should increase climate change–focused research on Delaware National Estuarine Research Reserve properties. DNERR research staff support and conduct research with a focus on NOAA's mission to protect, restore, and manage use of coastal and ocean resources through an ecosystem approach to management. The DNERR serves as a platform for long-term research and monitoring related to climate change.
To incorporate climate change into asset management for hard and natural infrastructure:	
DNREC should apply an asset management approach when addressing climate risk to building facilities, other structures, and natural infrastructure. The elements of an asset management approach—monitoring of asset quality, risk analysis of climate science and impacts, and options for addressing vulnerabilities based on cost and budget—can improve long-term decision making and minimize future costs to maintain infrastructure. DNREC programs should integrate relevant elements into existing asset systems used for planning to preserve invested dollars over the expected life cycle of the asset/infrastructure.	
Adapt building processes	DNREC (Division of Parks and Recreation) should develop new standards for buildings in response to changing threats. Evaluate vulnerable facilities, decide which to abandon and which to rehabilitate to new standards, and transition facilities to new locations at the end of their "life cycle."
Consider relocating Division of Fish and Wildlife facilities	DNREC (Division of Fish and Wildlife) should consider relocating facilities, including offices, education centers, boat ramps, and equipment storage areas, and redesign or relocate facility access roads already at risk from flooding and storm surge. Several coastal public-access areas managed by DFW are already prone to flooding caused by extreme tides and storm surge. Other facilities will be at greater risk as sea levels rise and more frequent extreme storms impact coastal areas. An interruption in outdoor recreation and education services is already occurring at facilities due to flooding, and personnel have not been able to reach offices as a result of flooding during storms and extreme high tides. Loss of license revenue will result if access to wildlife areas and boat ramps is prevented by persistent flooding, and loss of productivity will result if personnel cannot reach assigned work locations. DelDOT will need to be involved regarding flooded and damaged public roads that lead to DFW facilities.
Develop a climate change adaptation plan for the Delaware National Estuarine Research Reserve	DNREC (Delaware Coastal Programs) should develop a climate change adaptation plan for the two Delaware National Estuarine Research Reserve properties in the state—St. Jones Reserve and Blackbird Creek Reserve. This plan will provide ways to incorporate sea level rise considerations into land acquisition activities; develop a framework for decision making regarding land protection and restoration strategies based on habitat vulnerability; and develop wetland protection, restoration, and retreat strategies in response to sea level rise. Additionally, the plan will also provide land managers and farmers with guidance on ways to manage lands and habitats affected by sea level rise and on preparing a description of best management practices and considerations for adaptation.
Adapt coastal impoundments and ponds	DNREC (Division of Fish and Wildlife) should adapt coastal impoundments and ponds by stabilizing and increasing the resiliency of levees, water-control structures, and dams, and implement water-level management and restoration activities that will improve accretion and vegetation growth. Adaptation plans should be developed to slow the pace of current impacts and to mitigate for current and future loss of habitat functions and values for wildlife and fish as well as mosquito and flood control functions. Failure to address stabilization, restoration, and retreat can result in catastrophic and rapid loss of hundreds of acres of protective coastal wetland impoundments to open water, which will be far more costly to recover, if recovery is possible at all. DelDOT will need to be involved for road and levee repairs under their ownership.
Evaluate need for revisions to technical standards and specifications for stormwater management	DNREC (Division of Watershed Stewardship) should evaluate the need for revisions to technical standards and specifications for stormwater management. Stormwater requirements are subject to criteria that are modeled. Predictive models use surface water elevations that will be impacted by sea level rise. Future conditions will also require more frequent stormwater maintenance schedules as existing management facilities are subjected to backwater conditions and other impacts.

To provide technical assistance to local governments, communities, and businesses:	
DNREC should integrate actions to address climate change impacts as part of technical assistance provided to local governments and businesses. Multiple DNREC programs offer guidance to local governments and businesses. Assistance to local governments can include adding climate change impacts analysis and response strategies into hazard mitigation planning, feedback on land use decisions (PLUS), and economic development planning occurring at the local level; developing model ordinances to reduce the risk of climate impacts on infrastructure (e.g., secure heating oil and propane tanks); and developing climate adaptation projects for communities.	
Provide technical assistance to Delaware communities for climate change adaptation projects	DNREC (Delaware Coastal Programs) should provide technical guidance and funding to encourage communities to plan for and implement appropriate climate change adaptation measures. The Coastal Management Program's Coastal Management Assistance Grants provide grant funding to support projects and activities that improve local and regional capacity to conserve, manage, and promote the incorporation of coastal management issues into local planning and implementation activities.
Study how to prioritize funding options to give preference to areas with effective practices for drainage and floodplain management	DNREC should study how to prioritize funding to give preference to projects in communities that have taken effective steps to adopt best practices and standards for drainage and floodplain management. The Floodplain and Drainage Advisory Committee formed under Senate Bill 64 identified recommendations to reduce vulnerability to ongoing inland and coastal flooding and drainage challenges, coastal storms and other extreme weather events, and rising sea level. Working with local and county jurisdictions, current practices and future needs should be reviewed to identify options to fund projects in jurisdictions where policies that continue to reduce risk from flooding are in place.
Aid local governments in planning for climate change	DNREC (Division of Energy and Climate) should provide technical support to local governments, in coordination with OSPC, to enhance focus on climate impacts (including the reduction of greenhouse gas emissions) and long-term sustainability (through adaptation and mitigation) in the comprehensive plan and in implementing ordinances. Improving community resiliency is best accomplished by local governments through their Comprehensive Land Use Plans. The majority of local governments in Delaware do not have the resources (e.g., staff/expertise/finances/time) to adequately address climate change, thereby improving their community's preparedness and resiliency. DEC can assist the OSPC by ensuring that revised plan guidelines and checklists include consideration of future climate impacts.
Ensure effective energy code compliance	DNREC (Division of Energy and Climate) should work with county, municipal, and local governments to ensure the uniform training, compliance, and enforcement of energy codes. New energy code requirements are driving the need for additional highly specialized training and compliance inspection methods that arguably need to be standardized across the state. Energy codes are critical to ensure that the buildings being built today meet modern conservation and efficiency standards. Having an up-to-date, progressive, and well enforced energy code can do much to lessen energy demands over the long term, ensure a reliable energy grid, and save consumers money in the long run. DNREC should work with affected stakeholders to evaluate ways to ensure that new energy code requirements are uniformly and successfully implemented.
Develop model building code	DNREC (Division of Energy and Climate [DEC]) should develop a model building code that could be adopted at the state or local level. Various groups, including local governments, the Home Builder Association of Delaware, and Delaware AIA, have expressed strong interest and acknowledged benefits of a model code. DEC can facilitate a dialogue between responsible and affected parties to support improved building codes that improve resilience to climate impacts in the building sector.
Develop model ordinance to secure home heating oil and propane tanks	DNREC (Division of Waste and Hazardous Substances' Tank Management Section) should develop a model ordinance for local governments to use to require that home heating oil tanks, both propane and oil, be strapped down or otherwise secured to prevent detachment and release during a flooding event. Propane tanks for home heating and gas grills routinely become detached during flood events, creating hazards to property and emergency responders as they can become like torpedoes until the gas is spent. Home heating oil tanks can also become disconnected and release their contents. Several propane companies in coastal areas are now requiring that their home heating propane tanks be strapped down. From the Accidental Release Prevention Program (ARPP) viewpoint, the outreach to the owners of the large, ASME propane tanks regulated by the ARPP, which may be located in the flood/storm surge zones, can be made through ARPP itself. ARPP can notify and verify that the owners ensure that their tanks are securely anchored to prevent both floatation and inversion (tank rotation that severs the piping connections). The outreach to the owners of the propane tanks and DOT cylinders that fall outside of the ARPP inclusion would need to be conducted with coordination with other Divisions and Departments.

Assist local governments in developing strategies to protect wastewater treatment facilities from flooding	DNREC (Division of Water's Surface Water Discharges Section) should develop a strategy to assist local governments in protecting wastewater treatment facilities from flooding and inundation from sea level rise. Wastewater treatment plants are often located near sea level in Delaware and thus are subject to periodic flooding events and may be subject to more long-term flooding influenced by sea level rise. Impacts include increases in spill incidence responses, plant capacity or engineering modifications, and increased field inspections. Increased frequency of flooding may require more dramatic responses, including facility relocation or increasing the elevation of vulnerable facility infrastructure.
Assist suppliers of potable water (from surface water intakes) in developing strategies to protect water intakes from flooding and salt water	DNREC (Division of Water's Water Supply Section) should develop a strategy to assist suppliers of potable water from surface water intakes to develop strategies to protect water intakes from flooding and salt water. The contamination of public water intakes from flooding or salt water due to sea level rise will require several likely responses depending on the local situation, including the following: more extensive treatment of surface water; abandonment/relocation of the intake; interconnection with other public water systems; and switching to groundwater where available. There are only a limited number of fresh surface water intakes in Delaware, but they serve a large percentage of the population of northern New Castle County. Hydrologic modeling studies should be conducted to provide better estimates on the need to protect existing intakes, the siting of new intakes, and projected time needed to respond.
Assist suppliers and users of potable water (from wells) to develop strategies for protection of wells from flooding and salt water	DNREC (Division of Water's Water Supply Section) should develop a strategy to assist suppliers and users of potable water from wells to develop strategies to protect wells from flooding and salt water. The contamination of public and private wells from flooding or salt water due to sea level rise or inundation of low-lying wells will require several likely responses depending on the local situation, including the following: treatment or reconditioning of the well; reconstruction of the well with a depth change or relocation; abandonment/relocation of the well; and interconnection with other systems. The increasing use of a limited and possibly shrinking fresh groundwater resource will challenge the general rules for fair distribution of this resource as users compete for the resource. Protection programs will become more important as the resource becomes more limited, particularly in coastal areas. Hydrologic modeling studies should be conducted to provide better estimates on the need to protect existing wells and for the siting of new wells. In addition, more comprehensive monitoring for salt water in coastal aquifers will improve our predictive ability.
To integrate climate impacts into scientific study, regulation, and permitting decisions:	
To the extent it is practicable and appropriate, DNREC should work to integrate anticipated climate impacts into the Department's permitting decisions. DNREC has more permitting programs and issues more permits to individual Delawareans than any other state agency. Permits are issued for myriad activities, including well and septic system permits for homeowners, air discharge permits for commercial and industrial sectors, stormwater and erosion control permits in the building sector, and dozens of other permits and approvals for activities that may have a detrimental effect on our land, air, water, or ecological resources, or which are otherwise required by statute to be approved by a government agency. In many cases, anticipated climate change impacts are not authorized as criteria that can be applied in deciding to approve, deny, or approve with conditions permit applications before the agency. In such cases, regulatory or statutory modifications may be necessary to allow use of those criteria in making permitting decisions on applications before DNREC.	
Evaluate need for improving spill containment requirements for hazardous materials	DNREC (Division of Waste and Hazardous Substances) should evaluate the need for improving spill containment requirements for Above Ground Storage Tanks and hazardous waste storage areas, which are vulnerable to flooding and storm surge impacts. The Accidental Release Prevention Program (ARPP), the Above Ground Storage Tank Program, the Hazardous Waste Program, and the Local Emergency Planning Committees can begin looking for necessary containment to cover storm surge heights, but only the ARPP has the regulatory authority to require increased containment wall height. The other programs can make recommendations. The state has requirements for adequate spill containment for contents of an Above Ground Storage Tank (AST) and hazardous waste, but this containment is based on the amount of material stored in the tank or containment area and not on storm surge height. Furthermore, if liquid raw materials or intermediate/finished products are not stored in regulated ASTs, then the state has no requirements for spill containment unless they are considered extremely hazardous substances and fall under the state's Extremely Hazardous Substances Act. There are also no containment requirements for hazardous raw materials or intermediate/finished products in a solid state. During a storm surge, such materials may dissolve in the floodwaters and be moved off site.
Incorporate Executive Order 41 in the Federal Consistency Program's enforceable coastal management policies	DNREC (Delaware Coastal Programs) should incorporate Executive Order 41 into its enforceable coastal management policies through the Coastal Zone Federal Consistency Certification Program. Consistency certification is a process that requires federal agencies to follow state coastal management policies when conducting a project or issuing a permit that could affect coastal resources, and will encourage better climate adaptation throughout the state.

Evaluate need for revisions to stormwater regulation	DNREC (Division of Watershed Stewardship) should evaluate need for revisions to stormwater regulation. Changes in magnitude and frequency of precipitation may require regulatory revisions based on updated weather data. May also require more frequent maintenance schedules as existing management facilities are subjected to these larger, more frequent events. The information that the Stormwater Program uses to base regulatory requirements upon is not developed at the state level but by federal and national data sets.
Evaluate changes to wetland and water quality monitoring	DNREC (Division of Watershed Stewardship) should evaluate potential changes to the methods of placement of wetland and water quality monitoring stations, methods of research and data collection, and possible redirection of research priorities in regard to changing conditions. Possible adaptation response would include moving monitoring stations to more secure sites, purchasing more rigorous equipment, changing monitoring parameters for climate change–related metrics, and either abandoning monitoring sites or establishing new sites. This adaptability would be necessary to continue to collect data to develop reports to agencies and the general public in regard to restoration success, wetland health and level of function, and water quality changes. Additionally, DNREC is required to report this data to EPA. Outreach would remain the same but would be changed to add more emphasis on monitoring and assessment in regard to changing climate. There already exists collaboration on monitoring with various agencies, such as USGS, Delaware Geological Survey, and intra-DNREC programs. Adaptation would be coordinated on a project-specific basis with other partners. The lead on the project again is project specific, and those that are the lead now would likely be the lead for adaptation response.
Evaluate design specifications and maintenance practices for rain gardens and other small-scale stormwater systems	DNREC (Division of Watershed Stewardship) should evaluate design specifications and maintenance practices to ensure that rain gardens and other stormwater systems on state lands remain functional with increases in extreme precipitation. Rain gardens and other stormwater practices using micro-topography may help offset the effects of more intense storms, so more promotion of their benefits would be beneficial. Small-scale stormwater best management practices (BMPs) can redirect a large amount of rainwater in a short period of time (< 48 hours) when properly designed and installed. With more intense storms and an increased amount of rainwater, a higher stormwater runoff coefficient may be necessary to properly design the size of these structures. The runoff coefficient is used to determine the most suitable size of the BMP and the amount of rainwater that the system can handle and infiltrate. If the amount of water is too much for the BMP structure to handle, they should be designed such that larger storm events bypass the system into a separate facility where site conditions allow. Routine maintenance of these small BMPs is critical to their function. The Division of Facilities Management within the Office of Management and Budget may see an increased need for their support in order to properly maintain on-site BMPs at state agency locations. Collaboration with the Department of Education may also be required because rain gardens have been installed as an educational component at a number of schools within the state.
Evaluate the adequacy of drainage infrastructure	DNREC (Division of Watershed Stewardship) should evaluate the adequacy of drainage infrastructure to address changes in precipitation and sea level rise. Climate change dynamics such as sea level rise and increased storm activity and precipitation will create the need for increased drainage services, and will stress already inadequate drainage infrastructure. Demand for new drainage infrastructure and service costs will increase where precipitation rates increase or sea level rise prevents adequate outlets to tidal waters. There are many densely developed parts of the state where a 2-foot rise in sea level will create major drainage issues. Land use decisions will be impacted as drainage infrastructure is incorporated into new development projects, which will be a challenge in many locations. DelDOT will face many of the same issues, and collaboration will be required between agencies.
Evaluate voluntary and regulatory strategies to ensure that Delaware emission sources are well controlled	DNREC (Division of Air Quality) should ensure that Delaware's emission sources of SO_2, NO_x, and volatile organic compounds (VOCs) remain well controlled. DE currently has issues with the attainment and maintenance of ozone and fine particulate matter, which are health-based air quality standards. Ambient concentrations of these pollutants are temperature-dependent, and increased temperature will exacerbate the problems. DE sources of these pollutants are generally well controlled, but as technology advances, additional control opportunities become available.
Consider incorporating equipment siting requirements into air permitting process	DNREC (Division of Air Quality [DAQ]) should consider a policy to require new permit applicants to consider inundation and sea level rise. Air emissions sources and emission control equipment may become at risk to flooding as more frequent extreme storms impact the state. DAQ should evaluate requiring as part of the existing permitting process that new sources of air emissions evaluate and appropriately site new equipment.

To incorporate adaptation into operational budget and capital planning processes:	
DNREC should integrate climate change into budget planning process and the long-range capital planning activities. Planning for and investing in infrastructure projects that improve Delaware's resiliency are possible when consistent and dedicated funds are available. Integrating climate adaptation strategies directly into the operating and capital budget planning process will help institutionalize discussions about future resiliency needs and investment into natural and hard infrastructure projects. DNREC should consider climate change impacts when reviewing proposed projects and suggest climate-related metrics for capital budget spending.	
Improve energy reliability and response to emergency events	DNREC (Division of Energy and Climate) should increase involvement and activities associated with energy emergency planning. DEC currently has direct involvement in Emergency Management response activities for energy-related events associated with state weather and other emergencies. As we prepare for more drastic weather and climate events, DEC expects to increase its Energy Assurance planning efforts and involvement with DEMA and preparedness for statewide Emergency Management activities and/or events, which may require additional resources for the Division.
Discuss additional support for living shorelines to support shoreline management and protection	DNREC (Division of Watershed Stewardship) should be the lead on shoreline management and protection for living shorelines. Assistance and collaboration with other state partners will be needed, because increased funding, more staffing resources, and collaboration with additional partners may be required. The increased use of mechanisms such as living shorelines to protect natural and human-made infrastructure will be crucial in regard to climate change. Adaptation to existing living shoreline methods and strategic placement for infrastructure protection is highly important so that sea level rise and climate change is planned for and counteracted well in advance. Responses would include ensuring the vitality and function of existing living shoreline projects. This could require more staffing, changes to policy, increased research, and more outreach. Climate change could also develop a response to increase the amount and scale of living shoreline projects, or conversely cause living shorelines to become obsolete due to increased sea level rise and shoreline energy, which would lead to increased erosion and/or the use of hardened/armored structures.
Plan for increasing demands for shoreline management and beach preservation	DNREC (Division of Watershed Stewardship) should plan for increasing needs, costs, and potential regulatory changes for shoreline management and beach preservation. The Division should monitor rates of coastal change, erosion, beach widths, storm damage, dune deterioration, and the cost of shoreline maintenance. Staff should consider the costs and benefits of project upgrades, which will likely be needed to maintain current levels of recreational beach amenities, park infrastructure, dune dimensions, and levels of coastal storm protection. Climate change dynamics such as sea level rise and increased storm activity could put additional stress on shoreline management and dune preservation/enhancement. Additional sand resources will be needed; more frequent and robust shoreline maintenance activities will be increasingly costly. Staffing increases could be needed if current service levels are maintained in the face of more frequent damage to beaches and dunes/dune crossovers. Regulatory changes to the Beach Use Regulations may be needed to maintain current levels of dune preservation/protection as sea levels increase and damages worsen. The Beach Preservation building line may not be appropriate in its current location to protect dunes as shoreline migration continues. The State Park system along the coast will be impacted by these changes. The major park infrastructure along the ocean and bay shorelines will be stressed by these increased risk factors.
Evaluate needs for channel maintenance	DNREC (Division of Watershed Stewardship) should evaluate needs for channel maintenance to maintain current levels of navigable waterways, recreational boating and fishing amenities, and park use. Climate change dynamics such as sea level rise, increased storm activity, and precipitation runoff could put additional stress on the Division's channel maintenance responsibilities. Increased storm activity and sediment accumulation could make channel maintenance activities increasingly costly. Staffing and contractual project increases could be needed if current or increasing service levels are required in the face of higher boating use and more frequent damage to channels by storm and tide-driven material. Major park infrastructure along the Delaware Bay and Inland Bays is linked to recreational and commercial boat use that depends on channel maintenance.

Prepare for expanded mosquito production season	DNREC (Division of Fish and Wildlife) should prepare to control mosquito populations nearly year-round to address increased complaints and to reduce transmission of mosquito-borne diseases, including maximizing use of non-insecticidal source reduction methods (e.g., open marsh water management, impoundment water-level management, fish stocking); expanding public education and outreach efforts to increase participation in water sanitation to decrease mosquito-breeding habitats; and exploring new regulatory tools to increase compliance. Increased mosquito population and mosquito-borne disease surveillance and monitoring will also be needed, as well as an increase in use of larvicides and adulticides as warranted to meet the public's needs, demands, and expectations.
Prepare for increased nuisance wildlife complaints	DNREC (Division of Fish and Wildlife) should prepare to address an increase in nuisance wildlife complaints by increasing outreach about best practices and services offered by commercial operators and volunteer organizations. Increased complaints are expected as suitable habitat for some species shrinks and wildlife move closer to residential and urban areas. An increased demand for assistance with sick or injured wildlife after extreme storm/flooding rain events is also anticipated. Permitting of commercial operators and volunteer rehabilitation organizations needs to be updated and refined.
Prepare for increased number of fish kills and harmful algal blooms	DNREC (Division of Fish and Wildlife) should prepare to handle an increased number of fish kills and harmful algal blooms. Increased fish kills will result from decreased holding capacity for dissolved oxygen in water. Increased need for response may require additional resources.
To ensure protection of public health and safety:	
Develop plan for access	DNREC (Division of Parks and Recreation) should develop a plan to provide alternative evacuation routes, access roads, and trails and ensure that communication would be available in the event of an emergency. DelDOT and DEMA should be involved, as they address roadways and emergency response.
Issue emergency waivers for repairs to infrastructure, environmental resources, and property resulting from storms and flooding events	DNREC (Division of Water's Wetlands and Subaqueous Lands Section) should issue emergency waivers for repairs to infrastructure, environmental resources, and property resulting from storms and flooding events. This adaptation would allow applicants to obtain expedited authorizations for repair and replacement activities in waters of the state and would reduce staff review time during these times of high permit demands. This adaptation has been important for the repair/replacement of roadways and bridges and for the repair/replacement of docks, piers. and shoreline stabilization on public and private properties. This adaptation has allowed the prompt allocation and utilization of federal funds for the nourishment of damaged beaches and the repair of damaged earthen dams.
Update and implement Debris Management Section of the State Emergency Operations Plan	DNREC (Division of Waste and Hazardous Substances) should work with DEMA to support the update of requirements in the Debris Management Section of the State Emergency Operations Plan and ensure their implementation. Many requirements were never funded and therefore never implemented. The plan requires updating before a storm hits that requires the plan’s implementation. This recommendation requires DEMA leadership.
To improve data and information available to the public:	
Update floodplain maps with consideration of climate change dynamics	DNREC (Division of Watershed Stewardship) should update floodplain maps with consideration of climate change dynamics. As flood risk factors increase, there will be an ongoing need to update these maps frequently and potentially to produce maps that are future-risk-based. Demand for updated floodplain maps and forward-looking study methodology is likely as flood and coastal storm risks are impacted by climate change. Climate change dynamics such as sea level rise, increased storm activity, and precipitation runoff will likely drive the need for updates to floodplain maps to reflect changing flood risk. Current federal policy and modeling practices intentionally do not factor future changes in sea level and precipitation into 100-year floodplain maps. In part this is due to federal insurance requirements that these maps reflect current risk, not future risk. Also, the hydrology and hydraulics practices for calculating flood levels and flood risk maps are driven by historical and current data and lack proven guidance for performing these studies for future conditions.

Coordinate on the use of updated floodplain maps to assist with flood mitigation activities	DNREC (Division of Watershed Stewardship) should coordinate with DEMA on the use of updated floodplain maps to assist with flood mitigation activities. Climate change dynamics such as sea level rise and increased storm activity and precipitation will create the need for updated floodplain mapping and higher floodplain standards for keeping development safe. The cycle at which floodplain maps are updated is currently inadequate, but is becoming more manageable as technologic advances lower the cost of flood studies. Floodplain mapping updates and floodplain development standards that account for rising sea level and increased flood risk will be needed. Ideally these programs become more "forward-looking" instead of being tied to historic data, stream flows, coastal storms of record, and models. The outcome should be flood risk maps that depict future risk factors, floodplain development standards to guide development away from current and future flood risk areas, and new standards that look at future risks. Because DEMA will be similarly faced with increased pressure to provide assistance for flood mitigation activities, a shared collaborative approach will be needed.
Update mapping of tidal wetland jurisdictional boundaries	DNREC (Division of Water's Wetlands and Subaqueous Lands Section) should update the existing tidal wetland jurisdictional boundary maps to more accurately identify the limits of the state's jurisdiction over tidal wetlands and develop a protocol for future updates. Sea level rise is resulting in the landward migration of tidal wetlands, which is not being depicted in the existing maps that are static and last updated in 1988. This adaptation will minimize impacts to tidal wetlands that result from unpermitted excavation, filling, and construction activities and provide guidance for the siting of infrastructure and structures vulnerable to sea level rise.
Increase educational awareness of climate change in Delaware	DNREC (Delaware Coastal Programs) should increase climate change content in educational and outreach programs that promote a better understanding of Delaware's estuarine and coastal areas and promote informed coastal decision making. DNERR offers education and training programs for a range of audiences, including students, teachers, and families, as well as state and local government leaders and other coastal decision makers. The goal of the program is to improve environmental literacy in our communities to enable environmentally sustainable decision making. Pertinent climate change information can be included in curricula that have been developed for the various education and outreach programs: Coastal Training Program, Community Programs, School Programs, Teacher Professional Development, and through Thank You, Delaware Bay.
Educate staff and the public	DNREC (Division of Parks and Recreation) should educate staff and develop educational brochures for constituents on vector-borne diseases, prevention and treatment of heatstroke and dehydration, and what to do in the event of extreme weather events. They should also consider changes in timing and duration of public programs and fee season.
Build capacity to conduct climate change–focused air quality modeling	DNREC (Division of Air Quality) should conduct regional-scale modeling with CMAQ and CAMx. These regional-scale models are necessary to evaluate the impact of temperature change on ozone levels and fine particulate matter in DE.
Increase climate change–focused research and modeling	DNREC (Division of Air Quality) should conduct additional research/modeling to better understand the impacts of increased temperature on ozone concentrations. Ozone formation is highly temperature dependent, and increased temperatures will increase the number of days that ozone levels are unhealthy and the level of ozone concentrations on those days. Research and modeling is needed to relate the increased ozone levels to the national ambient air quality standards, the quantity of NO_X and VOC emissions in DE, and the relative impact of ozone and ozone precursor emissions transported into DE from upwind states.
To address other Department-wide priorities:	
Develop and apply resiliency compliance criteria for distributing state and federal funds	DNREC should develop resiliency principles, incentive structures, and/or eligibility criteria for grant and contract funds based on the flexibility and intent of the funding source. When distributing funds to contractors, businesses, and communities, DNREC should ensure to the maximum extent possible that funds are used in ways that minimize risk from climate impacts (e.g., higher temperatures, increased precipitation, sea level rise, and greater risk of flooding) and that safeguard communities from preventable loss.
Support long-term climate resilience through Cabinet Committee on Climate Resiliency	DNREC should continue to support climate mitigation and adaptation policy in coordination with the Governor's Committee on Climate and Resiliency, convened under Executive Order 41. DNREC recommends that the Committee continue operating over the long term, and that the Division of Energy and Climate (DEC) provide annual updates to them on changes in our understanding of the effects of climate change on Delaware and its residents. Climate change will continue for decades, and our understanding of the science of greenhouse gas effects on the planet will continue to evolve. DEC needs to stay abreast of changing science and policy developments and continuously apply those changes to Delaware's climate adaptation and mitigation responses.

Delaware Department of Safety and Homeland Security - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Develop operational plans to adapt to sea level rise	DSHS should develop operational plans to address the potential impacts of sea level rise. These operational plans may also include measures to ensure that new facilities are not constructed in lower elevation areas, so as to mitigate flooding impacts.
Consider alterations to policies regarding worker safety in an increased temperature environment	DSHS should consider alterations to policies regarding worker safety in an increased temperature environment. Necessary policy changes may include additional training on the risks of extreme heat to outdoor workers, changes to uniform dress code under certain circumstances, and alterations in scheduling during extreme heat events. Increased temperatures affect all state agencies, but especially those whose employees work outside for extended periods of time, such as Delaware State Police, DelDOT, DNREC, etc. There will need to be collaboration among these and other state partners to address this issue. The lead should come from state agencies with the most employees affected by increased temperatures, along with guidance concerning heat-related illnesses from the Division of Public Health.
Conduct research on the potential effects of climate change on structures and vehicles	DSHS should conduct additional research to provide accurate information on the effects of increased temperatures and increased precipitation on buildings and vehicles, including the effects on existing structures and vehicles. A potential focus for the research could be to gauge the effects of increased temperatures and prolonged heat waves on state buildings and vehicles to ascertain if the current cooling systems in state buildings and vehicles are robust enough to handle the additional stress that will be placed upon them in the future. Additional research should be conducted to gauge the vulnerability of the state's communication infrastructure to ensure the reliability of this vital resource in the face of climate change. Based on the outcome of the research, action plans can be developed and implemented.
Make programmatic adjustments to adapt to increasing levels of precipitation, flooding, and sea level rise	DSHS should make programmatic adjustments to adapt to increasing levels of precipitation, flooding, and sea level rise. These programmatic adjustments can be tailored specifically to Divisions within DSHS based on need. For example, DEMA may need to have staff and Emergency Service Coordinators (ESCs) report to the Emergency Operations Center earlier in an event and also readjust timelines for evacuation of citizens from vulnerable communities. In addition, DEMA will need to expand its outreach and education to the local governments and the public concerning building in flood-prone areas and floodplains, and programs available through DEMA to assist with mitigating vulnerable properties. The Division of Communications (DivComm) may need to reevaluate the lightning suppression equipment to include the grounding of internal and external equipment that is currently in place at the state's radio communications sites to ensure its compliance with industry guidelines. DivComm may also need to reconfigure current or install new lightning suppression equipment and grounding systems where needed to ensure uninterrupted radio communications for the various agencies throughout the state, including the Delaware State Police, municipal police, fire departments, Department of Corrections, and DelDOT. Also, DivComm may need to reevaluate the ability to properly protect the state radio communications site shelters and auxiliary power generators from any potential sea level rise and should consider the feasibility of installing drainage culverts or water barriers around the sites to divert water away.

Delaware Department of State - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
To identify and support policy initiatives that reduce greenhouse gas emissions (climate mitigation):	
Review Commission options to help reduce greenhouse gases and mitigate climate change	DOS (Public Service Commission staff) should take the opportunity to chair an orderly, task force focused approach to review existing and potential utility actions to help mitigate climate change and reduce greenhouse gases with consideration for customer rate impact. The PSC should assign a Review Manager to coordinate and manage the task force process and to prepare a "Findings and Recommendations" report to the Commission.
Broaden utility review of climate change initiatives to include non-regulated entities	DOS (Public Service Commission staff) should broaden the review by inviting participation unregulated and municipal public utilities as members of the task force and establish a proposed schedule of work leading to a final report within 12 months. As the PSC only regulates investor-owned utilities, participation and cooperation of unregulated utilities would be on a voluntary basis.
Review utility tariff approaches to minimizing greenhouse gases	DOS (Public Service Commission staff) should broaden the review to include various tariff approaches that could help reduce energy use and related greenhouse gases, while minimizing customer rate impact. The review should include: a. Tariffs that encourage conservation of resources and stimulate growth of distributed resources; b. Tariffs that recognize the benefits of energy efficiency and the direct use of natural gas; c. Tariffs that improve customer choice and produce savings through dynamic or off peak energy use; d. The impacts made by peak demand costs, net metering limitations and other tariff issues.
To enhance utility infrastructure to ensure reliability of service:	
Review potential for infrastructure enhancements that can help mitigate climate change exposure	DOS (Public Service Commission staff) should utilize the existing task force to also review the following key issues on which actions could be taken to help mitigate climate change. The review should consider rate impact and supplement the "Findings and Recommendations" Report to the Commission: a. Major utility areas at risk from climate change and sea level rise; b. Discussions with utilities relating to their plans for infrastructure resiliency investment and where that might help to mitigate the impact of climate change; c. Potential mechanisms, including securitization of asset upgrades, to reduce ratepayer mitigation costs; d. Utility actions and monitoring/reporting requirements.
Coordinate review of storm response procedures with all regulated utilities	DOS (Public Service Commission staff) should consider a review of current utility policies related to storm response encompassing a wide range of response procedures currently in place to ensure public safety and address potential public health concerns related to climate change.
To incorporate climate change into asset management and protection of historic and cultural resources:	
Complete mapping of cultural resources into GIS-based system	DOS (Historical & Cultural Affairs) should increase readiness (preparedness) for climate change events by completing mapping of all cultural resources in the Cultural and Historical Resources Information System (CHRIS), a GIS-based system. This will allow for broader planning related to the risk to cultural resources and provide for expedited review in all federal undertakings requiring such review by the National Environmental Protection Act (NEPA) and/or the National Historic Preservation Act (NHPA).
Conduct vulnerability assessments	DOS (Historical & Cultural Affairs) should conduct vulnerability assessments and scenario planning, to include evacuation and triage procedures. Historical & Cultural Affairs will enhance adaptation/preparedness by developing risk criteria, assessing and characterizing the vulnerability of state assets (facilities and cultural resources), and providing scenario planning guidance and training to include evacuation and triage procedures.
Ensure preparedness for threatened sites	DOS (Historical & Cultural Affairs) should document underground utilities, underground storage tanks, septic systems, and other infrastructure of vulnerable assets, maintain site and floor plans, identify utility shut-off valves and exit routes, and maintain documentation in readily accessible formats.
Evaluate costs and benefits of creating historic preservation tax credit for adaptation and resiliency	DOS (Historical & Cultural Affairs) should evaluate the specific costs and benefits of creating a category of historic preservation tax credits that eligible property owners can apply for to offset the costs of adaptation and protection measures.

Publish cultural resource management plans	DOS (Historical & Cultural Affairs) should increase readiness (preparedness) for climate change events by: (1) developing and implementing cultural resource management plans that identify significant buildings and archaeological sites, and documenting and/or recovering information as indicated; (2) providing adequate facilities to protect curated artifact collections and associated documentation.
To incorporate climate change into asset management:	
Mitigate below-grade facilities	DOS should identify all work locations considered to be "below grade" and vulnerable to increased frequency of flooding and mitigate potential adverse effects by incorporating into maintenance plans regular inspections of drainage systems, ventilation, and entry and passageways, and by implementing corrections. Evaluate feasibility and incorporate into long-range planning relocation of these operations to less vulnerable sites.
Create energy baseline for leased sites	DOS should create baseline energy efficiency standards for all leased sites in the department, to include baseline energy consumption, tenant-available monitoring of energy usage, use of passive ventilation, and use of renewable energy sources.
Create energy baseline for office equipment	DOS should create baseline energy efficiency standards for all office equipment and promote the use of Energy Star equipment where appropriate.
Ensure new building compliance	DOS should ensure that all new buildings built by the Department of State shall be in compliance with Executive Order 18, especially in the categories of energy conservation and efficiency; use of clean, renewable energy; and environmentally responsible and energy conscious construction.
Ensure financed building compliance	DOS should ensure that all new buildings receiving funding from the State of Delaware through the Department of State shall be in compliance with Executive Order 18, especially in the categories of energy conservation and efficiency; use of clean, renewable energy; and environmentally responsible and energy conscious construction.
To ensure workforce safety and capacity to provide services:	
Increase amount of technical staff	DOS (Public Advocate) should address the need for additional technical staff to address the potential increase in call volumes and more complex hearings (where climate change mitigation costs may be built into rates).
Promote personal energy use awareness	DOS should enhance workforce climate literacy by developing a training program to ensure that all employees are aware of their personal energy use and ways to use energy more efficiently.
Establish protocols to protect outdoor workers	DOS should increase workplace safety by establishing protocols to protect employees working outside from adverse effects of extreme temperature days.
Evaluate and promote workplace options for employees	DOS should evaluate and promote the use of videoconferencing capability for all agencies, especially those with public hearing functions; a ride sharing program to allow for sharing of vehicles across agency lines; telecommuting options; and flexible work and leave schedules during weather events that result in disruption, where feasible and desirable.
To ensure consumer protection:	
Evaluate alternate utility rate structures	DOS (Public Service Commission staff) should, upon approval by the Public Services Commission, collaborate with utility companies, the Public Advocate, and various stakeholders to design measures that would be suitable to address climate change initiatives with reasonable attainable goals, reasonable costs, and reasonable expectations.
Assess financial impact of any new rates	DOS (Public Advocate) should work to ensure that the financial impact of any potential new rates includes consideration of the utility consumer interests.
Enhance outreach to utility consumers	DOS (Public Advocate) should enhance outreach to utility consumers on the issues of climate change, mitigation, energy efficiency, and any potential rate changes.
Include protected classes and undocumented communities in outreach efforts	DOS (Human Relations Commission) should establish public information protocols to ensure fairness and equity in the dissemination of information related to Executive Order 41 implementation and ensure that any relevant plans, programs, services, incentives, and relief include protected classes and undocumented communities.

Delaware Department of Transportation - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
To incorporate climate change into asset management:	
Continue development of geospatial data sets that can help identify vulnerable areas and help estimate the impact of reasonably anticipated events (such as a Category 3 hurricane)	DelDOT should work with outside agencies to review and revise current rainfall curves and to develop comprehensive and dynamic rainfall and maximum likely storm surge models to assess impacts to infrastructure (not just transportation) in vulnerable areas. Current models and geospatial data capture only a partial view of the effects of climate change, mostly from a static viewpoint, and not from the effects of major storm surge, periods of heavy rainfall, or other major catastrophic events. Updates to geospatial forecasts incorporating these scenarios will help suggest where to place investments to improve the resilience of our communities (e.g., bury utilities, build sea walls, reinforce dams, etc.) These data will then be used by local jurisdictions to determine land use in comprehensive plans. DelDOT will use previous storm data (i.e., from Superstorm Sandy) as scenario planning data for development of potential risks in these geographically vulnerable areas.
Conduct comprehensive assessment of state roadway risks and assets	DelDOT proposes to conduct a comprehensive analysis of the state's roadways, bridges, and other infrastructure (stormwater ponds, dams, and dikes) to identify those elements or portions of the transportation system that provide access to essential services, such as hospitals and emergency shelters, and that could be vulnerable to climate change impacts such as flooding. The purpose of this analysis will be to create a plan to improve the resiliency of the transportation system by rendering these essential elements as reliably and predictably available for use in emergency situations as possible given our current knowledge and understanding of the maximum likely events such as extreme weather.
Integrate climate resiliency into project development, traffic, bridge, and highway design	DelDOT should integrate into its bridge and highway design manuals strategies for improving the resiliency of the transportation system (including against sea level rise) for short-term, medium-term, and long-term anticipated effects. Current projects are developed with an eye toward present and future traffic flows, safety improvements, and maximum lifecycle value of the asset. New designs will also take into account short-term, medium-term, and long-term effects of climate change, based on geospatial information, to accommodate these effects over the lifecycle of the asset. Project development will assess the potential cost impacts of these adjustments to determine the efficacy of building to adapt to anticipated climate change impacts. For example, traffic safety and management will evaluate the need to increase and improve roadway messaging, lighting, and retro-reflectivity in their design manuals to accommodate the greater anticipated frequency and severity of rain events.
Build transportation enhancements (pathways, trails, roadscapes, etc.) to accommodate impacts of climate change	DelDOT should incorporate accommodations in its Transportation Alternatives Program to provide resiliency for extreme heat, drought, heavy rainfall, or extreme cold and prolonged freezing. Current Transportation Alternatives projects strive for minimum of maintenance and context-sensitive design. Future designs should include noninvasive resilient plants and should deliberately minimize stormwater runoff impacts.
Identify and assess existing chronic flooding and erosion problems caused by sea level rise, frequent storms, tidal forces, subsidence, and aging infrastructure	DelDOT should coordinate with DNREC (Divisions of Fish and Wildlife, Watershed Stewardship, and Water) to identify and assess existing chronic flooding and erosion caused by sea level rise, frequent storms, tidal forces, subsidence, and aging infrastructure (e.g., water-control structures, levees, culverts, and roadside shoulder erosion).
Evaluate materials used to reduce the impacts of stormwater runoff	DelDOT should evaluate and qualify materials used to treat roads to meet standards for environmental impacts to vegetation, rivers, streams, etc. As greater moisture events (heavy rainfall, snow) occur due to climate change, use of chemicals for snowmelt plays a part in the impact of stormwater on roadside vegetation, wildlife and fish, and other aquatic species. Development of new designs with stormwater management alternatives and use of low impact chemicals (or no chemicals at all) will reduce these impacts.
Reevaluate stormwater management approaches	DelDOT should work with DNREC and the Office of State Planning Coordination to review the state's strategy for stormwater management with an eye to improved resiliency. Special attention should be paid to striking the right balance between deliberately retaining stormwater in an effort to enhance groundwater recharge and accommodating efficient drainage. Currently, stormwater management designs focus on volume and location. Alternative designs for stormwater management and advanced techniques to capture runoff and pollutant discharge will be explored. If appropriate, changes should be made in our design standards and in our regulatory requirements for subdivisions.

Explore new pavement technology	DelDOT should explore the deployment of new technologies in asphalt and concrete pavement composition to mitigate melting of road surfaces or other damage. Currently, asphalt pavements are impacted by prolonged heat and other environmental effects (water, salt, etc.). Alternative materials and substrates will be explored to prevent climate change–related failures and lengthen the lifecycle of paved surfaces to withstand extreme temperature changes and moisture impacts.
Incorporate climate impacts into cost-effective investment in infrastructure	DelDOT should reevaluate the process by which projects are prioritized into the Capital Improvement Program to ensure that the process adequately reflects the strategies contained in currently adopted comprehensive land use plans. Currently, investments are made primarily for improving safety, accommodating greater traffic volumes, and maximizing the lifecycle value. As climate changes the variables for design (e.g., more right-of-way needed for a higher bridge), greater funding in the Capital Improvement Program will be needed to accommodate costs of longer and larger bridges (and subsequent increased maintenance costs). DelDOT will evaluate how best to include in the decision-making process the cost/benefit of building to accommodate potential vulnerabilities weighed against the financial means to build them.
Evaluate obtaining insurance to assist in recovery from catastrophic events	DelDOT should work with the Office of Management and Budget (OMB) and the Insurance Coverage Office to assess the efficacy of obtaining some sort of insurance that could help provide the funds necessary to recover from catastrophic and prolonged loss of major elements (roadways, bridges, and equipment) within the transportation system. Because the state self-insures, DelDOT is concerned that a catastrophic event involving either Delaware's roadways or DelDOT equipment and the revenue generated by opening the state to interstate commerce will put the state finances at risk, particularly if there was a significant loss of economic activity during this time.
To ensure workforce and public health and safety:	
Evaluate and adjust worker safety guidelines	DelDOT should evaluate, and as necessary, adjust guidelines addressing worker safety and train workers to identify risks of exposure to high heat, extreme temperatures, and impacts to roadway and project site conditions. Currently, DelDOT monitors extreme events and adjusts work schedules accordingly. DelDOT should review and adjust its safety guidelines to accommodate for higher temperatures, impaired air quality, and extreme site conditions. It should encourage its contractors to do the same for its workers.
Provide training to improve worker knowledge	DelDOT should train workers utilizing materials for roadway maintenance to apply more resilient materials in responsible ways. Contractors currently do not undergo DelDOT training programs on state-of-the-art materials science or application. DelDOT should develop a best practice training program for approved construction firms.
Evaluate driving restrictions for air quality events	In conjunction with the Governor's Office, DNREC, and DHSS, DelDOT should evaluate the costs, benefits, and feasibility of "reduced driving days" when atmospheric conditions are such that air quality is a significant health risk. Currently, air quality is assessed and advisory warnings are issued for certain segments of the population (aged, young, those with health conditions). As the temperatures begin to increase over historical averages, ever-greater numbers of citizens may be impacted. The state should develop policies for addressing advisory and required compliance for public safety to a greater number of people who previously would not have been impacted.
Develop revised maintenance schedules in response to air quality	DelDOT should develop revised maintenance schedules in response to air quality and climate conditions. During poor air quality days, less mowing and reduced work during the day will reduce our pollution footprint. Electrification of vehicle work areas should be considered for needed idling to maintain air conditioning in vehicles. Decisions to reduce workdays will be balanced against higher costs, nuisance issues (e.g., work at night), and lengthening of projects.

Adjust transit service in emergencies	DelDOT should build into its emergency response strategies to provide transit as necessary without endangering drivers or passengers. DelDOT currently weighs its transit deployment based on extreme weather events. As the intensity of these events grows, alternative deployment strategies should be considered. For instance, vehicles will be redistributed to more localized service routes based on density to avoid impassable roads to reach passengers in need. Also, transit vehicles will be taken out of service if imminent danger is posed to drivers and potential passengers. DelDOT will provide more maintenance and alternative vehicle types with longer life spans, and accommodate worker conditions as temperatures increase. In addition, both DelDOT and Delaware Transit Fleet vehicles will have location options for storage at higher elevations at times of flooding. Lastly, more shelters for passengers to protect them from the elements (rain, cold, and heat) will be evaluated.
Reevaluate emergency response protocols	DelDOT and Homeland Security will reevaluate our current long-term strategies for response to significant catastrophic events and our current short-term evacuation policies, and detour/evacuation route management and implementation. Currently, the Transportation Management Center, in conjunction with DEMA, provides coordination of emergency events ranging from 72 hours to two weeks in duration. If a catastrophic emergency hits Delaware, DelDOT and Homeland Security will assist in the long-term recovery process. It is recommended that a full-scale emergency response exercise occur with participation from all state departments and programs.
To support climate resiliency in local communities:	
Support local governments with land use assessment tools	DelDOT will continue to work with the Office of State Planning, the municipalities, and the counties on the development of geospatial mapping and infrastructure assessment tools to help inform the municipalities and counties about the potential impacts of climate change and assist in developing strategies for enhanced resilience. Currently, comprehensive land use plans vary with respect to their treatment of resilience and do not account for greater rainfall, sea level rise, or dynamic events such as storm surge, drought, increased summer temperatures, etc. Adaptation of comprehensive plans to address these vulnerabilities will allow governments to do more to protect the long-term health and safety of residents.
To identify and support policy initiatives that reduce greenhouse gas emissions (climate mitigation):	
Evaluate low-emission vehicle deployment	DelDOT should purchase and deploy lower emission light-duty vehicles equal to 10% of its fleet by 2020. Currently, DelDOT does not purchase lower emission/no-emission vehicles due to the high cost, maintenance requirements, and state bidding rules. DelDOT will re-evaluate the purchase of these vehicles and will coordinate efforts with the Office of Management and Budget. Until government provides a catalyst for the purchase of the vehicles, the cost will not decrease for the market in general. DelDOT will perform a life cycle cost analysis to determine the financial efficacy of various types of alternative vehicles. This analysis does not preclude the adoption of the vehicles, but rather will inform what types of vehicles may be more cost-effective and evaluate the economic benefits in stimulating the market for these types of vehicles.
Evaluate alternative energy technology in facilities	DelDOT will consider the deployment of more alternative energy technologies, namely energy efficiency and wind and solar technology, in its administrative and operational buildings. Currently, only one facility has solar installed. DelDOT will evaluate these programs for all new and renovated facilities for life cycle cost/benefit.

Delaware Economic Development Office - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Advocate for adoption of state recommendations for climate change adaptation	DEDO should position itself as an advocate for the adoption of the state's recommendations for climate change adaptation to the business and tourism communities. DEDO should further educate these interest groups on the vulnerabilities the state faces from climate change to further support the adoption of the adaptation recommendations. In doing so, DEDO will foster resilience to the business and tourism sectors, thus ensuring economic prosperity and longevity.
Provide and market public transportation to attractions throughout the state	DEDO should evaluate the possibility of establishing a joint marketing effort by state agencies working in partnership to instill a deeper awareness of the public transportation services capable of transporting travelers to Delaware's attractions. This strategy has the potential to mitigate greenhouse gas emissions by reducing the number of vehicles on the road due to increased use of public transportation.
Alter the standard for weekly rentals	DEDO should focus a Delaware Tourism Office outreach effort on realtors and rental agents at the Delaware beaches to create awareness of the benefits of changing the current standard of what constitutes a “weekly rental” of beach properties. Brokers/owners would be asked to work toward a system wherein rental changeover days and times would be staggered through the week, thus reducing the simultaneous influx and outflow of vacationers on specific weekend days only. This strategy would help reduce greenhouse gas emissions from traffic congestion, while also benefitting residents, tourists, and local businesses.
Promote economic growth and development in climate-resilient locations	DEDO should target growth and expansion of clean/light industry statewide to the areas most resilient to the impacts of climate change. This strategy has the potential to spur new jobs in sustainable industries while also ensuring the longevity of these structures.
Assist in bolstering resilience in the agriculture sector	DEDO should work with the Department of Agriculture and universities to develop approaches that reduce the impacts of climate change on local farmers, crops, and production facilities and to expand the use of agricultural technology in Delaware. This strategy will help improve the resilience of one of the major sectors contributing to Delaware's economy, while also having the potential to mitigate greenhouse gases through the use of more efficient technology.
Educate and assist businesses and industry in adapting to climate change	DEDO should utilize existing business retention outreach efforts to educate existing business and industry on the risks of climate change to their Delaware location(s) and develop approaches to mitigate that risk. This strategy will help ensure the resilience of the business and industrial sectors in Delaware, both of which contribute heavily to the state's economy.
Advocate for the reuse of existing industrial brownfield sites	DEDO should advocate for the reuse of existing industrial brownfield sites and support infrastructure statewide to reduce the use of greenfield sites and the construction of new, duplicate infrastructure. This strategy would allow for future development, while maintaining greenfields throughout the state.

Delaware State Housing Authority - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Evaluate energy-efficiency standards of the Low Income Housing Tax Credit (LIHTC) program	The Delaware State Housing Authority (DSHA) should review the Low Income Housing Tax Credit program to identify areas for improvement so that current energy standards will be exceeded. As weather and climate change, buildings may not be sufficient from an energy-efficiency standpoint. Incorporating increased standards will ensure that developers design and construct energy-efficient buildings and therefore alleviate health and safety concerns from excessive heat. DSHA is the allocating and monitoring agency for the LIHTC program for Delaware. The program was developed to stimulate production and preservation of low-income housing. Each state is given the responsibility of allocating credits to qualified projects in an amount not to exceed that which is needed to obtain financial feasibility up to the maximum amount available to that state. Each allocating agency must have a qualified allocation plan as part of their LIHTC application. This allocation plan lists all of the requirements needed and categories with which DSHA prioritizes LIHTC applications for funding. DSHA will review the current required energy standards and determine areas that can be improved without adversely impacting the program's ability to provide quality affordable rental housing to low- and moderate-income households. There will likely be a need for training for developers who use the program or a resource that developers can go to for technical assistance (perhaps from DNREC) on the new energy requirements.
Explore partnering on grants that address resiliency, such as the upcoming HUD National Disaster Resilience Competition	The Delaware State Housing Authority (DSHA) should explore applying for grants that address resiliency by partnering with other state agencies, including DNREC. For example, in 2014 DHSA and DNREC are exploring the feasibility of applying for a major grant through the U.S. Department of Housing and Urban Development's (HUD) National Disaster Resilience Competition. This grant program, announced in September 2014, will make available $1 billion to the 67 communities (including Delaware) that suffered a presidentially declared major disaster from 2011 to 2013. The grant funding will be administered through a Community Development Block Grant process. DSHA should play a lead role in coordination with other state agencies, including DNREC, OSPC, and DelDOT, and with local governments. The money would fund the implementation of innovative resilience projects to better prepare communities for future storms and other extreme events.
Consider sea level rise in DSHA programs	The Delaware State Housing Authority should consider sea level rise impacts in its programs that facilitate new construction and or rehabilitation. These include the Low Income Housing Tax Credit program, the State Housing Development Fund, the HOME program, and the Community Development Block Grant program. DSHA will review these programs, in consideration of sea level rise, to determine modifications necessary to avoid, when possible, new construction in areas prone to flooding. For program changes, there will likely be a need for training for developers that use the program or a resource that developers can go to for technical assistance (perhaps from DNREC) on new building and construction requirements.
Incorporate information on sea level rise in homeownership counseling	The Delaware State Housing Authority should work with the eleven housing counseling agencies to incorporate awareness on sea level rise into their pre-purchase counseling. This can include information on how to determine whether a property is located in a flood zone or area prone to sea level rise. DSHA administers a single-contract system with all eleven housing counseling agencies in Delaware. Contract language specifies that services to clients will include counseling sessions covering specific topics, such as rebuilding credit, saving, and reducing debt. Providing meaningful outreach to homebuyers to investigate a property's potential vulnerability to sea level rise prior to purchase can help homebuyers avoid areas that would make them susceptible to expensive building damage resulting from rising sea levels or extreme storms causing floods. Many homebuyers who participate in pre-purchase counseling are first-time homebuyers or are financially constrained and would be severely burdened by additional expenses associated with flood-related building damage.
Promote sustainable building practices into the Downtown Development District (DDD) grant program	The Delaware State Housing Authority should promote sustainable building practices into the Downtown Development District grant program. DSHA should work with DNREC to incorporate incentives for developers to design and construct energy-efficient buildings that meet specified energy goals, as certified through a third party. Because DSHA does not have the capacity to ensure that participants in the program are actually meeting the identified energy goals, success will depend on collaboration with DNREC and Delaware Sustainable Energy Utility. Developers will need technical assistance.

Delaware Office of Management and Budget - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Advocate for changes to state building design practices and policies	OMB should advocate for changes to state building design practices and policies to promote environmentally friendly design considerations for state facilities to minimize environmental impact. Examples could include incorporation of higher building performance levels (such as LEED, Energy Star, etc.), utilization of renewable energy sources where practicable, utilization of high efficiency building systems that require less energy for operation, incorporation of drought-tolerant landscaping, and utilization of innovative design, such as green roofs, to keep buildings cooler. This strategy will require coordination with other state agencies that perform public works building projects.
Improve resilience of state facilities and equipment	OMB should work to improve the resilience of state facilities and equipment. Extreme weather–tolerant designs should be incorporated into state facility plans for new construction and for renovation of existing structures. OMB should also design and size replacement equipment for state facilities to accommodate additional stress caused by extreme weather events. OMB should target leased facilities housing critical state services that are resistant to extreme weather conditions.
Incorporate flooding considerations into siting of state facilities	OMB should develop comprehensive guidelines to site state facilities that account for sea level rise and flooding due to extreme rain events. OMB should review existing state facilities for potential effects of flooding.
Revise Life Cycle Costing Analysis to account for climate change impacts	OMB should review and revise Life Cycle Costing Analysis (LCCA) procedures to account for potential increased precipitation, sea level rise, and extreme temperatures. Doing so will aid in designing state facilities to economically minimize the impacts of climate change. Coordination with other sState agencies that perform public works building projects will be required.
Increase maintenance of state facilities as a result of climate impacts	OMB should evaluate maintenance schedules of buildings and grounds for potential climate change effects, building equipment specifications to ensure acceptable performance during extreme events, and roof replacement intervals to adjust for the potential for accelerated wear due to extreme weather events. OMB should also evaluate how extreme weather could impact grounds maintenance. Maintenance staff should become familiar with potential effects of extreme weather.
Investigate alternate work schedules for outdoor workers	OMB should investigate alternate work schedules as appropriate for outdoor workers. Consider where appropriate flexible work schedules or scheduling during cooler times of day.
Incorporate resilience in Government Support Services (GSS) contracting	OMB should incorporate resilience into GSS contracting by building heating/cooling and weather-resistance requirements into contract specifications as necessary and as contract specifications are developed.
Incorporate resilience into Messenger Services	OMB should incorporate resilience into Messenger Services. The agency should review current delivery vehicle inventory for sufficiency during extreme weather; review whether daily service is absolutely necessary during extreme weather, including heat waves; and maintain contingency plans for those sites located in flood zones that may be difficult to access during extreme rain events.
Offer training opportunities for employees on impacts of climate change	OMB should offer employees training on the potential impacts that climate change may have on their employment and their homes. For example, training could include the use of personal protective equipment for employees working outdoors and emergency medical training such as first aid. This response would require assistance and collaboration with other state partners, with Statewide Training and Development taking the lead.

Delaware Office of State Planning Coordination - FINAL RECOMMENDATIONS	
Recommendation Title	**Recommendation Summary**
Revise PLUS checklist for Comprehensive Plans	The Office of State Planning Coordination should revise the PLUS checklist used by local governments for preparation of their Comprehensive Plans. OSPC has prepared checklists (last revised in 2003) designed to help municipal governments meet the requirements of state laws regarding the preparation of comprehensive plans. Revise the checklists to "strongly encourage" (in light of Executive Order 41) the consideration of future climate impacts. Improving community resiliency (including assessment of infrastructure vulnerabilities, land use policies, and other adaptation strategies) is best accomplished by local governments through their Comprehensive Land Use Plans.
Examine ways to incorporate climate change and sea level rise impacts into PLUS application	The Office of State Planning Coordination should examine ways to incorporate climate change and sea level rise impacts into the PLUS application used by project applicants. PLUS is an opportunity for projects to be reviewed for a variety of considerations, and climate change/sea level rise could be one of the criteria considered.
Provide technical support to local governments for Comprehensive Plans and local ordinances	The Office of State Planning Coordination should provide technical support to local government to address climate change impacts in their Comprehensive Plans and local ordinances. Improving community resiliency is best accomplished by local governments through their Comprehensive Land Use Plans. Many local governments in Delaware do not have the resources (e.g., staff, expertise, finances, and time) to adequately address climate change, thereby improving their community's preparedness and resiliency. OSPC should facilitate meetings with local governments, in coordination with DNREC, approximately 12–18 months before they begin to update their Comprehensive Plans. The purpose of meeting with local governments early in the process would be to provide technical (and, potentially, financial) support to enhance focus on climate impacts (including the reduction of greenhouse gas emissions) and long-term sustainability (through adaptation and mitigation) in the comprehensive plan and in implementing ordinances. This recommendation may require OSPC to modify existing policy/service and to create a new financial assistance fund.
Provide technical assistance to support integration of climate impacts and to reduce greenhouse gas (GHG) emissions through adaptation and mitigation at the local level	The Office of State Planning Coordination should provide technical assistance to support integration of climate impacts and to reduce GHG emissions through adaptation and mitigation. The majority of local governments in Delaware do not have the resources (e.g., staff/finances/time) to adequately address climate change, which would improve their community's preparedness and resiliency. OSPC can provide financial assistance for the same if funds become available through DNREC or another state agency. OSPC would administer financial assistance, with administrative support from outside of OSPC.
Examine ways to incorporate climate change and sea level rise as factors in the next update to State Strategies for Policies and Spending	The Office of State Planning Coordination should examine ways to incorporate climate change and sea level rise as factors in the next update to State Strategies for Policies and Spending, which is due in 2016. During 2015, OSPC will be working with stakeholders involved with the update process. A special focus of the update process will be coordination with DNREC to effectively include the goals and objectives of EO 41.
Establish and maintain GIS layers related to climate change and sea level rise impacts in FirstMap	The Office of State Planning Coordination should continue to work in conjunction with the Department of Technology and Information to operate FirstMap, the geospatial data warehouse for the State of Delaware. All geospatial data related to climate change and sea level rise should be loaded into FirstMap for statewide access. The Delaware Coastal Program should develop a web application using FirstMap to show appropriate information for contractors, consultants, and the general public regarding climate change and sea level rise.