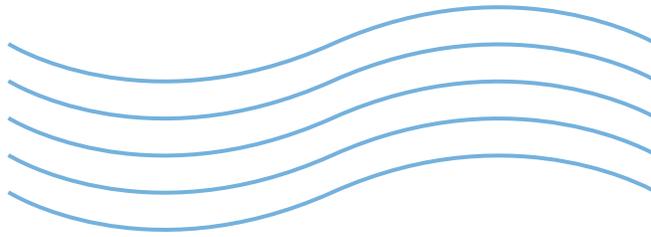


# Preparing for Tomorrow's High Tide

2014 Sea Level Rise  
Workshop Proceedings and  
Interim Implementation Plan

September 2014



## About this Document

This document contains the results of the workshop “Preparing for Tomorrow’s High Tide: Implementing the Recommendations of the Sea Level Rise Advisory Committee.” This workshop, held in March 2014, brought together stakeholders for the purpose of developing specific implementation actions for the sea level rise adaptation recommendations published by the Sea Level Rise Advisory Committee in September 2013. The document provides a general description of the workshop and provides detailed summaries of the discussions that occurred during four break-out sessions. It also includes a list of specific actions developed by workshop participants that could lead to implementation of the recommendations made by the Sea Level Rise Advisory Committee.

The information contained in this document can be used as an Interim Implementation Plan to guide efforts by stakeholders for sea level rise adaptation. Workshop results can also be used to develop partnerships, plan projects and programs, and inform grant proposals. In the coming months, additional work will be done to fill gaps and refine the information and actions outlined in this document to create a Sea Level Rise Adaptation Implementation Plan for the state.

### Other Documents in the Preparing for Tomorrow’s High Tide Series

**Progress Report of the Delaware Sea Level Rise Advisory Committee** (November, 2011)

**Sea Level Rise Vulnerability Assessment for the State of Delaware** (July, 2012)

**Mapping Appendix to the Sea Level Rise Vulnerability Assessment for the State of Delaware** (July, 2012)

**Recommendations for Adapting to Sea Level Rise in Delaware** (September, 2013)

### For More Information

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*Cover Photo: Partnership for the Delaware Estuary staff install a living shoreline in Mispillion Harbor near Slaughter Beach, Delaware.*

*Cover Photo Credit: Partnership for the Delaware Estuary*



**Preparing for Tomorrow's High Tide:**

**2014 Sea Level Rise Workshop Proceedings  
and  
Interim Implementation Plan**

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Delaware Coastal Programs

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# Table of Contents

Acronyms .....iv

Workshop Summary .....v

    Background ..... v

    The Delaware Sea Level Rise Advisory Committee..... vi

    Delaware’s Vulnerability to Sea Level Rise ..... vi

    Recommendations for Adapting to Sea Level Rise..... vi

    Implementation of the Recommendations ..... vii

    Implementation Workshop: Purpose ..... vii

    Implementation Workshop: Agenda and Process..... viii

    Implementation Workshop: Summary of Workgroup Outcomes ..... x

    Next Steps ..... xiv

Implementation Activities — Land Use & Socioeconomics Workgroup ..... 1

**Recommendation 1.1: Improve coordination of permit decisions for adaptation projects among federal, state and local officials..... 2**

**Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts ..... 4**

**Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending ..... 6**

**Recommendation 3.2: Consider incorporation of sea level rise considerations into municipal and county comprehensive development plans..... 7**

**Recommendation 4.2: Provide education and outreach for impacted communities and citizens .... 10**

**Recommendation 4.3: Improve the ability of homebuyers to investigate a property’s potential vulnerability to sea level prior to purchase ..... 14**

**Recommendation 6.1: Create a coordinated effort to provide technical assistance to local governments ..... 16**

**Recommendation 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans ..... 19**

**Recommendation 7.1: Convene an expert panel to provide an assessment and analysis of funding options for adaptation measures ..... 21**

## 2014 Workshop and Implementation Plan

---

<b>Implementation Activities — Transportation &amp; Infrastructure</b> .....	<b>23</b>
<b>Recommendation 1.3: Increase opportunities for technology transfers and regional coordination for transportation issues affected by sea level rise</b> .....	<b>24</b>
<b>Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts</b> .....	<b>26</b>
<b>Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending</b> .....	<b>28</b>
<b>Recommendation 3.6: Encourage inclusion of sea level rise in Transportation Project Design Manuals</b> .....	<b>30</b>
<b>Recommendation 3.13: Conduct a legal review for disinvestment of publicly owned infrastructure and privately owned buildings</b> .....	<b>32</b>
<b>Recommendation 3.14: Develop a statewide retreat plan and update it periodically</b> .....	<b>33</b>
<b>Recommendation 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise</b> .....	<b>35</b>
<b>Recommendation 5.14: Identify the data necessary to plan transportation investments</b> .....	<b>37</b>
<b>Recommendation 6.5: Develop a database of costs of adaptation options for use by decision-makers and the public</b> .....	<b>38</b>
<b>Implementation Activities — Water Resources Workgroup</b> .....	<b>41</b>
<b>Recommendation 1.1: Improve coordination of permit decisions for adaptation projects among federal, state, and local officials</b> .....	<b>42</b>
<b>Recommendation 1.2: Create new partnerships to increase resources for research and development of adaptation options.</b> .....	<b>44</b>
<b>Recommendation 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects.</b> .....	<b>46</b>
<b>Recommendation 2.4: Consider SLR implications in future regulatory updates for septic systems and wells</b> .....	<b>47</b>
<b>Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending</b> .....	<b>48</b>
<b>Recommendation 3.12: Designate shoreline zones for adaptation action</b> .....	<b>49</b>
<b>Recommendation 4.4: Provide targeted outreach to water and wastewater operators and water utilities</b> .....	<b>51</b>

## WORKSHOP SUMMARY

---

<b>Recommendation 5.10: Develop a model that will predict changes to salinity in surface water that may occur under differing sea level rise scenarios.....</b>	<b>54</b>
<b>Recommendation 5.11: Develop a statewide groundwater model.....</b>	<b>55</b>
<b>Recommendation 5.12: Develop and maintain a comprehensive database that contains the location and condition of all wastewater infrastructures .....</b>	<b>56</b>
<b>Recommendation 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans .....</b>	<b>58</b>
<b>Recommendation 6.4: Develop best management practice manuals for adaptation in Delaware ....</b>	<b>60</b>
<b>Implementation Activities — Wetlands, Shoreline &amp; Habitat Workgroup .....</b>	<b>61</b>
<b>Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts .....</b>	<b>62</b>
<b>Recommendation 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects .....</b>	<b>65</b>
<b>Recommendation 3.8: Develop a framework for decision-making regarding land protection and restoration strategies based on habitat vulnerability, migration potential and relative importance in the regional landscape, historical significance or other key factors .....</b>	<b>68</b>
<b>Recommendation 3.12: Designate shoreline zones for adaptation action .....</b>	<b>72</b>
<b>Recommendation 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise.....</b>	<b>75</b>
<b>Recommendation 5.13: Identify and preserve areas for potential wetland migration.....</b>	<b>77</b>
<b>5.18: Foster pilot projects that demonstrate the effectiveness of best management practices for management of agriculture lands affected by sea level rise.....</b>	<b>79</b>
<b>6.5: Develop a database of costs of adaptation options for use by decision-makers and the public..</b>	<b>81</b>
<b>Appendix A – Workshop Attendees and Breakout Groups.....</b>	<b>83</b>
<b>Appendix B - Workshop Materials .....</b>	<b>89</b>
<b>Appendix C – Recommendation Matrix .....</b>	<b>107</b>

# Acronyms

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BMP – Best Management Practices

CCP – Comprehensive Conservation Plan

DEMA – Delaware Emergency Management Agency

DHSA – Delaware State Housing Authority

DNERR – Delaware National Estuarine Research Reserve

DNREC – Delaware Department of Natural Resources and Environmental Control

EO 41 – Governor Markell’s Executive Order 41: Preparing Delaware for Emerging Climate Impacts

FEMA – Federal Emergency Management Agency

IPA – Institute for Public Administration, University of Delaware

MPO – Metropolitan Planning Organization

NALCC – North Atlantic Landscape Conservation Cooperative

NASA – National Aeronautics and Space Administration

NOAA – National Oceanographic and Atmospheric Administration

NRCS – Natural Resources Conservation Service, United State Department of Agriculture

PLUS – Preliminary Land Use Service

SAA – Statewide Activity Approval

SLR – Sea Level Rise

USACE – US Army Corps of Engineers

USDA – US Department of Agriculture

USFWS – US Fish and Wildlife Service

WILMAPCO – Wilmington Metropolitan Planning Council

# Workshop Summary

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This document contains the results of the workshop “Preparing for Tomorrow’s High Tide: Implementation the Recommendations of the Sea Level Rise Advisory Committee.” Held in March 2014, the workshop brought together stakeholders to develop specific implementation actions for each of the sea level rise adaptation recommendations published by the Sea Level Rise Advisory Committee in September 2013. This document provides background about Delaware’s sea level rise adaptation initiative, the purpose of the workshop and a summary of workshop results. It also provides detailed summaries of all discussions that occurred during break-out sessions, including specific implementation activities that can be taken for each recommendation of the Sea Level Rise Advisory Committee. This document can be used as an Interim Implementation Plan to guide efforts by stakeholders towards sea level rise adaptation. Workshop results can also be used to develop partnerships, plan projects and inform grant proposals. In the coming months, additional work will be done to fill gaps and refine the information and actions outlined in this document to create a comprehensive Sea Level Rise Adaptation Implementation Plan for the state.

## Background

Sea level rise is one of the primary effects of global climate change and one that is particularly significant for the state of Delaware. The state’s low average elevation and dependence upon coastal resources for jobs, tourism, and recreation make it particularly vulnerable to the impacts of sea level rise. These impacts include permanent flooding (or inundation) of wetlands and dry land, saltwater intrusion into fresh water supplies and rising water tables. Rising sea levels will also increase the likelihood of flooding and damage during coastal storm events. The impacts of sea level rise will be felt statewide, as no part of the state is more than ten miles from tidal water.

The state of Delaware takes the threat of sea level rise and climate change seriously and is pursuing proactive measures to reduce its vulnerability to these threats. The state is a leader in sea level rise planning; it has developed sea level rise planning scenarios, mapping tools, vulnerability assessments and recommendations for sea level rise adaptation, all while increasing awareness of the issues and building support for on-the-ground action.

## 2014 Workshop and Implementation Plan

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### The Delaware Sea Level Rise Advisory Committee

In 2010, the Secretary of the Delaware Department of Natural Resources and Environmental Control (DNREC) convened an advisory committee composed of twenty-four representatives of state and local agencies, industry, business groups, and not-for-profit agencies. This group, led by the DNREC Delaware Coastal Programs Section, was tasked with assessing the state's vulnerability to sea level rise and developing recommendations for long-term policy decision, management actions and resource investments. In 2013, the Advisory Committee completed its work, providing the Secretary with a document and list of fifty-five recommendations that sought to improve the state's capacity to adapt to sea level rise. The Advisory Committee also published a comprehensive statewide vulnerability assessment in 2012. Both products were developed with extensive public input and approved with a super-majority of committee members.

The complete list of Sea Level Rise Advisory Committee members and details of their meetings and discussions can be found online: <http://de.gov/slradvisorycommittee>.

### Delaware's Vulnerability to Sea Level Rise

In 2012, the Sea Level Rise Advisory Committee assessed the impact of sea level rise on Delaware's communities, public safety, economy, infrastructure and natural resources using future scenarios developed by a statewide technical group. They found that between eight and eleven percent of the land statewide could be permanently flooded at high tide by 2100. Within these areas lie residences, industrial areas, roadways, protected land, wetlands, and wastewater facilities. In addition to permanent flooding, saltwater intrusion into groundwater and surface water was identified as a significant issue, as were rising water tables and increased risk of damage from coastal storms. With each of these potential impacts come a number of secondary effects including loss of homes, reduced employment, releases of contaminated material from industrial sites, increased drainage problems, and corrosion of pipelines.

The Delaware Sea Level Rise Vulnerability Assessment can be downloaded online: <http://de.gov/slrva>.

### Recommendations for Adapting to Sea Level Rise

The results of this comprehensive assessment of the state's vulnerability to sea level rise underscore the importance of adapting to sea level rise. In a broad sense, sea level rise adaptation means "adjusting" to new conditions. It involves taking steps to minimize and cope with the negative effects of sea level rise and taking advantage of any positive effects. Adaptation actions can be planned and implemented at a variety of geographic levels, and by a variety of stakeholders. During the course of its work to develop adaptation recommendations, the Sea Level Rise Advisory Committee focused on actions that would build the state's capacity to respond rather than pinpointing on-the-ground actions in specific locations. After public input and debate, the Advisory Committee approved a set of fifty-five recommendations focused on improving coordination between agencies, providing regulatory flexibility, providing consistent policies for growth and

spending, increasing public awareness, improving key data sets and providing technical assistance to public and private agencies.

The Recommendations for Adapting to Sea Level Rise in Delaware can be downloaded online:

<http://de.gov/sradaptplan>.

### **Implementation of the Recommendations**

After the publication of the Recommendations for Adapting to Sea Level Rise in Delaware and the dissolution of the Advisory Committee, the DNREC Delaware Coastal Programs committed to coordinating efforts to implement the recommendations, working in collaboration with state agencies, local and county governments, non-governmental organizations, educators, businesses and citizens. Crucial to implementation of many recommendations was the signing of Governor Markell's Executive Order 41—"Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions." This executive order, signed in September 2013, fulfilled Recommendation 2.2 of the Advisory Committee and directed all state agencies to avoid building structures in flood prone areas and to include sea level considerations if avoidance is not feasible. It also directed all state agencies to prepare a list of actionable adaptation recommendations for all climate impacts (increased temperatures, increased precipitation and rising sea levels). This executive order has provided the mandate and structure to institutionalize several key sea level rise adaptation recommendations and has helped increase awareness of sea level rise vulnerabilities throughout state agencies.

The recommendations of the Sea Level Rise Advisory Committee were designed to be broad in nature so that they were not unnecessarily prescriptive. However, because specific actions were not proposed by the Advisory Committee, it is difficult to determine the activities that should be undertaken, the agencies and groups that should be involved and the timing of implementation. It is also difficult to track whether each recommendation has been implemented and overall progress. For example, Recommendation 1.1 seeks to "improve coordination of permit decisions for adaptation projects among federal, state and local officials" but the Advisory Committee did not specify which permits could benefit from improved coordination, or what that improved coordination would entail.

### **Implementation Workshop: Purpose**

The purpose of the workshop was to bring diverse stakeholders together to collaboratively develop specific activities that can be undertaken for each of the sea level rise adaptation recommendations published by the Sea Level Rise Advisory Committee in September 2013. Secondly, the workshop provided a venue to discuss work that was already underway or complete in Delaware or adjacent states; this helps ensure that efforts are not duplicated and allows staff to track and learn from ongoing efforts.

In addition, the workshop provided a timely venue to generate information for President Obama's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience. The Task Force, established

## 2014 Workshop and Implementation Plan

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in President Obama's Executive Order on Climate Preparedness, was tasked in part with providing the President with information about how the Federal government can remove barriers, create incentives and modernize Federal programs to prepare for climate change. Information from this workshop was submitted to the Task Force for consideration.

### Implementation Workshop: Agenda and Process

The Implementation Workshop was held on Wednesday, March 26, 2014 at the Delaware Technical and Community College Terry Campus in Dover, Delaware. Invitations were sent to stakeholder groups likely to be interested in participating in the event. Public participation was welcomed and the event was publicized on the state's public meeting calendar. Seventy-five people from thirty-five different organizations attended the workshop. State government representatives accounted for nearly half the participants; the remainder was composed of representatives of local governments, non-governmental organizations, industry, and real estate interests. Private citizens not affiliated with any particular interest group also participated, as did several representatives of the local media. A complete list of participants can be found in Appendix A.

The workshop began with a plenary session. All participants were brought together for opening remarks and a presentation that outlined sea level rise vulnerability in the state, potential adaptation actions, and the work of the Sea Level Rise Advisory Committee. Participants also were given their charge and instructions for the day. See Appendix B for a copy of the agenda and the plenary presentation.

After the plenary session, participants were divided into four thematic workgroups: Land Use & Socioeconomics, Transportation & Infrastructure, Water Resources, and Wetlands, Shorelines & Habitat. Each workgroup was provided with a list of approximately 20 recommendations that were most pertinent to their subject matter expertise; many recommendations were provided to several workgroups because of their interdisciplinary nature.

Several recommendations were pre-selected by staff for discussion by participants during the morning session. Participants then prioritized the remaining recommendations for discussions during the afternoon using the sticker dot technique to vote. Workgroups were able to discuss between nine and twelve recommendations during the course of the day. A total of twenty-nine of the fifty-five recommendations were discussed by the workgroups. See Appendix C for a matrix of the recommendations provided to and discussed by each workgroup.

Eleven recommendations were not provided to any workgroup for discussion. This decision was made in order to allow the workgroups to focus on the recommendations that required the most discussion or coordination. Recommendations not provided to workgroups included those that had already been completed or were underway, were specific in nature, or require further discussion by technical experts. In the coming months, Delaware Coastal Programs staff will reach out to technical experts to discuss and document

## WORKSHOP SUMMARY

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the additional activities necessary to implement the research and monitoring recommendations already underway.

The recommendations not provided to any workgroup and the rationale for each are as follows:

### Recommendation is complete

- 2.2: Encourage the governor to sign an executive order that would direct state agencies to plan for sea level rise

### Recommendation is underway; requires further discussion by technical experts

- 5.1: Improve monitoring of current sea level conditions and improve predictions for timing of inundation
- 5.2: Install additional water level and salinity observational stations in Delaware tidal waters
- 5.3: Improve the accuracy of Delaware's elevation benchmark network
- 5.4: Continue and expand studies regarding sediment accretion rates and susceptibility of wetlands to sea level rise
- 5.6: Develop sea level models that incorporate storm surge impacts
- 5.17: Encourage the development of a research and policy center at a university or college campus that would focus on applied research for sea level rise and adaptation

### Recommendation is specific and can be implemented without outlining additional activities

- 1.5: Provide sea level rise information to the Delaware Agricultural Land Preservation Program for consideration
- 1.6: Provide technical assistance to Delaware's Open Space Council for incorporating sea level rise into its criteria for acquisition of natural areas
- 1.7: Conduct a comprehensive inventory of key funding, coordination, regulations and policies and analyze them for barriers and opportunities for sea level rise adaptation
- 5.9: Model potential stormwater inundation problems in highly vulnerable areas

Each workgroup was provided a team of staff to lead and capture the discussions: a lead facilitator, a co-facilitator and a note-taker. The lead and co-facilitators ensured that conversations stayed on topic and that everyone participated in the conversations. Facilitators wrote key information on easels, while the note-takers captured the conversations in writing.

For each recommendation selected for discussion, workgroup members were asked the following questions:

- Are there any planned or completed activities related to the recommendation?
- What are specific actions that could be taken to implement the recommendation?

## 2014 Workshop and Implementation Plan

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- Which actions are pre-requisites?
- What agencies or groups should be involved in implementation?
- What are the approximate costs for each action?
- Are any Federal programs or policies a barrier to action?

Each workgroup was working under considerable time constraints, with less than thirty minutes allotted for discussion of each recommendation. Discussions differed between each recommendation and between each group depending upon participant interest and available information. Even though a small amount of time was allocated for each recommendation, significant ideas and information were generated as a result of the diversity, knowledge, and cooperation of the workgroup participants.

Comprehensive results of each workgroup can be found in the following sections of this document. Results have not been synthesized between workgroups at this time. This synthesis will occur in subsequent phases of implementation. A brief summary of each workgroup's conversations is below.

### **Implementation Workshop: Summary of Workgroup Outcomes**

Workshop participants were broken into four thematic workgroups to provide input on steps that could or should be taken to implement each recommendation of the Sea Level Rise Advisory Committee. The outcome of each workgroup is summarized briefly below. Full descriptions of the outcome of each workgroup can be found in the following chapters.

#### **Land Use & Socioeconomics Workgroup**

The Land Use & Socioeconomics Workgroup held in-depth conversations about nine of the twenty recommendations provided to them. Recommendations that were discussed by this workgroup included:

- 1.1: Improve coordination of permit decisions for adaptation projects among federal, state and local officials
- 1.4: Incorporate sea level rise into public and private sector regional planning efforts
- 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending
- 3.2: Consider incorporation of sea level rise considerations into municipal and county comprehensive development plans
- 4.2: Provide education and outreach for impacted communities and citizens
- 4.3: Improve the ability of homebuyers to investigate a property's potential vulnerability to sea level rise prior to purchase
- 6.1: Create a coordinated effort to provide technical assistance to local governments
- 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans

- 7.1: Convene an expert panel to provide an assessment and analysis of funding options for adaptation measures

The discussions of this workgroup highlighted many initiatives that are already underway or completed including Governor Markell's Executive Order 41 and incorporation of sea level rise considerations into plans like the Strategies for State Policy and Spending and the Chesapeake Watershed Implementation Plan. Extensive public outreach and technical assistance to municipal governments is also underway.

The workgroup members proposed thirty-five specific activities that would lead to implementation of the nine recommendations they were able to address during the day. Methods to provide outreach and technical assistance to municipal governments, home-buyers, and citizens generated the most discussion and concrete ideas for implementation. The workgroup also highlighted the need for cost-benefit analysis for adaptation strategies and a feasibility study for changes to funding mechanisms.

As with many discussions about sea level rise, the protection of private property rights was a recurring theme throughout the conversations, as was how to generate the political will to make difficult decisions.

### **Transportation & Infrastructure Workgroup**

The Transportation & Infrastructure Workgroup held in-depth conversations about nine of the twenty recommendations provided to them. Recommendations that were discussed by this workgroup included:

- 1.3: Increase opportunities for technology transfers and regional coordination for transportation issues affected by sea level rise
- 1.4: Incorporate sea level rise into public and private sector regional planning efforts
- 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending
- 3.6: Encourage inclusion of sea level rise in transportation project design manuals
- 3.13: Conduct a legal review for disinvestment of publicly owned infrastructure and privately owned buildings
- 3.14: Develop a statewide retreat plan and update it periodically
- 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise
- 5.14: Identify the data necessary to plan transportation investments
- 6.5: Develop a database of costs of adaptation options for use by decision-makers and the public

The Transportation & Infrastructure Workgroup highlighted many projects and initiatives that are complete or underway and that advance implementation of the sea level rise recommendations. The projects underway demonstrate the real concern that agencies have about managing and maintaining infrastructure in the face of sea level rise threats. Among them, DelDOT has completed an analysis of legal issues surrounding disinvestment of infrastructure that will help inform their future transportation plans; they have also re-rated bridges and incorporated sea level rise into these ratings. In addition, WILMAPCO completed a comprehensive vulnerability assessment of transportation infrastructure in New Castle and Cecil Counties. It

## 2014 Workshop and Implementation Plan

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is clear from the discussions that sea level rise is being taken seriously by engineers and planners in transportation and infrastructure sectors and conversations are occurring that will lead to more resilient infrastructure projects in the future.

Twenty-six specific implementation activities were identified as a result of these conversations. The need for improved information about costs of adaptation options and long-term benefits was highlighted, as was the need for pilot projects to demonstrate successful strategies to avoid flooding. The workgroup recommended improved mapping products and a comprehensive roadway analysis that would identify secondary impacts of flooded roadways. Workgroup members were also interested in guidance that would help select construction materials least susceptible to flooding. As with the three other workgroups, participants also highlighted the need for activities to educate the public and create partnerships with private infrastructure providers.

The need to align federal procedures and spending policies with state governments was a recurring theme during the workgroup session, as was the need to share data and information between levels of government. The need to recognize that there will be trade-offs between more resilient infrastructure and habitat and wetlands was also highlighted, though no specific activities were proposed.

### Water Resources Workgroup

The Water Resources Workgroup held facilitated discussions about twelve of the nineteen recommendations provided to them. The following recommendations were discussed:

- 1.1: Improve coordination of permit decisions for adaptation projects among federal, state and local officials.
- 1.2: Create new partnerships to increase resources for research and development of adaptation options
- 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects
- 2.4: Consider sea level rise implications in future regulatory updates for septic systems and wells
- 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending
- 3.12: Designate shoreline zones for adaptation action
- 4.4: Provide targeted outreach to water and wastewater operators and water utilities
- 5.10: Develop a model that will predict changes to salinity in surface water that may occur under differing sea level rise scenarios
- 5.11: Develop a statewide groundwater model
- 5.12: Develop and maintain a comprehensive database that contains the location and condition of all wastewater infrastructures
- 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans

- 6.4: Develop best management practice manuals for adaptation in Delaware

The Water Resources Workgroup highlighted several initiatives that are already underway that will increase our understanding of potential impacts of sea level rise to the state's water infrastructure. The US Geological Survey and University of Delaware are studying the potential impact of saltwater intrusion into groundwater supplies at a local and regional level. Local governments are also taking action: Bethany Beach received grant funding to monitor its drinking water wells for saltwater intrusion and the City of Wilmington helped to pilot an EPA software tool that helps water utilities understand climate change risks to their facilities.

Although some work is already underway, the workgroup identified many additional steps that should be taken to implement the recommendations of the Sea Level Rise Advisory Committee. Thirty-two specific implementation activities were identified during the day's discussions. Included in this list were steps that could be taken to provide targeted and general outreach and technical assistance to water utilities and water resource professionals, including workshops, trainings, and newsletters. Also suggested was the development of best management practice manuals for water utilities. Specific actions to create disincentives for development in vulnerable locations and to update key regulations were also identified.

### **Wetlands, Shorelines & Habitat Workgroup**

The Wetlands, Shorelines & Habitat Workgroup held in-depth conversations about nine of the twenty recommendations provided to them for discussion. The following recommendations were discussed:

- 1.4: Incorporate sea level rise into public and private sector regional planning efforts
- 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects
- 3.8: Develop a framework for decision-making regarding land protection and restoration strategies based on habitat vulnerability, migration potential, relative importance in the regional landscape, historical significance or other key factors
- 3.9: Develop a comprehensive wetlands restoration, protection and retreat strategy in response to sea level rise
- 3.12: Designate shoreline zones for adaptation action
- 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise
- 5.13: Identify and preserve areas for potential wetland migration
- 5.18: Foster pilot projects that demonstrate the effectiveness of best management practices for management of agricultural lands affected by sea level rise
- 6.5: Develop a database of costs of adaptation options for use by decision-makers and the public

This workgroup highlighted a number of research projects underway related to the recommendations. Among them, research on wetland change and migration, research to determine potential use of seashore mallow as a crop, economic research on the benefits of beach replenishment and economic valuation of wetlands. This workgroup also discussed restoration and living shoreline projects that are underway that can

## 2014 Workshop and Implementation Plan

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be used to demonstrate the effectiveness of emerging technologies and best practices. Many different initiatives to provide outreach to the public were also discussed, including a new video about wetlands and sea level rise and activities held during Sea Level Rise Awareness Week. Participants were also able to point to several local, state, and regional plans for restoration and conservation that now include sea level rise considerations. It was clear from the discussions that significant implementation is already occurring.

The Wetlands, Shorelines & Habitat workgroup identified an additional twenty-two activities that could be initiated to implement the recommendations of the Sea Level Rise Advisory Committee. As was the case with the three other workgroups, participants felt that additional education and outreach to targeted groups and the public would be a useful endeavor, but they also called for specific technical assistance, guidance and decision-making tools. The workgroup identified the need to identify habitat transition zones and wetland migration areas to inform land preservation efforts and wished to have a post-storm strategy for land conservation and management. Additional on-the-ground projects that can be used to demonstrate best practices were also highlighted as a need. The group also wished to overcome staffing limitations by hiring a person to act as a coordinator for natural resource issues involving sea level rise.

### Next Steps

This workshop was the first step to developing an Implementation Plan for the recommendations of the Sea Level Rise Advisory Committee. The information developed during the workshop and outlined in this document can be used as an Interim Implementation Plan to guide efforts by stakeholder towards sea level rise adaptation. Workshop results can also be used to develop partnerships, plan projects and programs, and inform grant proposals. In the coming months, additional coordination will be done to fill gaps and refine the information and actions outlined in this document to create a Sea Level Rise Adaptation Implementation Plan for the state.

# Implementation Activities — Land Use & Socioeconomics Workgroup

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*The following section documents the discussions of the Land Use & Socioeconomics Workgroup held during the Delaware Sea Level Rise Adaptation Plan Implementation Workshop. The workgroup was provided with a list of twenty land-use related recommendations from “Preparing for Tomorrow’s High Tide: Recommendations for Adapting to Sea Level Rise in Delaware.” The workgroup prioritized recommendations for discussion during the day and was able to discuss nine recommendations in detail. For each recommendation, specific “implementation activities” proposed by workgroup members are listed. These activities are intended to provide specific and discrete steps that can be taken to achieve the intent of each recommendation. For each activity, costs and necessary partners are listed if discussed by the group. In many cases, time did not allow for in-depth discussion of costs and partners. Recommendations not outlined below were not discussed by this workgroup, but may have been discussed by one of the other three workgroups at the workshop (see Appendix C).*

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.1: Improve coordination of permit decisions for adaptation projects among federal, state and local officials**

*Permitting processes that involve several different agencies, particularly those for transportation, sewer infrastructure, shoreline protection, and commercial or residential development, can be delayed when agencies lack a common set of goals or have conflicting regulatory requirements. As sea level rise adaptation becomes incorporated into project proposals, conflicting regulations may delay permitting processes. Early coordination of projects between state, federal and local officials could help minimize regulatory conflicts and delays, as would incorporation of sea level rise consideration into regulatory decisions. These actions may lead to more rapid issuance of permits for adaptation projects, more predictability for applicants, and an increased predictability and empowerment for local governments when planning and designing their own adaptation projects.*

### **Implementation Progress to Date**

Executive Order 41 requires state agencies to identify specific adaptation actions they can take within their agencies. It is anticipated that each state agency will consider regulatory procedures during the development of these actions.

### **Potential Implementation Activities**

#### **Activity 1: Identify specific regulatory barriers for sea level rise adaptation projects**

The workgroup discussed several problematic regulations and permits including the need for consistency in local floodplain regulations. Also discussed was a specific case where permitting processes for an improved dike system were delayed in part due to historic preservation requirements. Due to the short amount of time available, the group was not able to specify other potential problematic regulatory and permitting procedures. A comprehensive review of key regulations and procedures is necessary to understand where barriers and conflicts exist, particularly for emergency repairs and critical infrastructure. Once barriers and conflicts have been identified, recommendations for regulatory changes can be proposed.

**Cost:** No costs were discussed

**Partners:** DNREC, DEMA, DelDOT, FEMA, USACE, NOAA, Delaware Division of Historic and Cultural Affairs and Local Governments

#### **Activity 2: Create an adaptation clearinghouse to help local communities**

An adaptation clearinghouse could provide the public information to make educated decisions about adapting to sea level rise in their communities. The more information local communities have, the better

decisions the community can make. This clearinghouse should have a link to a technical team that can answer any questions local communities have that are not being answered by the clearinghouse.

**Cost:** No costs were discussed for this activity

**Partners:** USACE, DNREC, Delaware Division of Historical and Cultural Affairs, NOAA, FEMA, DEMA and Delaware Sea Grant

### **Activity 3: Make elevation surveys available to the public**

Providing the local communities with elevation surveys done by DelDOT, DNREC and private companies will limit the cost to local communities for adaptation project design. It will also minimize the workload some of these communities will have when addressing sea level rise. Community participation in sea level rise awareness and preparedness will increase if costs can be minimized.

**Cost:** No costs were discussed for this activity

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, DelDOT, Realtors, Private surveyors

### **Additional Information**

During the discussion, the workgroup also brought up two related points. One was that FEMA does not allow use of its flood mitigation grant programs on properties that may be contaminated. This limits the amount of property that FEMA can provide financial and technical assistance with. Another topic brought up multiple times during the discussion was balancing the ability of a property owner to use their property with regulations, public safety and future financial liabilities. No specific actions were identified for either of these topics.

## 2014 Workshop and Implementation Plan

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### Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts

*Much of Delaware's infrastructure is part of regional networks, including electrical generation, roads, rail, and landfills. Delaware's wetlands, habitats of conservation concern, beaches and nature preserves are also part of a regional system of wildlife and fish habitats. Incorporation of a common set of sea level rise information into regional planning processes for these resources will help ensure that informed decisions about adaptation are made and that the entire regional system is sustainable. Regional planning processes that should be targeted include: Wilmington Area Planning Council and Dover/Kent Metropolitan Planning Council long range plans for transportation, Amtrak long range plans, business group and industry contingency plans, and regional habitat plans.*

#### Implementation Progress to Date

Numerous regional planning efforts have already incorporated sea level rise as a planning consideration. As an example, the WILMAPCO conducted a multi-state sea level rise vulnerability assessment for transportation. The Mid-Atlantic Regional Council on the Ocean is a regional planning body for oceans that incorporates preparing for climate change as one of its key objectives. The Delaware Chesapeake Watershed Implementation plan incorporates sea level rise considerations. The Strategies for State Policy and Spending is also another regional planning effort in the State of Delaware.

#### Potential Implementation Activities

##### Activity 1: Develop a regional inventory of sea level rise activities

A regional inventory could provide new ideas or improve existing ideas that Delaware has for adapting to sea level rise. The Mid-Atlantic Regional Council on the Ocean completed a regional inventory in 2010 and could be encouraged to update it, benefiting Delaware and all of the Mid-Atlantic states (the inventory is available online):

<http://midatlanticocean.org/wp-content/uploads/2014/03/MARCO-Climate-Change-and-Sea-Level-Rise-Information-Exchange.pdf>

**Cost:** Costs were not discussed

**Partners:** Mid-Atlantic Regional Council on the Ocean, United State Fish and Wildlife Service, DNREC, NOAA, NASA

##### Activity 2: Host an annual regional meeting on sea level rise

A regional meeting about sea level rise could provide a venue for states to share their experiences and ideas about vulnerability and adaptation and to improve networks of regional experts. It could also provide an opportunity for implementers to share what has worked and what has not worked.

**Cost:** Costs were not discussed

**Partners:** Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, Mid-Atlantic Council on the Ocean, other state agencies

### **Activity 3: Include sea level rise considerations in municipal multi-jurisdictional master plans**

The Delaware Office of State Planning Coordination is encouraging towns and counties to begin Master Planning processes. Master Plans are more specific than the required Comprehensive Development Plans and can be coordinated between towns and counties. Bridgeville, Georgetown and Southern New Castle County have initiated master planning projects. These master plans could be a venue for identifying on-the-ground sea level rise adaptation strategies, particularly for flooding issues that cross municipal boundaries.

**Cost:** Costs were not discussed

**Partners:** Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, Utility Companies, Office of State Planning Coordination

### **Additional Information**

The workgroup also discussed the meaning of “regional.” Regional planning can apply to counties and towns, or to multiple state areas.

## 2014 Workshop and Implementation Plan

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### **Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending**

*Land-use decisions in Delaware are made at the local level, but the bulk of infrastructure and service that support these decisions are funded by the state. The Strategies for State Policies and Spending set forth clear advisory policies (including maps) about where the state will allocate financial resources for conservation, infrastructure improvements, and social services and are updated every five years. Incorporation of sea level rise into the suite of issues considered when the strategies are updated would provide an opportunity for coordination between agencies and local governments regarding sea level rise and may help further ensure wise use of state funding.*

#### **Implementation Progress to Date**

This recommendation is already underway and will be completed by the Office of State Planning Coordination. The State Strategy maps will incorporate mapped sea level rise areas and will be finalized in 2016.

### **Recommendation 3.2: Consider incorporation of sea level rise considerations into municipal and county comprehensive development plans**

*State law requires that every municipality in Delaware develop, and periodically update, a comprehensive development plan. These plans contain a municipal development strategy that includes expansion of boundaries, future plans for residential and commercial growth, and future infrastructure investments, among others. They also contain environmental and demographic information. Consideration of sea level rise impacts and potential adaptation actions would ensure that all municipalities in the state are proactively taking into account potential sea level rise impacts in their future plans for growth and development and may allow for increased communication about sea level rise between municipal, county and state governments.*

#### **Implementation Progress to Date**

Workgroup members reported that there have been no formal steps taken to implement this recommendation at a statewide scale. However as a result of an increased awareness of potential sea level rise impacts, the issue is being discussed more routinely during planning processes. The Town of Frederica has recently received grant funding through the Coastal Management Grant Program to assess their vulnerability to sea level rise and to incorporate this information into their Comprehensive Plan. Delaware Sea Grant has been working with communities to increase their resiliency and preparedness to sea level rise as well.

#### **Potential Implementation Activities**

##### **Activity 1: Update the PLUS Checklist**

Workshop participants suggested adding sea level rise as a component of the checklist that is filled out by developers for the state mandated Preliminary Land Use Service (PLUS) application. Adding a field for sea level rise would ensure that local governments were taking into account information about sea level rise prior to making land use decisions.

**Cost:** No costs for this activity were discussed

**Partners:** Office of State Planning Coordination, DNREC, DNREC Delaware Coastal Programs, Local Governments, Delaware Sea Grant, DEMA, Center of the Inland Bays, Partnership for the Delaware Estuary, FEMA

##### **Activity 2: Create model language for sea level rise in comprehensive development plans**

Developing model language about sea level rise for comprehensive development plans would help local governments incorporate these concerns into their plans and would help keep language pertaining to sea level rise consistent between all plans.

## 2014 Workshop and Implementation Plan

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**Cost:** No costs for this activity were discussed

**Partners:** Office of State Planning Coordination, DNREC, DNREC Delaware Coastal Programs, Local Governments, Delaware Sea Grant, DEMA, FEMA, Center of the Inland Bays, Partnership for the Delaware Estuary

### **Activity 3: Provide sea level rise educational opportunities during the comprehensive development plan process**

Similar to above, language and content should be expanded to demonstrate the tangible benefits of planning for sea level rise.

**Cost:** No costs for this activity were discussed

**Partners:** Office of State Planning Coordination, DNREC, DNREC Delaware Coastal Programs, Local Governments, Delaware Sea Grant, DEMA, FEMA, Center of the Inland Bays, Partnership for the Delaware Estuary

### **Activity 4: Include incentives for inclusion of sea level rise into comprehensive development plans**

Providing financial or other incentives to county and municipal governments could provide the impetus required for voluntary incorporation of sea level rise considerations into comprehensive development plans. Incentives could be grants or funding to help develop the comprehensive plan or it could be criteria to qualify for other programs or funding. Note, the DNREC Delaware Coastal Programs offers an annual grant program for this purpose; the intent of this activity would be to expand upon those efforts.

**Cost:** No costs for this activity were discussed

**Partners:** Office of State Planning Coordination, DNREC, DNREC Delaware Coastal Programs, Local Governments, Delaware Sea Grant, DEMA, FEMA, Center of the Inland Bays, Partnership for the Delaware Estuary

### **Activity 5: Develop specific community sea level rise adaptation plans**

Comprehensive development plans must be updated by municipalities every ten years. There was a feeling among workshop participants that updating the plans more frequently (for example, every 5 years) would provide the community with an opportunity to utilize up to date and reliable information for adaptation decisions. Absent that, communities should be encouraged to develop specific sea level rise adaptation plans which can be updated as new data becomes available. Funding and technical assistance should be provided for this purpose.

**Cost:** No costs for this activity were discussed

**Partners:** Office of State Planning Coordination, DNREC, DNREC Delaware Coastal Programs, Local Governments, Delaware Sea Grant, DEMA, FEMA, Center of the Inland Bays, Partnership for the Delaware Estuary

## 2014 Workshop and Implementation Plan

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### **Recommendation 4.2: Provide education and outreach for impacted communities and citizens**

*Communities that may be the most impacted by sea level rise should be provided with up-to-date information on sea level rise scenarios and be informed of adaptation measures that can reduce the impacts on their homes and communities. Residents of these areas should be made aware of available information about long-term and short-term adaptation measures, benefits and risks of various adaptation measures, combinations of risk factors (e.g., drainage and stormwater, coastal storms and sea level rise), and changes occurring in the insurance industry that may impact insurance availability and cost.*

#### **Implementation Progress to Date**

Workshop participants identified several activities that have already been undertaken to implement this recommendation.

The Delaware Sea Grant, DEMA and DNREC worked together to publish the “Homeowners’ Handbook to Prepare for Natural Hazards.” This guidebook outlines steps homeowners can take to prepare for coastal flooding and other natural disasters. It includes information about sea level rise.

The Institute for Public Administration, DNREC and Sea Grant sponsored training for municipal officials in June 2014 that focused on flood preparedness and the role of sea level rise in increasing future flood risk. This training program is anticipated to become an annual training course as part of the Local Government Leadership Training Series.

A working group of environmental advocacy organizations established the first “Sea Level Rise Awareness Week” in Delaware in fall of 2013 and repeated the effort in 2014. As part of this collaborative effort in 2013 and 2014, over 20 special events were held. Michael Oates produced a sea level rise video, “Rising Tides,” that highlights issues in Delaware. That video is available online for all to view at:  
<https://www.youtube.com/watch?v=YycRoiSRR-M>

#### **Potential Implementation Activities**

##### **Activity 1: Provide an annual mailing to residents**

An annual mailing could be sent out by local governments to residents who could potentially be affected by sea level rise and flooding. This mailing could improve the understanding of these citizens about their existing and future flood risk, how to adapt their own property and what to do in an emergency. Educational mailings can give participating governments points through the FEMA Community Ratings Service.

**Cost:** Costs for this activity were not discussed.

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA

### **Activity 2: Create a sea level rise outreach group to coordinate information and workshops**

The coordination of information and workshops will boost local communities' knowledge of sea level rise. The group could better assist communities with specific concerns.

**Cost:** Costs for this activity were not discussed

**Partners:** Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA, Partnership for the Delaware Estuary and Center for the Inland Bays

### **Activity 3: Create a speakers bureau for sea level rise and flood issues**

The creation of a group of individuals that are knowledgeable and capable of discussing sea level rise will provide increased opportunities for citizen awareness of sea level rise. Currently, there are only a few people who routinely provide presentations and talks about this issue, and demand for talks about the subject is outstripping supply.

**Cost:** No costs for this activity were discussed

**Partners:** Sea Grant, University of Delaware, DNREC, DEMA, DelDOT, FEMA, Partnership for the Delaware Estuary and Center for the Inland Bays.

### **Activity 4: Create a sea level rise video presentation and/or webinar**

The creation of a video or webinar would allow seasonal residents or residents who could not attend presentations to receive the information. It also would allow residents who partake in the presentations to refresh their knowledge of the issues. A video or webinar could also free up time for the individual presenters to tackle other obstacles of sea level rise.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA

### **Activity 5: Create public service announcements to go out during hurricane season**

A public service announcement about sea level rise and coastal hazards could be played during hurricane season to remind residents of the long term consequences of flooding, flood preparation and evacuation routes. The public service announcement could be shown on the NOAA National Weather Service website, the Weather Channel, local channels, and local community radio and TV channels.

**Cost:** No costs for this activity were discussed

## 2014 Workshop and Implementation Plan

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**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA, NOAA, National Weather Service, media outlets

### **Activity 6: Create and distribute a survey to local communities and resident asking them “What information they want to know about sea level rise?”**

A survey or needs assessment that would ask local residents what they would like to know about sea level rise would help technical experts and educators design outreach products, messages and trainings that best match citizen and local official needs.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA

### **Activity 7: Work with state legislators to host citizen workshops in their districts**

These workshops would center on flood insurance, sea level rise, and hurricane preparedness. A recent workshop sponsored by a legislator was very successful and it provided the community with a lot of one on one time with the state experts on these subjects. This also shows the community that the local politicians are worried about these problems.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA, Local Politicians

### **Activity 8: Create a centralized web resource for coastal hazard and sea level rise information; link it to county and municipal websites**

There should be a centralized Delaware specific website for coastal hazard and sea level rise information. It could be managed at one of the colleges or universities. The site should be linked from county and municipal websites so that the information is more accessible and available to all citizens. Communities should also be provided with links to interactive mapping sites.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Local Governments, DelDOT, FEMA, Local Politicians.

### **Activity 9: Provide information in additional languages**

There are currently no outreach materials available about sea level rise in Spanish or other languages. All outreach and education efforts should consider community need for information in languages other than English and accommodate these needs.

**Cost:** No costs were discussed for this activity

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA Realtors, DelDOT, Delaware Housing Authority

### **Activity 10: Incorporate sea level rise information into the Delaware Helpline (\*211)**

The Delaware Helpline, administered by Delaware Health and Social Services, provides Delawareans with a one-stop-shop to obtain health care services, housing services and consumer services. Providing flooding, evacuation, flood insurance and sea level rise information to the Delaware Helpline would expand opportunities for citizens to receive information on these topics.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Health and Social Services, Delaware Sea Grant, University of Delaware, DNREC, DEMA, Realtors, DelDOT, Delaware State Housing Authority

### **Additional Information**

The group emphasized that information and messages are more effective when they come from state and local residents instead of federal government employees. All partners should work together to come up with a unified theme and/or message that can be used as part of a public service campaign.

## 2014 Workshop and Implementation Plan

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### **Recommendation 4.3: Improve the ability of homebuyers to investigate a property's potential vulnerability to sea level prior to purchase**

*Homebuyers' access to information about future sea levels should be improved through development of a comprehensive website that illustrates current flooding and future sea level rise inundation risks. In addition, prospective homeowner understanding of flood risks should be improved through increased interactions with local municipal planners. For example, the city of Newark has a successful program where prospective homeowners meet with land use planners prior to their purchase to review the property and surrounding land uses. A similar model could be employed in other municipalities to include sea level rise information.*

#### **Implementation Progress to Date**

The Sea Level Rise inundation map viewer created by the Delaware Coastal Programs (<http://de.gov/slrmap>) is a tool that is currently being used by homeowners and projected homeowners to assess their risks. This tool is anticipated to be updated by the Department of Natural Resources and Environmental Control by the fall of 2014.

#### **Potential Implementation Activities**

##### **Activity 1: Create a brochure to better inform home buyers**

Delaware Sea Grant currently has a Homebuyer's Brochure but it is still in draft format and has not been released to the public. This document would need to be updated but could better inform home buyers if it explained the risks, flood insurance, and the state's current actions and stance on sea level rise.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Realtors.

##### **Activity 2: Provide outreach and education to realtors**

Provide targeted outreach to realtors regarding flooding, sea level rise and insurance issues so that they can better answer questions about these subjects for their clients. This can be through presentations, training courses, brochures or websites.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Sea Grant College Program, DNREC, DEMA, Delaware Association of Realtors

### **Activity 3: Incorporate sea level rise information into Delaware State Housing Authority Housing Counseling Programs**

The Delaware State Housing Authority and their partners offer housing education classes for potential homebuyers. Flooding, flood insurance and sea level rise could become a part of their curriculum. They could also provide sea level rise specific classes for homebuyers, homeowners, and realtors. The more information that is provided to new homebuyers the better informed and prepared they will be for any sea level rise based problems. The Homebuyers Fair that is held every year would also be a great event for this information to be shared and received by a large audience in a minimal amount of time and effort.

**Cost:** No costs were discussed for this activity

**Partners:** Delaware Sea Grant, University of Delaware, DNREC, DEMA, Realtors, DelDOT, Delaware State Housing Authority

### **Additional Information**

The Sea Level Rise Advisory Committee did not recommend changing Delaware's real estate disclosure form and instead chose to focus on educating homebuyers about flooding and sea level risk. Although changes to the disclosure form are not proposed, this workgroup did spend considerable time discussing the benefits and shortcomings of the real estate disclosure process. There is general agreement that the disclosure form, which is filled out by the seller, has many inherent issues. The Flooding disclosure as written is ambiguous, asking "Is this property in a floodplain or wetland?" and allowing an answer of yes, no or maybe. In addition, the form is filled out by a home seller, who may or may not know or research the floodplain status of their home and can easily check "don't know." Lastly, the form is not provided early in the process and many home buyers do not take the time to read or understand its contents.

Although the Sea Level Rise Advisory Committee did not recommend changes to this process, several in this workgroup wished to see the real estate disclosure process changed to mimic the radon and lead paint disclosures, which are handouts the buyer must read and sign. However, there is concern that should this move forward, the liability would fall to the realtors. Because there was debate about this idea, it is not listed above as an "activity." There was general agreement that the earlier a home buyer receives the information the better.

## 2014 Workshop and Implementation Plan

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### **Recommendation 6.1: Create a coordinated effort to provide technical assistance to local governments**

*Municipal and county governments may not currently have the staff resources, technical capability or funding to plan for and adapt to sea level rise. There is no one coordinated entity that is providing coastal hazard and sea level rise assistance to municipal governments. The DNREC Delaware Coastal Programs provides technical assistance and grant funding annually. The University of Delaware Sea Grant College Program provides technical assistance through its Sustainable Communities Program. The Office of State Planning and Coordination provides technical assistance to communities conducting comprehensive development plan revisions, as does the University of Delaware's Institute for Public Administration. The DNREC Shoreline and Waterway Management Program provides assistance to communities to develop floodplain regulations and receive discounted flood insurance rates through the Community Ratings System. A coordinated effort by these (and other) entities could result in consistency among local jurisdictions and ensure that all municipal governments wishing to plan for coastal hazards and sea level rise have an opportunity to obtain the technical assistance they need. It could also result in coordinated grant funding opportunities for municipalities.*

#### **Implementation Progress to Date**

The workshop participants identified several activities that are currently being undertaken that help to implement this recommendation. These include executive orders, training opportunities, funding and planning assistance.

Executive Order 41, signed by Governor Markell in September 2013, directs state agencies to prepare for sea level rise and to develop new ways to provide technical assistance to municipalities. This brings sea level rise to the forefront of state government activities and provides state agencies with the necessary authority to incorporate sea level rise into their technical assistance to local governments.

The DNREC Delaware Coastal Programs, DNREC Shoreline and Waterway Management Section and the University of Delaware Sea Grant Program are coordinating with the University of Delaware's Institute for Public Administration (IPA) to develop a coastal resiliency training module as part of IPA's Academy for Excellence in Local Government Leadership. This training module will highlight sea level rise issues and is planned to be offered on an annual basis to Delaware's municipal officials.

Funding for sea level rise planning is currently being offered by the DNREC Delaware Coastal Programs grant program, which provides local communities with funding and technical assistance to perform sea level rise based projects.

Planning assistance is currently provided by the DNREC Community Assistance program. This program inspects the implementation of each community's floodplain program to make sure they are in compliance

with floodplain standards and provides technical assistance to communities to adopt higher standards. Direct planning assistance is also exemplified by Delaware Sea Grant projects with the City of Lewes and Delaware City. These projects help these communities identify their vulnerabilities and implement future flood risk reduction strategies. The Town of South Bethany has also formed a Storm Surge and Sea Level Rise Subcommittee which has created recommendations for improvements to town building codes to allow homes to be raised to avoid flood impacts. This group has been receiving technical assistance from DNREC and Delaware Sea Grant.

### Potential Implementation Activities

#### **Activity 1: Improve access to state agency data for use by local governments**

Workshop participants identified issues obtaining information and data that would allow them to easily assess their vulnerability and plan resiliency projects. Road, culvert and outfall elevations held by DelDOT were specifically cited, but communities also have difficulty accessing basic geographic data, including sea level and floodplain data. Community participants emphasized that they are paying large amounts of money to have studies done to collect information that may have already been collected by a state agency, but cannot be found or shared.

**Cost:** No costs for this activity were discussed.

**Partners:** DelDOT, DNREC, counties and municipalities, Delaware State Housing Authority

#### **Activity 2: Create a team in each county to help develop projects for hazard mitigation and sea level rise**

Participants wanted to create a team of knowledgeable professionals that could provide assistance in developing projects for hazard mitigation and sea level rise. This team could consist of county floodplain managers, infrastructure professionals, public works professionals, and environmental scientists. This group could assess projects, gather information, and help develop projects in a coordinated way.

**Cost:** No costs for this activity were discussed.

**Partners:** County officials, Local Business owners, DNREC, DelDOT, DEMA

#### **Activity 3: Create a website or portal where the public can go for help and information**

This activity was brought up throughout the day by this group and is referenced under several other recommendations. This website, or portal, would provide information on sea level rise and how to get technical assistance. This website should provide the public with all the information they would need to make an informed decision on land use and community activities to mitigate and adapt to sea level rise for the future.

**Cost:** No costs for this activity were discussed

## 2014 Workshop and Implementation Plan

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**Partners:** Delaware Sea Grant, DNREC Delaware Coastal Programs, DNREC Delaware Division of Energy and Climate, Colleges and Universities, DNREC Division of Watershed Stewardship

### **Activity 4: Include sea level rise and natural hazards in Comprehensive Land Use Planning Process**

Including sea level rise and natural hazards in the Comprehensive Land Use Planning Process is a natural step to introduce sea level rise into future planning for communities. Communities should incorporate sea level rise into these plans so they can prepare and so that any future infrastructure will consider sea level rise before it is constructed.

**Cost:** No costs for this activity were discussed

**Partners:** Community Planning Boards, DNREC, DelDOT, Office of State Planning Coordination.

### **Activity 5: Provide model zoning code language for sea level rise**

Model zoning code language reflecting best practices for sea level rise could be developed and provided to interested municipalities for adoption. Developing model language for zoning code improvements saves municipal governments from the expense of developing their own language while increasing the potential for consistency between local and county governments.

**Cost:** No costs for this activity were discussed

**Partners:** Delaware Office of State Planning Coordination, DNREC Delaware Coastal Programs, DNREC Delaware Division of Energy and Climate, Delaware Office of Management and Budget, Delaware Office of the Governor, Delaware Division of Facilities Management, League of Local Governments, University of Delaware Institute for Public Administration.

### **Additional Information**

Workshop participants mentioned that unincorporated and underserved communities also need to be the targets of sea level rise literature and knowledge. Executive Order 41 was a recurring theme in these conversations. Some federal barriers that could hinder this recommendation are the coordination between federal government agencies. There was an example highlighted where National Oceanic and Atmospheric Administration and U.S. Army Corps of Engineers were doing two different studies but had similar objectives.

### **Recommendation 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans**

*Facilities often have robust continuity plans where they address interdependencies, but no inventory of these plans has been conducted. Sea level rise could be incorporated into these plans to ensure facilities are resilient to the impacts of storm surge coupled with sea level rise. Technical assistance could be provided through one-on-one outreach or through databases and information clearinghouses.*

#### **Implementation Progress to Date**

No specific implementation actions were reported by workshop participants.

#### **Potential Implementation Activities**

##### **Activity 1: Calculate the risks and liabilities of existing facilities**

Existing facilities should identify their sea level rise risks and vulnerabilities. The facilities could provide a worst case scenario if a flood destroys their facilities. This would provide state and local officials with the understanding the risk with these facilities currently are.

**Cost:** No costs for this activity were discussed.

**Partners:** Local Industries, Ports, DNREC

##### **Activity 2: Create a local emergency planning committee**

A local emergency planning committee could provide the information and partnership opportunities that will improve coordination and information for all local emergency personal. The collection of individuals that would be part of this committee will provide the local community with better planning and execution during an emergency event. The committee can discuss emergency actions that need to be taken, have been taken, and vulnerabilities that the communities currently have. This committee should coordinate with DEMA to make sure there is consistency amongst the groups, or the committee can be an offshoot of DEMA.

**Cost:** No costs for this activity were discussed.

**Partners:** Private companies, Public companies, Fire companies, Emergency responders, DEMA

##### **Activity 3: Create an incentives program**

An incentive program for sea level rise preparedness could be created for industrial facilities. Such an incentive program could provide monetary or other incentives to facilities that conduct sea level rise assessments and adaptation plans and could provide funding or incentives for proactive on-the-ground adaptation actions at facilities that would improve public safety and environmental health in surrounding areas.

## 2014 Workshop and Implementation Plan

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**Cost:** No costs for this activity were discussed.

**Partners:** Local Industries, Ports, DNREC, DEMA

### Additional Information

Participants provided that many of these industrial sites have a site by site flood plan.

Currently there is no disclosure at a real estate sale of any commercial property relating to sea level rise flooding, or coastal hazards. It is currently self-policed by the financiers.

The Brownfields program is a program that new industries should be made aware of.

### **Recommendation 7.1: Convene an expert panel to provide an assessment and analysis of funding options for adaptation measures**

*At the current time, there is little specific information available regarding the potential cost of on-the-ground adaptation measures in Delaware. Because costs are unclear, it is difficult to recommend a particular course of action. An expert panel should be brought together to investigate the suite of options that are available to state and local governments and individuals to fund future adaptation measures. Included in this analysis should be traditional revenue generators such as taxes and fees, but it should also include innovative funding mechanisms such as special tax districts, incentives and cost-share programs. The analysis should utilize the preliminary funding options formulated by the Sea Level Rise Advisory Committee and public comments received during the Adaptation Engagement Sessions as a baseline.*

#### **Implementation Progress to Date**

Workshop participants did not report any activities related to this recommendation.

#### **Potential Implementation Activities**

##### **Activity 1: Identify how much and where money is needed**

Workshop participants offered that in order to understand the best way to pay for adaptation, some estimate of how much funding would be needed and where it would be spent would be useful. This in turn would drive the selection of options to pay for adaptation strategies.

**Cost:** No costs for this activity were discussed

**Partners:** Bankers, Realtors, DelDOT, Office of Management and Budget, Controller Generals, Insurance Commission, Legislators, Economists, University of Delaware, Delaware Economic and Financial Advisory Council

##### **Activity 2: Conduct a feasibility study for new sources of funding for sea level rise adaptation**

The group provided some financial options for funding adaptation measures including weekly rental tax, tax ditch type association for those affected by sea level rise, and beach tag tax. The group also mentioned incentives like having “strings” attached to money given to communities that they have to build above standards and to have sea level rise be a major factor in any decisions. Additional potential funding sources should be identified, and a feasibility study should be conducted to determine which might work best for Delaware and its residents.

**Cost:** No costs for this activity were discussed

## 2014 Workshop and Implementation Plan

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**Partners:** Bankers, Realtors, DelDOT, Office of Management and Budget, Controller Generals, Insurance Commission, Legislators, Economists, University of Delaware, Delaware Economic and Financial Advisory Council

**Activity 3: Perform a cost-benefit analysis on how much to mitigate vs. retreat**

A Cost-Benefit analysis of the cost to mitigate residents (e.g. elevate houses) versus retreat could provide necessary information for Activities 1 and 2 in this section.

**Cost:** No costs for this activity were discussed

**Partners:** Bankers, Realtors, DelDOT, Office of Management and Budget, Controller Generals, Insurance Commission, Legislators, Economists, University of Delaware, Delaware Economic and Financial Advisory Council

# Implementation Activities — Transportation & Infrastructure

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*The following section documents the discussions of the Transportation & Infrastructure Workgroup held during the Delaware Sea Level Rise Adaptation Plan Implementation Workshop. The workgroup was provided with a list of twenty infrastructure related recommendations from “Preparing for Tomorrow’s High Tide: Recommendations for Adapting to Sea Level Rise in Delaware.” The workgroup prioritized recommendations for discussion during the day and was able to discuss nine recommendations in detail. For each recommendation, specific “implementation activities” proposed by workgroup members are listed. These activities are intended to provide specific and discrete steps that can be taken to achieve the intent of each recommendation. For each activity, costs and necessary partners are listed if discussed by the group. In many cases, time did not allow for in-depth discussion of costs and partners. Recommendations not outlined below were not discussed by this workgroup, but may have been discussed by one of the other three workgroups at the workshop (see Appendix C).*

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.3: Increase opportunities for technology transfers and regional coordination for transportation issues affected by sea level rise**

*Delaware, Maryland, Pennsylvania and New Jersey have an integrated road, bridge and railway system which will require coordination and cooperation among the states and the U.S. Department of Transportation to adequately address sea level rise. Using existing professional venues, such as regional Metropolitan Planning Organizations and the American Association of State Highway Transportation Officials, DelDOT should integrate this new dimension into its planning, design, and operation policy discussions and standards development.*

#### **Implementation Progress to Date**

Workshop participants identified multiple activities that were currently underway or in the planning stages. Delaware Department of Transportation (DelDOT) currently has an existing structure for the sharing and transferring of data. Technology development and transfer are also currently built into the DelDOT budget, and will remain to support these efforts. It was noted that the Wicomico County MPO covers a small portion of Sussex County. A consensus was reached that, when talking about technology transfer, science and technology transfer need to be included as well.

#### **Potential Implementation Activities**

##### **Activity 1: Develop process for technology coordination and transfer**

**Cost:** <\$10,000

**Partners:** No partners were discussed.

##### **Activity 2: Coordinate with universities and colleges**

**Cost:** \$10,000 – 100,000

**Partners:** No partners were discussed.

##### **Activity 3: Host a yearly conference about sea level rise**

**Cost:** \$10,000

**Partners:** No partners were discussed.

##### **Activity 4: Educate underserved communities**

This activity was brought up as a way to help gain political consensus for moving forward.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

### **Additional Information**

Several federal barriers were discussed during the discussions. The group expressed the need for help from the Federal Rail Administration, Federal Transportation Administration, and the Federal Motor Carrier Safety Administration with rail Right-of-Ways because they are privately owned. Creating a partnership with the federal agencies and gaining assistance from them will help with rights-of-way issues.

The group also discussed issues of privacy and restrictions when dealing with technology and data sharing. Solutions to these issues should be sought as they can hinder progress.

Workshop participants also raised concerns about the US Army Corps of Engineers (USACE) and would like the USACE to be open and engaging when in discussions with the state and other agencies about sea level rise and adaptation.

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts**

*Much of Delaware's infrastructure is part of regional networks, including electrical generation, roads, rail, and landfills. Delaware's wetlands, habitats of conservation concern, beaches and nature preserves are also part of a regional system of wildlife and fish habitats. Incorporation of a common set of sea level rise information into regional planning processes for these resources will help ensure that informed decisions about adaptation are made and that the entire regional system is sustainable. Regional planning processes that should be targeted include: Wilmington Area Planning Council and Dover/Kent Metropolitan Planning Council long range plans for transportation, Amtrak long range plans, business group and industry contingency plans, and regional habitat plans.*

#### **Implementation Progress to Date**

The Wilmington Area Planning Council (WILMAPCO) has completed a vulnerability assessment for New Castle County and Cecil County outlining areas which would be affected by sea level rise. The study took into account everything from transportation routes of trains and buses to impacts on environmental justice communities. The transportation vulnerability assessment done by WILMAPCO is being used by AMTRAK as a best practice rail vulnerability assessment for their work in designing future high-speed rail corridor along the eastern seaboard.

In addition, DNREC's Division of Watershed Stewardship has finalized standards and recommendations developed through its Floodplain and Drainage Advisory Committee. These standards can be used to inform and improve planning and implementation of adaptation.

#### **Potential Implementation Activities**

##### **Activity 1: Incorporate sea level rise into private sector infrastructure plans**

Workshop participants felt it would be necessary to identify the private sectors that need to assess private infrastructure by completing a vulnerability assessment. The private sectors that need to be included, but are not limited to, were those involved in the power grid, treatment plants, and water and gas lines.

**Cost:** No costs were discussed.

**Partners:** No partners were discussed.

##### **Activity 2: Incorporate sea level rise planning into public infrastructure plans**

Participants requested that sea level rise be incorporated into transportation plans developed by Metropolitan Planning Organizations (MPO) and into energy infrastructure plans developed by the Public Service Commission. Sea level rise mitigation and adaptation should be featured as a component of the long range plans for WILMAPCO and the Dover/Kent MPO.

**Cost:** No costs were discussed.

**Partners:** Public Service Commission, WILMAPCO, Dover/Kent MPO

### **Activity 3: Educate Communities about sea level rise**

Workshop participants felt it was necessary to work alongside DelDOT to educate communities about Sea Level Rise and how to plan for the future. In the same efforts, the participants wanted work with local governments to address Sea Level Rise. In order to reach the communities in a more consistent manner, the group suggested creating a guidance document that incorporates all agencies regarding flooding and sea level rise. This would be easier and cheaper than actually visiting the communities, until specific needs arise.

**Cost:** \$100,000 – 1M

**Partners:** DelDOT, municipalities, counties

### **Additional Information**

The biggest federal barrier that was addressed during discussion was that if a single dollar of federal money is used for a project, then all of the project must follow federal rules and guidelines. The group thought there needed to be more coordination between the federal and state agencies in these efforts; along with coordination with Metropolitan Planning Organizations.

## 2014 Workshop and Implementation Plan

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### **Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending**

*Land-use decisions in Delaware are made at the local level, but the bulk of infrastructure and service that support these decisions are funded by the state. The Strategies for State Policies and Spending set forth clear advisory policies (including maps) about where the state will allocate financial resources for conservation, infrastructure improvements, and social services and are updated every five years. Incorporation of sea level rise into the suite of issues considered when the strategies are updated would provide an opportunity for coordination between agencies and local governments regarding sea level rise and may help further ensure wise use of state funding.*

#### **Implementation Progress to Date**

Participants highlighted the ongoing efforts by the state and federal government regarding this recommendation, especially Executive Order 41 and President Obama's Executive Order on Climate Preparedness.

#### **Potential Implementation Activities**

##### **Activity 1: Clarification of Executive Order 41**

Workshop participants wanted clarification of Executive Order 41 as it applies to state funding and what is considered state funding. Also, the participants were interested in what facilities and structures the order applied to. It was also discussed that EO 41 should be incorporated into the PLUS process so that counties and municipalities could benefit from sea level rise information about development projects. Everyone in attendance agreed that the PLUS program should have more authority and should incorporate sea level rise.

**Cost:** \$10,000

**Partners:** No partners were discussed.

##### **Activity 2: Develop planning tool for effective spending of money**

No further discussion occurred about this activity.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

##### **Activity 3: Identify and track success of sea level rise adaptation projects**

Participants highlighted a desire to identify and list projects that incorporated sea level rise considerations, including source and amount of funding, to determine if the outcome is positive or negative.

**Cost:** \$10,000 – 1M

**Partners:** No partners were discussed.

### **Additional Information**

Participants felt that Delaware should receive support from federal agencies on sea level rise policies. For example, the federal government should recognize Delaware's freeboard recommendation of 18 inches for state projects, and provide funding for construction to that level, instead of providing funding only for the federal guideline of 12 inches.

## 2014 Workshop and Implementation Plan

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### Recommendation 3.6: Encourage inclusion of sea level rise in Transportation Project Design Manuals

*To ensure consistency of highway infrastructure across the country, national standards are cooperatively developed by state Department of Transportations and the Federal Highway Administration under the banner of the American Association of State Highway and Transportation Officials. These adopted standards cover all aspects of design and road geometry, as well as signals, signs and markings. These standards need to be updated to reflect the predicted effects of sea level rise on such long-lived assets such as roadways and bridges, accounting for differences in sea level rise scenarios in different areas of the nation.*

#### Implementation Progress to Date

Workshop participants mentioned many ongoing tasks pertaining to this issue. Recently, DelDOT began “re-rating” bridges and updated its policies based upon the new ratings. Sea level rise was considered during this re-rating process. DelDOT’s new bridge ratings include bridges that are already constructed but, currently, sea level rise is not taken into consideration when building and planning new bridges.

A study done by WILMAPCO addressed which bridges may be flooded, or otherwise impacted structurally by sea level rise in New Castle County and Cecil County.

DelDOT has also begun to look at sea level rise and flood impacts to roadways and corridors, within and outside of Delaware, and to develop strategies. Similarly, a new study of the impacts of sea level rise on rails and Amtrak, including its maintenance facility and operation center, has recently begun. Finally, it was mentioned that DelDOT is in the process of completing an asset inventory and this would be an opportunity to compare to sea level rise data.

#### Potential Implementation Activities

##### Activity 1: Conduct a route analysis

The participants expressed concern over whether or not the state can manage its assets if water were to rise today. Maintaining connectivity for the residents is a priority, but the participants wanted to know what land and destinations are vulnerable, if they will be preserved and how that will impact the transportation network. Similarly, it was brought up that in Sussex County there is already limited public transportation, and with low elevations, there are limited options for bus stops and similar transit.

**Cost:** No costs were discussed.

**Partners:** No partners were discussed.

## Transportation & Infrastructure

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### **Activity 2: Assess construction material suitability for sea level rise and flooding**

Some materials used in construction (concrete and compressed sand blocks) can be subject to erosion. Participants discussed the idea of conducting an analysis of materials used for construction and design to determine their suitability for use in flood prone areas. Results could be added to design manuals.

**Cost:** \$10,000 – 100,000

**Partners:** No partners were discussed.

### **Activity 3: Update FEMA maps with sea level rise**

Participants thought better maps and modeling were needed (instead of bathtub models) and that FEMA floodplain maps should be updated to incorporate sea level rise.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

### **Activity 4: Update the Roadway Design Manual to include sea level rise**

A list of manuals that needed to be updated to include sea level rise were mentioned, and included bridge, roadways, project development, land use, right of way, and building code.

**Cost:** <\$10,000

**Partners:** No partners were discussed.

### **Additional Information**

It was stated that the USACE and DelDOT need to coordinate more because currently the USACE does not consider sea level rise when dealing with bridge issues. USACE has responsibility for the bridges over the canal, but were not participating in the breakout group.

Participants from DelDOT expressed concern about permitting and trade-offs. For example, increases in bridge height require that bridge approaches be reconstructed. This will cause roadways to expand two feet on either side for every foot that a road must be raised, and, in turn, could cause habitat and wetland impacts. The trade-offs between adapting infrastructure to sea level rise and wetland conservation will have to be considered during project development and permit application processes through the USACE and the DNREC Subaqueous Lands Section.

## 2014 Workshop and Implementation Plan

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### **Recommendation 3.13: Conduct a legal review for disinvestment of publicly owned infrastructure and privately owned buildings**

*Retreat is an important strategic option for dealing with sea level rise. Many private and public buildings and other infrastructure, such as roads, may become impractical to maintain as the environment changes and may be abandoned. There are many public health and safety implications that must be addressed, such as removal of contaminants, as well as legal implications, such as loss of access to a property or loss of property value due to removal of an inter-related public or private asset. In addition, there are also equal protection and environmental justice implications for low income and/or minority communities that could be affected by disinvestment. A review of the legal framework, especially real estate and environmental law, will be needed in order to begin to understand the legal feasibility as well as true costs and consequences of a retreat strategy.*

#### **Implementation Progress to Date**

DelDOT requested a legal study and opinion regarding disinvestment of vulnerable roadways. It was determined that DelDOT cannot refuse a property owner access to his or her property without compensation for differences in property value that could be created by lack of access.

#### **Potential Adaptation Activities**

##### **Activity 1: Identify legal barriers and assets for retreating**

Create inventory maps of impacted structures and infrastructure and address the legal barriers surrounding these items. Participants mentioned that DelDOT has no legal language for disinvestment, and, currently, the only framework that exists is the PLUS process, but this has no “teeth”.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

##### **Activity 2: Create inventory maps**

No further discussion occurred about this activity.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

#### **Additional Information**

Participants mentioned that there may be legal barriers to passing down the responsibility and maintenance of roads from the state level to the municipal level.

### **Recommendation 3.14: Develop a statewide retreat plan and update it periodically**

*There are certain locations within the state where “retreat” may be the best adaptation strategy, including some natural areas, agricultural areas and developed areas where protection may not be feasible due to expense or engineering constraints. There is a desire from businesses, citizens and state agencies to have predictability in adaptation responses so that they can make long-term plans. A statewide plan outlining areas where retreat may be the most appropriate adaptation option would allow state agencies to put lifespan limits on infrastructure in vulnerable areas, allow targeted land acquisition for inland migration of wetlands and shorelines, and provide predictability for citizens. Significant new data about adaptation costs, shoreline responses to sea level rise and demographic information would be required before a retreat strategy could be crafted. Any retreat plan would also require extensive dialogue with elected officials, business and commercial property owners and citizens.*

#### **Implementation Progress to Date**

Workshop participants agreed that conversations within various agencies were just beginning regarding this topic. One example of work currently under way is the Delaware Bay Beach Work Group, led by the DNREC Shoreline and Waterway Management Section. This committee is investigating issues of inundation and erosion in bay beach communities and conducting cost-benefit analysis of different management scenarios including retreat.

#### **Potential Implementation Activities**

##### **Activity 1: Maintaining public utilities and roadways**

Participants expressed the need to coordinate with utility companies that share the right of ways with DelDOT. A question that was raised during the discussion was, “To what level of service are utility companies required to provide to residents?”

**Cost:** No costs were discussed

**Partners:** No partners were discussed

##### **Activity 2: Educate the public and homeowners**

The participants thought it would be helpful to create visualizations to demonstrate retreat to the public.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed

## 2014 Workshop and Implementation Plan

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### Activity 3: Economic analysis of retreat

The participants noted that completing a cost benefit analysis of retreat would most likely result in the replenishment of beaches because of the value placed on coastal homes. Participants believed that the only way to mandate a retreat is through legislative actions, and even then one would encounter conflicts between local and state governments. Additionally, participants would like an economic analysis of the secondary effects of retreat.

**Cost:** \$10,000 – 100,000

**Partners:** No partners were discussed

### Additional Information

The participants stressed more than once throughout the discussion that legislative action is the **ONLY** way to mandate a retreat of coastal communities. However, they suggested that with incentivized federal money for retreat, you may be able to persuade coastal homeowners to retreat or, at the very least, address sea level rise planning.

### **Recommendation 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise**

*A comprehensive outreach strategy should be developed to increase stakeholders' understanding of sea level rise, its effect on many aspects of life, and ways to reduce these impacts. A strategy may include consideration of the best ways to reach different audiences. Education efforts should include both year-round and seasonal residents, children, government officials, businesses, commercial property owners, farmers, real estate agents, insurance agents, utilities and industries so that informed decisions can be made in the future. Increased education could engage more agencies, increase funding opportunities and result in support to help integrate sea level rise into long-range management plans, gain acceptance of the management decisions made, and possibly influence legislative decision making. In addition, providing information about other successful sea level rise adaptation programs and initiatives may further increase Delaware's acceptance of sea level rise and adaptation strategies.*

#### **Implementation Progress to Date**

The workshop participants outlined numerous activities currently underway that pertained to this recommendation. The National Geographic Society and the University of Maryland have developed curriculum components for k-12 classrooms. DNREC has a department policy that requires consideration of sea level rise when constructing a project and directs employees to educate the public about sea level rise issues. WILMAPCO has begun including sea level rise into their education and outreach activities, such as a webpage and handouts. Additionally, the state Historic Preservation Plan also addresses sea level rise. Finally, a participant from DEMA told the group of two successful buyouts and retreat in recent years because of the inclusion of sea level rise into their outreach with communities.

#### **Potential Implementation Activities**

##### **Activity 1: Incorporate sea level rise into educational curriculums**

The workshop participants would like to encourage the Department of Education to begin to include sea level rise into their science curriculums. The group also thought it would be important to reach out to the non-formal education outlets, such as boy scouts and girl scouts to include sea level rise in their programs.

**Cost:** <\$10,000 – 100,000

**Partners:** No partners were discussed

##### **Activity 2: Engage Decision Makers**

Engage decision makers, as well as the Chamber of Commerce and similar civic organizations, to advocate for sea level rise policies.

**Cost:** <\$10,000-100,000

**Partners:** No partners were discussed

## 2014 Workshop and Implementation Plan

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### **Additional Information**

The workshop participants thought it was important that outreach messages be consistent with the current presidential Executive Order on Climate, and messaging should be coordinated with federal agencies. Participants wished to know outreach is a legitimate use of federal funds, or if there is specific federal funding for outreach.

### **Recommendation 5.14: Identify the data necessary to plan transportation investments**

*Roads and bridges that are located in areas that are expected to have flooding issues as illustrated through the inundation models in the vulnerability assessment should be specifically identified. Routes should then be prioritized based on: system performance, age and condition, lifespan, origin and destination, replacement schedule, adjoining land use (both present and future), and choke points. Sea level rise inundation scenarios should be incorporated into the existing mechanisms used by DelDOT to prioritize projects.*

#### **Implementation Progress to Date**

The workshop participants acknowledged that the statewide sea level rise vulnerability assessment published in 2012 identified most of the data; however, they felt that vulnerable roads should be prioritized. Additionally, DelDOT is considering further analysis for Transportation Investment Districts. Currently there are 24 in total and possibly 11 more in the future.

#### **Potential Implementation Activities**

##### **Activity 1: Identify data gaps**

No further discussion occurred about this activity.

**Cost:** \$1M +

**Partners:** No partners were discussed.

##### **Activity 2: Identify secondary impacts of SLR**

Secondary impacts of losing land to sea level rise on the population, industry, and the relative importance of transportation links should be identified and assessed. The participants also discussed the connectivity issues with loss of roads, and thought it would be necessary to conduct a study to address this.

**Cost:** 1M +

**Partners:** No partners were discussed.

#### **Additional Information**

A large data gap that was addressed involved private freight data. This data is not available either publicly or through the federal government as it poses security issues, and therefore is a huge barrier.

## 2014 Workshop and Implementation Plan

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### **Recommendation 6.5: Develop a database of costs of adaptation options for use by decision-makers and the public**

*Such a database should include examples of the costs of elevating buildings, beach nourishment, abandoning buildings, and elevating roadways, building hardened shorelines, elevating and repairing dikes, and constructing living shorelines. Cost estimates cannot be site-specific but may be able to provide general guidelines. This database should also incorporate cost benefit analyses that would evaluate retreat, accommodation, avoidance and protection measures, including return on investment.*

#### **Implementation Progress to Date**

During the discussion, participants mentioned ongoing work by DelDOT including their costing exercise for assets vulnerable to sea level rise.

#### **Potential Implementation Activities**

##### **Activity 1: Create metadata standards**

Workshop participants felt that metadata standards needed to be created or outlined to improve capacities for data sharing. Participants also wanted more education and training for users on developing and using metadata. Also, within the study, the participants wanted to create a Standard Operating Procedure that covers unit costs and costs of things that may not have a quantitative value (heritage or historic value).

**Cost:** \$10,000 – 100,000

**Partners:** No partners were discussed

##### **Activity 2: Compare costing exercise**

Workshop participants agreed that the costing exercise being done by DelDOT needed to be compared to studies from other states and should consider secondary impacts of raising roads and bridges.

**Cost:** \$1M+

**Partners:** No partners were discussed

### **Activity 3: Delineate the database**

No further discussion occurred about this activity.

**Cost:** \$100,000 – 1M

**Partners:** No partners were discussed.

### **Additional Information**

Workgroup participants discussed the need for more information from the federal government to determine how they are governing values and using them for decision making. The federal government has their own definition of unit costs, but the participants would like more information on how they calculate the value.

## 2014 Workshop and Implementation Plan

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# Implementation Activities — Water Resources Workgroup

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*The following section documents the discussions of the Water Resources Workgroup held during Delaware’s Sea Level Rise Adaptation Plan Implementation Workshop. The workgroup was provided with a list of twenty-one water resources related recommendations from “Preparing for Tomorrow’s High Tide: Recommendations for Adapting to Sea Level Rise in Delaware.” The workgroup prioritized recommendations for discussion and was able to discuss twelve recommendations in detail. For each recommendation, specific “implementation activities” proposed by workgroup members are listed. These activities are intended to provide specific and discrete steps that can be taken to achieve the intent of each recommendation. For each activity, costs and necessary partners are listed if discussed by the group. In many cases, time did not allow for in-depth discussion of costs and partners. Recommendations not outlined below were not discussed by this workgroup, but may have been discussed by one of the other three workgroups at the workshop (see Appendix C).*

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.1: Improve coordination of permit decisions for adaptation projects among federal, state, and local officials**

*Permitting processes that involve several different agencies, particularly those for transportation, sewer infrastructure, shoreline protection, and commercial or residential development, can be delayed when agencies lack a common set of goals or have conflicting regulatory requirements. As sea level rise adaptation becomes incorporated into project proposals, conflicting regulations may delay permitting processes. Early coordination of projects between state, federal and local officials could help minimize regulatory conflicts and delays, as would incorporation of sea level rise consideration into regulatory decisions. These actions may lead to more rapid issuance of permits for adaptation projects, more predictability for applicants, and an increased predictability and empowerment for local governments when planning and designing their own adaptation projects.*

#### **Implementation Progress to date**

Participants did not identify any specific implementation projects for this recommendation.

#### **Potential Implementation Activities**

##### **Activity 1: Evaluate innovative projects that have been permitted in other states**

A project can be considered “innovative” for a variety of reasons; sometimes a project has been implemented successfully but is considered innovative because it is new to a region or state. For “innovative” projects, it is important to understand how a similar project may have been permitted in other parts of the country, how effective that project was in adapting to sea level rise and what lessons may have been learned. Understanding lessons learned helps facilitate permitting for a comparable project in Delaware. Delaware will need to establish a way of gauging if a project was successful to better understand how well similar projects may work in Delaware.

**Cost:** No costs were discussed.

**Partners:** DNREC, applicable permitting agencies

##### **Activity 2: Educate consultants**

Workgroup participants discussed the need to educate and train project consultants about strategies to adapt to sea level rise. Providing consultants with sea level rise information could allow or encourage them to discuss sea level rise with applicants for permits and to design their projects for sea level rise.

**Cost:** \$<10,000

**Partners:** DNREC, consulting firms

### **Activity 3: Provide permit incentives for sea level rise adaption measures**

Workgroup participants encouraged permit incentives for voluntary sea level rise adaptation actions. Incentives could include reduced permit review fees or expedited permitting review time. An example of siting a well head outside of the 1.5 meter sea level rise inundation area was given. However, for well permits specifically, most permits are processed in only 1-2 weeks limiting the usefulness of fast-tracking permit review. The concept may be more useful for other water resource permits.

**Cost:** No costs were discussed.

**Partners:** DNREC

### **Activity 4: Improve communication between state and county agencies**

Continue to use existing coordination mechanisms to communicate about sea level rise to other state and county agencies. Mechanisms mentioned include the PLUS process and the New Castle County Technical Review Committee.

**Cost:** No costs discussed

**Partners:** DNREC, New Castle County Technical Review Committee, County Governments

### **Additional Information**

Concern was expressed about the potential for a legal issue if a project was denied a permit for not adapting to a sea level rise scenario. There was also concern about innovative projects that may need monitoring plans and more time for review.

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.2: Create new partnerships to increase resources for research and development of adaptation options.**

*New and innovative solutions may exist for adaptation to sea level rise, including new shoreline stabilization methods, wave attenuation structures, oyster reefs, and offshore structures. Pilot projects to determine the efficacy of untested techniques may yield positive results. Forming new partnerships or strengthening existing partnerships with neighboring states, federal agencies, the consulting community, universities, and non-profits will greatly expand the knowledge and funding available for research and development. Collaboration can also expand regional sediment management research and opportunities for beneficial reuse of dredged spoil.*

### **Implementation Progress to date**

A slide show was developed by Pew Research Center about companies that have addressed sea level rise and climate change, focusing on a particular water company as an example.

Ceres, a non-profit advocacy organization, supports sustainable business models and has put together reports on no-action alternatives for the National Flood Insurance Program and the Crop Insurance Program (<http://www.ceres.org>).

### **Potential Implementation Activities**

#### **Activity 1: Gather information about what private businesses and industry have done to address and accommodate for sea level rise**

Private businesses can be great models for innovation since they are profit driven and risk adverse. Their decision making processes and data may be useful elsewhere, for example some companies have done their own salinity modeling. Pew Research Center recently put together a slide show on these types of private adaptation activities. Additional information should be compiled and used as an example of potential adaptation actions.

**Cost:** The Chamber of Commerce may be able to assist with cost estimates.

**Partners:** DuPont, the tourism industry, Port of Wilmington, Delaware City Refining Company, DNREC

**Prerequisite:** This activity should be a prerequisite to all other activities.

### **Activity 2: Hold workshops for private sector partners**

Private businesses can be useful messengers of innovative measures that can be implemented to address sea level rise. Information presented by a private business to others in the private industry, particularly for voluntary measures, removes the mandatory/requirement/regulation pressures that often arise when government provides information on the topic.

**Cost:** <\$10,000

**Partners:** Private business/industry

## 2014 Workshop and Implementation Plan

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### **Recommendation 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects.**

*Sea level rise is an emerging issue that many state and local regulations do not yet consider. A variety of adaptation measures from raising buildings to protecting shorelines may not be permissible or may take longer to permit than measures which do not include sea level rise considerations, setting up a perverse incentive that could result in no adaptation or maladaptation. Local and state regulations and building codes should be assessed for opportunities to provide incentives for adaptation, particularly for demonstration projects. As an example, the Delaware Department of Natural Resources and Environmental Control recently issued a “Statewide Activity Approval” for shoreline stabilization projects that incorporate natural and planted marshes. Under this approval, average permitting times will be reduced to one to two weeks.*

#### **Implementation Progress to date**

Participants did not identify any specific implementation projects for this recommendation.

#### **Potential Implementation Activities**

##### **Activity 1: Assist with permit approval**

Innovative projects may need funding and/or permit approvals. State agencies can help provide assistance to figure out what may need to be done to complete these projects.

**Cost:** No costs were discussed.

**Partners:** DE Office of Drinking Water

### **Recommendation 2.4: Consider SLR implications in future regulatory updates for septic systems and wells**

*Sea level rise and its associated impacts, such as increased flooding, rising water table, and salt water intrusion can reduce or eliminate the functionality of on-site wastewater treatment systems and groundwater wells. Permit criteria for the siting, design, and construction of wastewater disposal systems and wells are specified in state regulations. Incorporating sea level rise considerations into future updates of these regulations to implement protective design and siting requirements could reduce vulnerability of septic systems and wells. Additional studies of sea level rise implications for Delaware's groundwater would be necessary before criteria could be developed. The costs of any additional requirements should be carefully considered and weighed against the lifespan of each system.*

### **Implementation Progress to date**

In the 1950's the city of Lewes moved its wells due to salt water intrusion.

Well regulations are updated every five years.

### **Potential Implementation Activities**

#### **Activity 1: Maintain communication with Wells and Septic regulatory divisions**

DNREC divisions should maintain communication about when regulations are being updated. When regulations are being updated, other DNREC divisions should be provided with the opportunity to review the updates and provide input on ways to include sea level rise adaption mechanisms. As of March 2014 the wells regulations were open for review and could include updated floodplain maps to inform well heights and siting.

**Cost:** No costs discussed

**Partners:** DNREC

#### **Activity 2: Educate stakeholders**

DNREC, along with the Delaware Association of Realtors, should provide education opportunities for homeowners about potential risks of siting a well in an area that may experience salt water intrusion during the expected lifespan of the well. Educational seminars and talks should also be provided at annual conferences of well drillers held in the region since they are often the first person a homeowner contacts about drilling a well.

**Cost:** <\$10,000

**Partners:** DNREC, Delaware Association of Realtors

## 2014 Workshop and Implementation Plan

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### Recommendation 3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending

*Land-use decisions in Delaware are made at the local level, but the bulk of infrastructure and service that support these decisions are funded by the state. The Strategies for State Policies and Spending set forth clear advisory policies, including maps, about where the state will allocate financial resources for conservation, infrastructure improvements, and social services. These maps are updated every five years to ensure they are up-to-date. Incorporation of sea level rise into the suite of issues considered when the strategies are updated would provide an opportunity for coordination between agencies and local governments regarding sea level rise and may help further ensure wise use of state funding.*

#### Implementation Progress to date

No specific implementation was discussed.

#### Potential Implementation Activities

##### **Activity 1: Create disincentives for construction in sea level rise zones**

Disincentives should be developed for new buildings that would be located in an area expected to be inundated by sea level rise. Designating these areas as vulnerable by classifying them as Level 4 would discourage state support for infrastructure and other services. Retreat strategies can, and should, be included for these projects. Local governments should be educated on the utility of flood management tools that can deter development in flood prone areas. These disincentive areas can capture projects that fall outside local flood ordinances and do not require flood insurance.

**Cost:** No costs were discussed.

**Partners:** DNREC, local governments

**Prerequisite:** Develop new Delaware specific floodplain and sea level rise maps, as called for by EO 41.

##### **Activity 2: Provide educational outreach**

Most sewer infrastructure that supports development in Kent and Sussex Counties is funded through the county and paid for by the county's residents through county taxes. Glendale is an example of how state money can be used on these types of projects.

**Cost:** No costs were discussed.

**Partners:** DNREC, County Governments

### **Recommendation 3.12: Designate shoreline zones for adaptation action**

*Shoreline protection and restoration projects require federal, state and sometimes local permits. Hardening of shorelines (e.g., with bulkheads or riprap) is generally discouraged by state policies, but may be the most appropriate adaptation response in urban or industrial areas. Conversely, soft or “living” shorelines may be the most appropriate in rural or environmentally sensitive areas. Criteria for shoreline adaptation would have to be based on peer-reviewed literature and done in collaboration with stakeholders. Planning for and designating areas statewide where shoreline hardening would be allowed, where hardening would be discouraged, and where living shorelines will be encouraged will provide certainty for permit applicants and may streamline the permitting process. These designations should also be incorporated into appropriate federal, state and local permitting processes.*

#### **Implementation Progress to date**

No specific implementation was discussed.

#### **Potential Implementation Activities**

##### **Activity 1: Develop community-based vulnerability maps**

Maps to identify the vulnerability of water infrastructure to both storm events and sea level rise should be developed. These maps should include facilities and associated pipelines. These maps would help to target areas for communities to focus their sea level rise adaptation efforts. Development of these maps will require additional information about the heights of the facilities, the depths and locations of pipelines, along with potential sea level rise and flood levels. Maps that include this type of information can be included in Comprehensive Land Use Plans and other long-range planning documents as well.

**Cost:** No costs were discussed.

**Partners:** Delaware Municipalities

##### **Activity 2: Develop a comprehensive shoreline map**

A comprehensive shoreline map should be developed that identifies adaptation zones or areas that should be designated for retreat based on development of thresholds for abandonment. Thresholds can also be developed for remediation, build-up and then retreat. Additionally, these maps can indicate where areas could be designated for new flood control projects for flood prone areas. Having such maps could assist with the acquisition of grants and other funding.

**Cost:** No costs were discussed.

**Partners:** Delaware Municipalities

## 2014 Workshop and Implementation Plan

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### Additional Information

Participants of the Water Resources Workgroup agreed that it would be worthwhile to designate shoreline zones, but there was concern that any protection measures may not be comprehensive enough. An example was provided with regards to the Red Lion Dike tide gates where DNREC reconstructed the dike but the tide gates were not repaired as the agency responsible for the operation and maintenance of that structure did not chose to conduct repairs at that time. This causes regular free flow up Red Lion Creek and there is no projected timeline for repair of the tide gates. Additionally, there were concerns about the political costs that may be associated with a map like this.

### **Recommendation 4.4: Provide targeted outreach to water and wastewater operators and water utilities**

*Opportunities exist to reach out to state, municipal, county and private water and wastewater professionals at annual conferences of water associations, such as the Delaware Rural Water Association and the Delaware Onsite Wastewater Recycling Association. These conferences are key venues for disseminating information on sea level rise, engaging stakeholders and experts in planning for its impacts, and evaluating preferred adaptation options and strategies to meet long-term goals.*

#### **Implementation Progress to date**

Communities are aware that there is a potential for impacts to drinking water quality from sea level rise.

South Bethany obtained grant funding from the DNREC Delaware Coastal Programs to begin monitoring its drinking water wells for saltwater intrusion. Wells near Long Neck in Sussex County were moved due to salt water intrusion.

#### **Potential Implementation Activities**

##### **Activity 1: Develop continuing education course(s) for licensed operators**

Drinking water, wastewater, wells, and septic operators are required to attend continuing education courses to maintain their licenses. A 4 - 7 hour course can be developed that would provide specific information about sea level rise and how facilities could adapt to sea level rise. Delaware Technical and Community College (DelTech) offers courses each semester and invites all licensed well, septic, water and wastewater operators to attend these courses. There are currently courses being taught that specifically address watersheds and Total Maximum Daily Loads (TMDLs); these could be used as examples for a sea level rise specific course. If associated regulations are updated and modified, this spurs education courses that are specific to those changes and credits can be awarded to attendees if sea level rise relates to any regulation changes.

Alternatively, it may be easiest to develop an outreach class that is taught by a representative from Delaware Coastal Programs that will target adjuncts who can provide the training to the licensed operators. The Delaware Rural Water Association and DelTech have the resources needed to host the courses. DelTech would be the lead on any of these courses with assistance from organizations knowledgeable about sea level rise.

Funding may be available through available grants for people to attend these courses.

**Cost:** <\$10,000; or \$10,000 to \$100,000

**Partners:** DNREC, DelTech, Delaware Rural Water Association, DNREC DNERR Coastal Training Program

## 2014 Workshop and Implementation Plan

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### Activity 2: Provide information for utility specific newsletters

Newsletters are regularly sent out to licensed operators in the state. A regular column or a special feature can be developed and submitted to these newsletters to reach water and wastewater facility operators to update them about the latest news, trends and ideas related to sea level rise and their industry.

**Cost:** <\$10,000

**Partners:** DNREC, drinking water operators' certification (Keith Harrison), Rural Community Assistance Project, USDA Rural Development, Wastewater Operators Association, Delaware Onsite Wastewater Recycling Association

### Activity 3: Provide information about sea level rise for newsletters

Newsletters and emails are regularly sent out to water resource communities to update the people who are licensed about new classes being offered and other important news and information that pertains to their field of expertise. Providing sea level rise information for these newsletters and emails can help further increase sea level rise awareness amongst these groups.

**Cost:** No costs were discussed

**Partners:** DNREC, drinking water operators' certification (Keith Harrison), Rural Community Assistance Project, USDA Rural Development, Wastewater Operators Association, Delaware Onsite Wastewater Recycling Association

### Activity 4: Provide sea level rise information for biannual CTAC meetings

The source water Citizen and Technical Advisory Committee (CTAC) is a governor-appointed standing committee that meets twice a year in May and November to discuss drinking water issues. This committee has 50 members that range from local, state and federal government agencies as well as representatives from water utility companies. While sea level rise is not currently a focus at these meetings, there has been increasing interest in sea level rise related issues, mainly concerning saltwater intrusion. Sea level rise information can be developed, distributed, and presented at these meetings.

**Cost:** No costs were discussed.

**Partners:** DNREC, DE Source Water Citizen and Technical Advisory Committee

### Activity 5: Attend state and regional conferences

Water and wastewater associations have regular conferences in the state as well as regionally. This may be an excellent opportunity to disseminate educational information as well as engage interested utility operators in conversations about sea level rise and ways of adapting for projected impacts.

**Cost:** <\$10,000

**Partners:** DNREC, Chesapeake Section, American Water Works Association, Chesapeake Water Environment Association, Water & Waste Operators Association of Maryland, Delaware and DC, Delaware Onsite Wastewater Recycling Association

### **Activity 6: Update well regulations to incorporate projected sea level rise scenarios**

As of March 2014, well regulations are in the final stages of review for updates and revisions to the current regulations. Meetings are being held to evaluate the current regulations and how they can be modified. It is recommended that a sea level rise/flooding expert become involved in the focus committee to present any current or new sea level rise projection maps and/or updated flood maps.

**Cost:** No costs discussed

**Partners:** DNREC

### **Additional Information**

It was pointed out that it is important to have the correct entity to deliver information about sea level rise. It may be useful to collaborate with private businesses or have a regional utility association come in early to help develop educational information.

## 2014 Workshop and Implementation Plan

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### **Recommendation 5.10: Develop a model that will predict changes to salinity in surface water that may occur under differing sea level rise scenarios**

*Improving our understanding of sea level rise impacts resulting from migration of salt water into the Delaware River is necessary to better assess risk to infrastructure, facilities and natural systems. Modeling can provide the information necessary to better anticipate impacts to natural systems and develop an understanding of the different threshold of these systems. This could be done on a smaller watershed scale using nested models.*

#### **Implementation Progress to date**

The Delaware Bay River Commission tracks the salt wedge in the Delaware Bay, specifically looking at drinking water issues with facilities with surface water intakes and may have a model that can be shared.

The U.S. Geological Survey (USGS) has a North Atlantic Coastal Plain model (<http://ny.water.usgs.gov/projects/NACP/>), covering southern Long Island south to North Carolina. A new salt water intrusion model is also in development by USGS (<http://water.usgs.gov/ogw/gwrp/saltwater/index.html>). The EPA may also have some models as well.

#### **Potential Implementation Activities**

##### **Activity 1: Develop a Delaware specific groundwater model**

Delaware's groundwater should be modeled and should include different hydraulic models (surface water, pollutants, inputs, etc.). A statewide model was explored in the recent past and was estimated to cost around \$250,000; the model was not initiated.

**Cost:** \$100,000 – 1M+

**Partners:** Partnership for the Delaware Estuary, Delaware Geological Survey, Delaware River Basin Commission, University of Delaware, Rutgers, Schuylkill Action Network, surrounding states, private industries that have freshwater intakes

### **Recommendation 5.11: Develop a statewide groundwater model**

*A general, screening-level groundwater computer model can provide information on how groundwater movements and water table levels may be impacted by sea level rise. This data would provide the necessary information needed to understand which industries and businesses may be at risk from corrosion, which contaminated sites may be at risk, and which habitats may be threatened. Site specific evaluations may be necessary, but an improved understanding of overall sea level rise impacts to the water table is required to better assess risk.*

#### **Implementation Progress to date**

USGS has a regional groundwater model from Long Island south to North Carolina.

In Delaware, Pete McLaughlin and Tom McKenna with the Delaware Geological Survey have been working on groundwater models.

#### **Potential Implementation Activities**

##### **Activity 1: Evaluate results from initial groundwater models**

Evaluate the groundwater models that are currently being developed and determine if additional studies may be needed or if other variables need to be added to the models. The impact of sea level rise on groundwater may be fairly substantial and impacts to soils may be higher than expected.

**Cost:** No costs discussed

**Partners:** Delaware Geological Survey, DNREC

##### **Activity 2: Modify models**

Groundwater models can incorporate salinity changes or develop a salt water intrusion package to build on the existing models.

**Cost:** \$100,000 – 1M+

**Partners:** Delaware Geological Survey, DNREC

##### **Activity 3: Disseminate information**

Groundwater models should be made available to DNREC permitting agencies, counties and local municipalities. Additionally, all entities should be made aware of potential caveats and any updates made to the models.

**Cost:** <\$10,000

**Partners:** DNREC, Delaware Division of Energy and Climate, University of Delaware, Delaware Counties and Municipalities

## 2014 Workshop and Implementation Plan

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### **Recommendation 5.12: Develop and maintain a comprehensive database that contains the location and condition of all wastewater infrastructures**

*The vulnerability assessment analyzed public wastewater facilities and pumping stations: data regarding private or community systems, pumping stations and pipelines are not available in a consolidated format. This information should be entered into a comprehensive database and routinely updated to plan more accurately for sea level rise impacts to wastewater systems and to identify opportunities to integrate services in vulnerable areas with systems that may be more reliable over time. The database should include a condition assessment of the facility in order to plan for anticipated maintenance and upgrades. It should also triage areas for repairs and relocation to expedite the process when funds are available.*

#### **Implementation progress to date**

DNREC tracks groundwater discharge for disposal and treatment facilities, but not for pumping stations and pipelines. DNREC also has a site index database that has information about rapid infiltration basins, spray irrigation sites, etc.

#### **Potential Implementation Activities**

##### **Activity 1: Develop comprehensive database with all wastewater infrastructure**

Due to proprietary information, the Delaware Department of Homeland Security is the appropriate place to house a database that includes all wastewater facilities, pipelines and associated infrastructure. The two primary DNREC entities that have this information may not be able to communicate with each other or share information about these systems. This information could be useful when one system becomes threatened by sea level rise and needs to hook up to another system with available capacity. Staff with Homeland Security may already have information about surface elevations that can be used to help with permit decisions. Data can include information about the elevation of pump stations and the roads that access them. Maps developed through this database can be used during permit renewals to address pump stations and wastewater infrastructure that may need to be modified to address sea level rise impacts.

**Cost:** <\$10,000

**Partners:** Delaware Department of Homeland Security, DNREC

##### **Activity 2: Establish a way to compile existing information**

Delaware Homeland Security will need to provide guidance about how to compile all of the existing information and may need to be encouraged to do so through EO 41.

**Cost:** No costs were discussed.

**Partners:** Delaware Department of Homeland Security, DNREC

### **Activity 3: Update wastewater regulations to address SLR**

Delaware's Public Service Commission could advocate for regulations that would encourage/require public utilities to address and accommodate for sea level rise.

**Cost:** No costs were discussed.

**Partners:** Public Service Commission, DNREC

### **Activity 4: Comprehensive Land Use Plans**

Counties have information about county run wastewater systems. County and municipal land use plans can include information about sea level rise scenarios and areas where wastewater systems may need to accommodate for sea level rise.

**Cost:** No costs were discussed.

**Partners:** Delaware Counties and Municipalities, Delaware Office of Management and Budget, DNREC

## 2014 Workshop and Implementation Plan

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### **Recommendation 6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans**

*Facilities often have robust continuity plans where they address interdependencies, but no inventory of these plans has been conducted. Sea level rise could be incorporated into these plans to ensure facilities are resilient to the impacts of storm surge coupled with sea level rise. Technical assistance could be provided through one-on-one outreach or through databases and information clearinghouses.*

#### **Implementation Progress to Date**

Wilmington was one of the cities that piloted the CREAT Model developed by the EPA, a climate resiliency tool that generalizes the costs for utilities and their systems to determine what is at risk. Understanding what is at risk is fundamental in developing a vulnerability assessment.

#### **Potential Implementation Activities**

##### **Activity 1: Provide technical assistance for the development of site specific vulnerability assessments**

Provide technical assistance to individual plant managers to assist in the development of site specific vulnerability assessments. Providing this assistance encourages the development of a site specific plan, ensures that the treatment plant developing the plan is aware of available sea level rise information, and helps maintain consistency amongst the plans throughout the state. Most of the tools that currently exist are at the national level and a Delaware specific template should be developed. Sea level rise information and adaptation information can be included as an expansion of the extreme weather plans that facilities already have.

**Cost:** <\$10,000

**Partners:** DNREC, facility managers, EPA's Check-Up Program for Small Systems, Delaware Rural Water Association, American Water Works Association

##### **Activity 2: Create regulations to require the development of plans that incorporate sea level rise**

Update applicable regulations during their open periods, with the support of Executive Order 41, to require the development or the expansion of existing plans to incorporate the consideration of sea level rise and identify adaptation measures. There may be substantial costs incurred by the facilities to develop these plans, but not for the development of the regulation.

**Cost:** \$10,000 – 100,000

**Partners:** DNREC

### **Activity 3: Develop standard operating procedures and create more robust emergency procedures that incorporate sea level rise**

Because of the money and time associated with the development of a plan, and to ensure that plans are regularly updated, a policy or regulation requirement should be in place statewide. This regulation can be included as part of a site's standard operating procedures.

**Cost:** <\$10,000

**Partners:** Plant managers/owners

### **Activity 4: Develop sea level rise continuing education courses**

Water and wastewater facilities are run by state licensed engineers that need to annually attend education courses. Continuing education courses should be developed that provide information to facility operators, plant managers and plant owners about how to develop a Standard Operating Procedures Manual that incorporates sea level rise. To facilitate this, creating a template would help maintain consistency between the plans throughout the state as well as the information that the plants are receiving. These educational sessions can supplement courses that are already being provided as part of existing education requirements. Educational outreach opportunities also exist at annual association meetings, such as at the Water Environment Federation technical conferences or others sponsored by the American Water Works Association.

**Cost:** \$10,000 – 100,000

**Partners:** DNREC, DelTech and other colleges and universities in the state

## 2014 Workshop and Implementation Plan

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### Recommendation 6.4: Develop best management practice manuals for adaptation in Delaware

*Adaptation measures will be implemented by a variety of stakeholders including municipal and county governments, state government, businesses and individuals. A set of best management practices (BMPs) should be provided for their use and reference. BMP manuals could be created for several different topics including infrastructure siting, residential development, and natural lands management. Manuals should be based upon successful strategies employed by other states, non-profits and the private sector and could be developed in cooperation with local colleges and universities. A toolbox for adaptation could also be created that would highlight successful policies in other states.*

#### Implementation Progress to date

Workshop participants did not identify any specific actions that have already been taken to implement this recommendation in Delaware, but did identify multiple toolkits and existing best management practice (BMP) guidance from federal and state sources that can be modified for sea level rise adaptation.

#### Potential Implementation Activities

##### Activity 1: Create a manual for adaptation measures

The EPA has several guidance documents and a toolkit for adapting to sea level rise and the USDA/NRCS has BMPs that can be used to help develop Delaware specific BMPs for different water resources and agriculture programs. These documents should be evaluated and modified to make them more Delaware specific. The Citizens Technical Advisory Committee's Water Resources Agency has also developed a recharge protections guidance manual. The development of a manual can take anywhere from 6 months to a year to develop and the information can be disseminated through the University of Delaware's Institute for Public Administration's (IPA) or Nonpoint Education for Municipal Officials (NEMO) courses.

**Cost:** \$10,000 – 100,000

**Partners:** DNREC, Non-governmental Organizations

##### Activity 2: Incentivize Best Management Practices

Identify an appropriate messenger, possibly an entity outside of state government, to promote the use of developed BMPs. Incentivize the use of the BMPs with better loan rates through the revolving fund or through the community rating system for flood hazards. There is also the opportunity to reach out to the USDA to incorporate sea level rise into their loan programs.

**Cost:** No costs discussed

**Partners:** DNREC Water Supply section, USDA

# Implementation Activities — Wetlands, Shoreline & Habitat Workgroup

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*The following section documents the discussions of the Wetlands, Shoreline & Habitat Workgroup held during the Delaware Sea Level Rise Adaptation Plan Implementation Workshop. The workgroup was provided with a list of twenty natural resource related recommendations from “Preparing for Tomorrow’s High Tide: Recommendations for Adapting to Sea Level Rise in Delaware.” The workgroup prioritized recommendations for discussion during the day and was able to discuss nine recommendations in detail. For each recommendation, specific “implementation activities” proposed by workgroup members are listed. These activities are intended to provide specific and discrete steps that can be taken to achieve the intent of each recommendation. For each activity, costs and necessary partners are listed if discussed by the group. Recommendations not outlined below were not discussed by this workgroup, but may have been discussed by one of the other three workgroups at the workshop (see Appendix C).*

## 2014 Workshop and Implementation Plan

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### **Recommendation 1.4: Incorporate sea level rise into public and private sector regional planning efforts**

*Much of Delaware's infrastructure is part of regional networks, including electrical generation, roads, rail, and landfills. Delaware's wetlands, habitats of conservation concern, beaches and nature preserves are also part of a regional system of wildlife and fish habitats. Incorporation of a common set of sea level rise information into regional planning processes for these resources will help ensure that informed decisions about adaptation are made and that the entire regional system is sustainable. Regional planning processes that should be targeted include: Wilmington Area Planning Council and Dover/Kent Metropolitan Planning Council long range plans for transportation, Amtrak long range plans, business group and industry contingency plans, and regional habitat plans.*

#### **Implementation Progress to Date**

The Delaware Byway Plan has identified the Route 9 corridor as an area of concern due to current and future impacts of sea-level rise. Strategies are currently being developed to enhance the Route 9 corridor area to address restoration opportunities, impacts to habitat, infrastructure and communities.

The DNREC Division of Fish and Wildlife is currently updating the State Wildlife Action Plan and will include a vulnerability assessment for sea level rise as part of this plan. The Wildlife Action Plan will also include outreach to its stakeholders and the public. The anticipated date of completion is fall 2015.

The North Atlantic Landscape Conservation Cooperative (NALCC) is a US Fish and Wildlife initiative (USFWS), a partnership of state agencies, non-governmental organizations and academia who seek to address regional conservation efforts. The NALCC is currently incorporating the future impacts of sea level rise by using spatial models to observe the natural migration of shorelines, storm events and habitation of marsh species. This spatial data will help identify areas that need protection and management.

Sea level rise was also incorporated into the Prime Hook National Wildlife Refuge Comprehensive Conservation Plan (CCP) by including goals and objectives with climate adaptation strategies. The CCP highlighted sea level rise as a decision-driver for the future conservation of the Prime Hook National Wildlife Refuge. USFWS is regionally following the outcome of the LCC and individual CCP's by moving toward regional coordination and an emphasis on surrogate species.

A Regional Sediment Management Plan for the Delaware Estuary has recently been approved and includes sediment uses for areas impacted by sea level rise. The Regional Sediment Management Plan was developed by the Regional Sediment Management Workgroup, composed of the USACE, Partnership for the Delaware Estuary, DNREC, Environmental Protection Agency, and Delaware River Basin Commission. The workgroup recently funded and helped implement the "Pepper Creek Beneficial Reuse Project."

### Potential Implementation Activities

#### Activity 1: Create a database for communication and coordination of planning efforts and conduct a gap analysis

Sea level rise is being incorporated into many regional planning efforts and there is a need to help increase communication and coordination among private, public sectors and academia. Since there is staff limitation among multiple agencies, it was suggested that a part-time position be funded to create a database of all current and ongoing sea level rise planning efforts and complete a gap analysis. Having one staff member (intern or graduate fellow) to be the point of contact for this database could help identify various planning efforts to prevent duplicative activities as well as increase communication among agencies. Initially, this staff member could be housed by Delaware Coastal Programs (DCP) until this position could be moved in-house by other groups.

**Cost:** \$50,000

**Partners:** DNREC Delaware Coastal Programs, DNREC Division of Fish and Wildlife

#### Activity 2: Create a Coastal Resiliency Toolkit

With the help from universities and state and federal agencies, The Nature Conservancy has developed a Coastal Resilience Toolkit in New Jersey. This web application is used to assist community planning by looking at sea level rise scenarios, migration corridors, and areas in need of protection. An example of community planning would be planning for strategic retreat. This web application does not include Delaware due to the need for funding to expand the system into adjacent states. This could be a useful tool for Delaware coastal communities planning for resiliency.

**Cost:** \$50,000 - \$75,000

**Partners:** USFWS, The Nature Conservancy, DNREC, University of Delaware, Delaware State University, other non-governmental organizations

**Prerequisite:** Recommendation 1.7 should be completed prior to this recommendation

### Additional Information

It was suggested that Recommendation 1.7 (Conduct a comprehensive inventory of key funding, coordination, regulations and policies and analyze them for barriers and opportunities for sea level rise adaptation) needs to be completed so it can be applied to Recommendation 1.4.

It was noted multiple times throughout conversations that there is a lack of communication about sea level rise planning efforts among public and private sectors. MARCO and the NALCC are two regional planning entities that should come together for regional planning efforts. There is also a need to reach out to energy facilities that are dealing with sea level rise as they are planning for future and replacements sites.

## **2014 Workshop and Implementation Plan**

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There were several questions that arose about the USACE Regional Sediment Management Plan, including whether there are limitations that prevent the USACE from conducting good beneficial reuse projects and whether USACE “business lines” need to be reconciled to implement ideas from the Sediment Management Plan.

### **Recommendation 2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects**

*Sea level rise is an emerging issue that many state and local regulations do not yet consider. A variety of adaptation measures from raising buildings to protecting shorelines may not be permissible or may take longer to permit than measures which do not include sea level rise considerations, setting up a perverse incentive that could result in no adaptation or maladaptation. Local and state regulations and building codes should be assessed for opportunities to provide incentives for adaptation, particularly for demonstration projects. As an example, the Delaware Department of Natural Resources and Environmental Control recently issued a “Statewide Activity Approval” for shoreline stabilization projects that incorporate natural and planted marshes. Under this approval, average permitting times will be reduced to one to two weeks.*

#### **Implementation Progress to Date**

The Statewide Activity Approval (SAA) for shoreline stabilization projects was developed and is being used to permit shoreline stabilization projects. The SAA reduces the permitting process by 1-2 weeks.

The purpose of the Industrial Users Workgroup was to encourage soft shore stabilization (green infrastructures) as opposed to hard structures.

The National Flood Insurance Program provides flood insurance discounts to residents whose community participates in the Community Ratings System. This system assigns points for voluntary risk reduction activities; the more points a community earns the better insurance discount it can provide its citizens. The problem is that not all areas are covered by the community rating system and floodplain regulations allow rebuilding in areas prone to damage.

#### **Potential Implementation Activities**

##### **Activity 1: Provide comprehensive outreach and education on the permitting process for environmental restoration projects**

Sometimes landowners become discouraged by the 8-10 week permitting process for projects that would result in habitat restoration and are often unclear on the state, federal, county permitting process. As an example, a homeowner in the Hartley area wanted to restore a forested wetland that was previously a dumping area. He became discouraged because of the 8-10 week permitting process. It was recommended that the permitting process needed to be clarified to allow landowners to understand the process. This can be addressed through an education and outreach program for landowners on the permitting process, restoration and other activities that would require a permit.

**Cost:** Unknown

## 2014 Workshop and Implementation Plan

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**Partners:** Delaware National Estuarine Research Reserve Coastal Training Program, Delaware Nature Society, The Nature Conservancy, DNREC

### Activity 2: Develop a post-storm retreat strategy

There is a need for increased communication with FEMA for post disaster activities and identification of areas that are in need of improvements for resiliency. A post-storm retreat strategy would help prepare residents, private and public sectors for future storms that could impact Delaware.

**Cost:** Unknown

**Partners:** DNREC, FEMA, NOAA

### Activity 3: Promote financial incentives for adaptation

The Clean Water Initiative includes cost share programs, low interest loans and State Revolving Fund green infrastructure incentives to communities. Some of this funding is the easiest funding for communities to obtain, but it needs to be promoted. One option would be to create a presentation to show the Clean Water Advisory Committee.

**Cost:** Unknown

**Partners:** DNREC, TNC, DNS

### Additional Information

The USACE Nationwide Permit program, a streamlined permit program for minor impacts to waters of the U.S., allows for hardening shorelines but not for innovative restoration. Although nationwide permits can be used for some restoration projects, there are issues with the vocabulary used. Using the terms “green infrastructure” can limit projects that can fit within the criteria and creates hesitation from contractors. Alternative language may be necessary.

There are regulatory issues with wetland classification; restoration plans that incorporate sea level rise go beyond wetland areas.

Impacts to adjacent properties need to be taken into consideration.

FEMA post disaster construction requirements allow little flexibility for adaptation in regulations with the exception of levees that protect communities. The levees in Delaware were allowed to add armory to prevent over washing.

There is also a need for regulatory consistency between states to have an outcome similar to the USACE nationwide permit.

## Wetlands, Shoreline & Habitat

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Allowing a higher density of properties would help preserve open space areas for sea level rise migration and protect sensitive areas. There is also a need for creating language in regulations that would allow for retrofit work.

## 2014 Workshop and Implementation Plan

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### **Recommendation 3.8: Develop a framework for decision-making regarding land protection and restoration strategies based on habitat vulnerability, migration potential and relative importance in the regional landscape, historical significance or other key factors**

*In order to prioritize land acquisition and protection strategies in light of sea level rise impacts, a decision tree, process model, cost/benefit analysis, or similar tools are needed. The U.S. Geological Survey is developing a computer model to prioritize habitat types for the northeast region. Upon completion, this model may assist in determining priority needs that consider a broader, regional context. Consideration should also be given to the ecological services provided by these lands and economic values placed on them. Land acquisition should be aggressively targeted for the highly ranked habitat types.*

#### **Implementation Progress to Date**

The NALCC has a sea level rise model and decision support tool that can be used to support this recommendation. The NALCC is also working on targeting areas of significance for wetland migration using sea level rise models.

The Delaware Open Space Council has redrafted its land conservation criteria to give greater emphasis to property that would be beneficial to wetland migration.

The DNREC Delaware Coastal Programs recently completed the Coastal and Estuarine Land Conservation Program Plan and included sea level rise in its plan and criteria.

Delaware Nature Society has a workgroup of conservation groups that own or protect land to identify priority habitats with conservation resources. This group is considered to be watershed specific. There is also a Bayshores specific subgroup that looks specifically at priority areas of conservation in the Delaware Bayshores region.

DNREC Delaware Coastal Programs has an ongoing project for a graduate research fellow that will focus on wetland ecosystem evaluations.

The Partnership for the Delaware Estuary has a conceptual “marsh futures” proposal/map that designates areas for living shorelines based on shoreline dynamics. Additional information about this project could be obtained from Dr. Danielle Kreeger.

### Potential Implementation Activities

#### **Activity 1: Create a sea level rise natural resources coordinator position**

This position could be complimentary to the position identified in Recommendation 1.4. Workgroup participants believe that it would be helpful to have one primary point of contact that specifically focuses on sea level rise and natural resources within the state. This position would prevent duplication of regional efforts and duplication of efforts between organizations.

**Cost:** Unknown

**Partners:** DNREC

**Prerequisites:** Position listed in Recommendation 1.4 would be complementary

#### **Activity 2: Provide funding and support for the Land Protection Workgroup**

Delaware Nature Society chairs a Land Protection Workgroup that includes conservation groups and government groups that own land. The goal of this group is to be complementary to land protection/conservation efforts and to identify strategic areas for protection from future sea level rise impacts. This workgroup has just developed and had an additional meeting in May 2014 to identify targeted areas for group project funding and land acquisition. Additional funding will be needed to complete a cost benefit analysis, expansion of the workgroup and land acquisitions. Another goal of this workgroup is to try and find a dedicated funding source to buy large areas of land that all workgroup members have identified as important, rather than having each member work individually on small pieces of land.

**Cost:** \$25,000-\$50,000 for workgroup expansion; Millions of dollars for land acquisitions

**Partners:** Delaware Nature Society, The Nature Conservancy, DNREC, Center for the Inland Bays, Farmland Preservation Program, USFWS, Delaware Wild Lands, Nanticoke River Alliance, Chesapeake Conservancy

### **Additional Information**

Kent Messer is a University of Delaware Environmental Economist who could serve as a local resource for projects and activities that support Recommendation 3.8. There is also a need to ensure that the Farmland Preservation Program, power companies and other private sectors are included in this process.

## 2014 Workshop and Implementation Plan

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### **Recommendation 3.9: Develop a comprehensive wetlands restoration, protection and retreat strategy in response to sea level rise**

*A comprehensive wetlands restoration strategy for the state is necessary given the anticipated impacts from sea level rise. The strategy should include: identification of uplands for preservation and acquisition to provide areas for marsh migration; prevention of the construction of structures that would act as barriers to migration; identification of wetland restoration techniques to allow wetlands to keep pace with sea level rise; cataloging of pertinent research needs; identification of policy and regulatory changes, and; development of an outreach strategy. Specific ideas that could also be incorporated include evaluating Phragmites control techniques, beneficial re-use of sediment, and rolling easements.*

#### **Implementation Progress to Date**

A Regional Sediment Management Plan for the Delaware Estuary has recently been approved and includes sediment uses for areas impacted by sea level rise. The Regional Sediment Management Plan was developed by the Regional Sediment Management Workgroup, composed of the USACE, Partnership for the Delaware Estuary, DNREC, Environmental Protection Agency, and Delaware River Basin Commission. The workgroup recently funded and helped implement the “Pepper Creek Beneficial Reuse Project.”

There are several projects in Delaware that are researching wetland responses to sea level rise. The Delaware Bayshores Initiative is identifying areas for upland migration and restoration in the Delaware Bay from New Castle to Lewes. Prime Hook National Wildlife Refuge is completing a restoration and monitoring project in response to the breaches in their dune system. Monitoring in Prime Hook National Wildlife Refuge will document changes to provide lessons learned from this large pilot project.

The National Fish and Wildlife Foundation is providing funding for impoundment restoration, Milford Neck restoration alternatives research/planning and Mispillion Harbor restoration. Delaware and New Jersey National Estuary Programs will be implementing restoration in Mispillion Harbor.

The Comprehensive Wetland Strategy will be updated to include sea level rise and climate issues, such as strategies for retreat. The NALCC has a sea level rise model and decision support tool that can be used to support this recommendation. The NALCC is also working on targeting areas of significance for wetland migration using sea level rise models.

The Partnership for the Delaware Estuary has a conceptual “marsh futures” proposal/map that designates areas for living shorelines based on shoreline dynamics.

The DNREC Division of Fish and Wildlife is beginning new management strategies for its coastal impoundments. The Little Creek impoundments engineering design has been funded, but funding for implementation of this project design might still be needed. The Ted Harvey impoundment test project for moving impoundments inland in response to sea level rise is funded and will be moving forward.

### Potential Implementation Activities

#### Activity 1: Update Wetland Maps to include migration zones

Currently, there is no regulatory authority for protecting land to allow for inland migration of wetlands. Incorporating areas that have potential to be wetland migration zones on regulatory wetland maps could allow for regulatory actions and protection of additional wetlands. There is currently a pilot project to test methodologies for updating the tidal wetland map statewide, but this does not include a wetland migration component.

**Cost:** Unknown

**Partners:** DNREC Delaware Coastal Programs, DNREC Wetlands and Subaqueous Lands Section

**Prerequisite:** No

#### Activity 2: Assess marsh transition zones

To develop wetland migration “hot spots,” an assessment of wetland transition zones is needed. Assessing marsh transition zones could help identify priority areas for land acquisition. The elevation of land will be an important factor towards developing a retreat strategy for wetlands in response to sea level rise.

**Cost:** Unknown

**Partners:** DNREC Delaware Coastal Programs, Wetland Monitoring and Assessment program, Delaware Wild Lands, Delaware Nature Society, The Nature Conservancy, Farmland Preservation

#### Activity 3: Conduct education and outreach programs for affected landowners

There is a need to provide education and outreach to private landowners about the process of wetland migration and potential impacts. Creating programs to inform private landowners may help prevent landowners from taking actions that could potentially have more negative impacts to the land (like berms and hardened shorelines).

**Cost:** Unknown

**Partners:** DNREC, The Nature Conservancy, Delaware Nature Society

## 2014 Workshop and Implementation Plan

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### **Additional Information:**

There is a need for coordination between programs to understand pilot projects, target areas for retreat, potential and new projects. Studies also need to be implemented about tools for managing wetland migration, like conservation easements.

### **Recommendation 3.12: Designate shoreline zones for adaptation action**

*Shoreline protection and restoration projects require federal, state and sometimes local permits. Hardening of shorelines (e.g., with bulkheads or riprap) is generally discouraged by state policies, but may be the most appropriate adaptation response in urban or industrial areas. Conversely, soft or “living” shorelines may be the most appropriate in rural or environmentally sensitive areas. Criteria for shoreline adaptation would have to be based on peer-reviewed literature and done in collaboration with stakeholders. Planning for and designating areas statewide where shoreline hardening would be allowed, where hardening would be discouraged, and where living shorelines will be encouraged will provide certainty for permit applicants and may streamline the permitting process. These designations should also be incorporated into appropriate federal, state and local permitting processes*

### **Implementation Progress to Date**

Permitting for shoreline structures is currently being done on a case by case basis. The Delaware City Refinery has proposed using wave attenuation devices to create a stable shoreline without additional placement of sediment.

There is a Delaware Living Shorelines Workgroup that is composed of multiple agencies whose goal is to implement living shoreline projects. These living shorelines are permitted using the Statewide Activity Approval, issued by the DNREC Division of Water. There is a need for a website for the Education and Outreach subcommittee since there is currently no lead or host.

The Wetland Monitoring and Assessment Program is working with the Partnership for the Delaware Estuary on living shoreline design and installation. There are currently four living shoreline projects being installed in low energy sites; these projects will be monitored for 3-5 years to provide information about their success. Contractors will be invited for the initial design phase and will be kept involved in the process to show the benefits of living shorelines.

The Partnership for the Delaware Estuary has a conceptual “marsh futures” proposal/map that designates areas for living shorelines based on shoreline dynamics.

The NALCC sea level rise sea level rise model and the Regional Sediment Management Plan could be used as a basis to designate shoreline zones for adaptation action. Workshop participants wanted more information about this modeling effort.

### Potential Implementation Activities

#### Activity 1: Use living shorelines as demonstration projects

It was identified that contractors prefer shoreline hardening methods over the use of living shorelines due to failure, maintenance and lack of living shoreline demonstration sites. There is a need for demonstration projects to highlight the design process and design options. Monitoring these sites is also important to show success. Providing contractors with data and demonstration sites with various designs this will allow them to better integrate these options into future project designs. Demonstration sites are not only beneficial to contractors, but they can be used with education and outreach programs to the public.

**Cost:** Varies depend upon location and design

**Partners:** DNREC, Partnership for the Delaware Estuary, USFWS, Center for the Inland Bays

#### Activity 2: Inland Bays Shoreline Vulnerability Assessment

The University of Delaware received a grant from DNREC to complete a storm surge study on the Inland Bays and Bayshores communities. This study is more site-specific and detailed than the existing sea level rise bathtub models. The key to this project is to expand it to the entire shoreline of Delaware, but a complete shoreline vulnerability assessment is needed in all three bays.

**Cost:** \$125,000

**Partners:** DNREC, University of Delaware, Center for Inland Bays

#### Additional Information:

Lack of staff and inability to fill vacancies was identified as a limitation to long term monitoring of living shoreline projects. An example of this is in the Wetlands and Subaqueous Lands section of DNREC. This section is understaffed with 5 individuals issuing permits for the entire state of Delaware.

Although some areas are understaffed, there is an opportunity for internships for undergraduate and graduate students to complete monitoring and create active documents. Increased communication between state agencies and academia and establishing contacts is an important step to allow students to take advantage of these potential opportunities.

There is also a need for hybrid living shoreline project designs that use some hardened structure. With the growing popularity of living shorelines, precautions need to be taken to make sure that the location of the living shoreline is appropriate to prevent failure. In some areas outside of Delaware, living shorelines are required and being installed in unsuitable locations which leads to a rate of high failure.

## **2014 Workshop and Implementation Plan**

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There was a question as to the points of contact for Executive Order 41 policy recommendations for sea level rise.

### **Recommendation 4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise**

*A comprehensive outreach strategy should be developed to increase stakeholders' understanding of sea level rise, its effect on many aspects of life, and ways to reduce these impacts. A strategy may include consideration of the best ways to reach different audiences. Education efforts should include both year-round and seasonal residents, children, government officials, businesses, commercial property owners, farmers, real estate agents, insurance agents, utilities and industries so that informed decisions can be made in the future. Increased education could engage more agencies, increase funding opportunities and result in support to help integrate sea level rise into long-range management plans, gain acceptance of the management decisions made, and possibly influence legislative decision making. In addition, providing information about other successful sea level rise adaptation programs and initiatives may further increase Delaware's acceptance of sea level rise and adaptation strategies.*

#### **Implementation Progress to Date**

Sea Level Rise Awareness Week, held in September 2013 and 2014, was organized by a coalition of environmental organizations. This outreach strategy was very successful. The group sponsored DNREC's Reclaim Our Rivers 5K during Sea Level Rise Awareness Week and participated in the University of Delaware's Coast Day.

DNREC's Wetland and Monitoring Assessment Program has produced a Wetlands Education video about sea level rise and wetlands.

The Delaware Nature Society teamed up with Interfaith Power and Light to educate the church community about climate change and sea level rise. Brenna Goggin from Delaware Nature Society has given Sunday presentations to the Presbyterian Church congregation in Wilmington. Church communities in Wilmington have been responding positively to information about sea level rise and have asked for additional presentations.

The Nature Conservancy Community Outreach Coordinator is expanding outreach activities to include sea level rise in the future, but funding and staff capacity are issues.

#### **Potential Implementation Activities**

##### **Activity 1: Create targeted workshops for sea level rise education**

Sea Level Rise Awareness Education is an important component in creating an outreach strategy to educate stakeholders about sea level rise. The Delaware Nature Society has already established Sea Level Rise Awareness Week, but still needs funding and would like to create workshops targeting specific stakeholder groups in Delaware.

## 2014 Workshop and Implementation Plan

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There is some pushback by parents to the Delaware Department for Education with regard to incorporating sea level rise into updated school curriculums. Hosting a targeted workshop for parents, teachers and the Department of Education could be beneficial. The education system is one example of a targeted group, but it could also include farmers, homeowners associations, communities and others.

**Cost:** \$5,000-\$10,000

**Partners:** State agencies, National Wildlife Federation, Pepco

### **Activity 2: Re-survey Delaware residents about sea level rise**

In 2009, about 1,500 Delaware residents over the age of 18 were surveyed about sea level rise and climate change. Almost 80% of people surveyed agreed that *if* sea level rise was happening that it would be a good idea to begin planning for the future. Results from re-surveying Delaware residents could be used to make more informative decisions about an education and outreach strategy.

**Cost:** Unknown

**Partners:** DNREC

### **Recommendation 5.13: Identify and preserve areas for potential wetland migration**

*As coastal wetlands become permanently inundated, it is vital to facilitate the landward migration of these habitats to maintain their valuable functions. Available geographic information system (GIS) data can help identify lands adjacent to wetlands that have the potential to accommodate future marsh migration. Criteria should be developed to prioritize lands for acquisition or permanent conservation easements. As an example, areas that are undeveloped or lack barriers such as major transportation routes or other infrastructure would more easily accommodate wetland migration. Also agricultural land that is no longer productive due to salt-water intrusion may better accommodate future wetland migration. Areas identified as suitable for potential migration and the means to prohibit structures or obstructions in these areas should be thoroughly evaluated.*

#### **Implementation Progress to Date**

The NALCC sea level rise model will help identify target areas for wetland migration. This will include regional priority and state priority areas. This sea level rise model has been in development for several years and is using Hurricane Sandy funds to create this decision support tool. The end product goal is to create a GIS layer or a web based tool for decision makers.

The Land Protection Group is currently identifying parcels for protection that are located next to protected lands.

#### **Potential Implementation Activities**

##### **Activity 1: Develop a coastal resilience toolkit**

With the help from universities and state and federal agencies, The Nature Conservancy has developed a Coastal Resilience Toolkit in New Jersey. This is a web application used to assist community planning by looking at sea level rise scenarios, migration corridors, and areas in need of protection. An example of community planning would be planning for strategic retreat. This web application does not include Delaware due to the need for funding. This could be a useful tool for Delaware coastal communities planning for resiliency.

**Cost:** \$75,000 - \$50,000

**Partners:** USFWS, regional non-governmental organizations, DNREC, University of Delaware, Delaware State University, other state groups

## 2014 Workshop and Implementation Plan

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### **Activity 2: Include beach and dune migration considerations in preservation decisions**

It was recommended that beach and dune migration rates should be incorporated with sea level rise estimates to identify areas to preserve. There is a lack of focus in resources on beaches and dunes. The NALCC sea level rise model uses piping plover habitat data for beaches and dunes.

**Cost:** Currently underway with the North Atlantic LCC

**Partners:** USFWS, DNREC Division of Fish and Wildlife, DNREC Delaware Coastal Programs, DNREC Open Space Program, The Nature Conservancy, Delaware Nature Society

### **Activity 3: Coordinate funding sources for purchasing land**

There is an agreement between the Open Space Council and the Farmland Preservation Program to leverage funding for land preservation for agricultural land and open space. This will require looking across Delaware's counties and identify program overlap. Although the Farmland Preservation Program does not want to change their program, there could be opportunity for easements for sea level rise and to include a premium on land located near wetlands.

**Cost:** Unknown

**Partners:** Open Space Council, Farmland Preservation Program, private foundations

### **Additional Information**

Some of the activities included under this recommendation have already been suggested in other sections. Recommendation 5.13 could be combined with a similar recommendation (5.18) or added as a sub-recommendation. Criteria have already been developed to identify and preserve areas for wetland migration and there are current projects already underway. Communication and coordination needs to be increased among public and private sectors to prevent duplicative efforts.

### 5.18: Foster pilot projects that demonstrate the effectiveness of best management practices for management of agriculture lands affected by sea level rise

*Pilot projects to demonstrate or to study the effectiveness of best management practices could be used to provide guidance to land managers to better adapt to sea level rise. These projects would provide insight on the effectiveness of the adaptation strategy and provide information on the associated costs.*

#### Implementation Progress to Date

The University of Delaware has an ongoing project studying the use of seashore mallow in marginal agriculture fields and its viability for chicken house bedding. University of Delaware also has a groundwater research project with sites at the Delaware National Estuarine Research Reserve.

Under Executive Order 41, the Department of Agriculture will be developing best management practices. Better cooperation and communication needs to be established with the Department of Agriculture and the Cooperative Extension.

#### Potential Implementation Activities

##### Activity 1: Conduct pilot projects for sea level rise transition zones

There is a need to understand the impacts of sea level rise and how it will impact forested lands. To understand the impacts of sea level rise to forested lands, pilot projects need be established. These projects would include experimenting with cutting down trees adjacent to wetland and agriculture lands to create a transition zone for the marsh to naturally migrate to and create suitable habitat. Bombay Hook currently has some agriculture fields that are adjacent to the marsh and could be a potential area for a pilot project.

It was noted that fine-scaled habitat characteristics, such as slope and hydrodynamics, should be taken into consideration when establishing pilot projects.

**Cost:** Unknown

**Partners:** USFWS, DNREC, The Nature Conservancy, University of Delaware, Delaware Wildlands

**Prerequisite:** Identify areas that areas that could be used as pilot projects.

##### Activity 2: Provide support for the University of Delaware seashore mallow project

The University of Delaware is studying the use of seashore mallow in marginal agriculture fields. There is a need for seed money for projects that can be stepping stones for larger proposals. One option for funding this project could be through the Delaware Coastal Programs Community Grant Projects.

**Cost:** Unknown

## 2014 Workshop and Implementation Plan

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**Partners:** University of Delaware, DNREC, Delaware Wild Lands

### **Activity 3: Create an education and outreach programs for farmers**

The impacts of sea level rise can be detrimental to farmers who dedicate their agricultural land to particular crops that cannot withstand changes to soil salinity. Many landowners will build berms or other types of hard structures to keep their land productive. By creating a program to educate private landowners about best management practices, alternative crops and farming strategies, doors would open for conversations about the impacts of sea level rise and adaptation strategies.

**Cost:** Unknown

**Partners:** DNREC, The Nature Conservancy, University of Delaware, Delaware Wildlands

### **Additional Information:**

In Maryland, The Nature Conservancy is working with the University of Delaware to plant switchgrass in low lying areas of agriculture fields. These low lying areas were historically wetlands or drainage areas. The Nature Conservancy would like to begin using this strategy to Delaware agriculture famers as an alternative to traditional drainage practices.

### 6.5: Develop a database of costs of adaptation options for use by decision-makers and the public

*Such a database should include examples of the costs of elevating buildings, beach nourishment, abandoning buildings, elevating roadways, building hardened shorelines, elevating and repairing dikes, and constructing living shorelines. Cost estimates cannot be site-specific but may be able to provide general guidelines. This database should also incorporate cost benefit analyses that would evaluate retreat, accommodation, avoidance and protection measures, including return on investment.*

#### Implementation Progress to Date

The DNREC Delaware Coastal Programs has obtained a NOAA Coastal Management Fellow to work on an “Economic Valuation of Ecosystem Services of Wetlands.” This staff member was hired to work specifically on the background data for developing a database.

The Delaware Bay Beach Working Group conducted an Economic Analysis that investigated management and retreat options in communities where the state manages beaches. This economic analysis can be incorporated into any new database.

#### Potential Implementation Activities

##### **Activity 1: Create a workgroup for the valuation of wetland ecosystem services**

Development of ecosystem services valuations for wetlands will require partnering with multiple state and government agencies as well as other non-governmental organizations with an interest in wetland valuation. A workgroup should be formed that could guide this project and the development of a database for decision-makers and the public.

**Cost:** N/A

**Partners:** DNREC Delaware Coastal Programs, DNREC Watershed Assessment Section, DNREC Shoreline and Waterway Section, The Nature Conservancy, Environmental Economists

##### **Activity 2: Create a database and hosting mechanism**

Two types of databases could be created: 1) publically available database; and 2) a decision support tool for coastal managers. This database would present the best available adaptation options and the cost in a particular area for coastal managers and decision makers after conditions have been input.

During the discussion, it was suggested that a database should include the following: examples and case studies with methods; comparisons of ecosystem services vs. building infrastructure, and a cost benefit analysis (the cost of losing resources and the cost of rebuilding). The cost benefit analysis should include impacts to adjacent land areas. There is also a need to define the term “return on investment” when quantifying the value of ecosystem services as well as looking at the long term “return” of adaptation options.

## 2014 Workshop and Implementation Plan

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DNREC could initially start the database until additional decisions are made about who would host this database and whether it could be linked to the NOAA Coastal Services Center.

**Cost:** \$75,000-\$100,000 (includes creation and maintenance)

**Partners:** The Nature Conservancy, DNREC

**Prerequisite:** Gathering data to support the database

### **Additional Information:**

There is a Wisconsin report that did a study that compared ecosystem services versus building infrastructure. This report also included the cost of losing natural resources. This could be a resource of background data as a first step towards creating a database.

# Appendix A – Workshop Attendees and Breakout Groups

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## 2014 Workshop and Implementation Plan

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## Appendix A

NAME		AGENCY
Ann	Alexander	AAUW Dover
Robert	Arlett	Beach Bound Realty
Tricia	Arndt	Delaware Department of Natural Resources and Environmental Control
Bonnie	Arvay	Delaware Department of Natural Resources and Environmental Control
Bernard	Au	Delaware Transit Corporation
David	Bacher	NRG Energy, Inc.
Barry	Benton	Delaware Department of Transportation
Jeffrey	Bergstrom	City of New Castle
Bob	Beyer	League of Women Voters of Delaware
Mark	Biddle	Delaware Department of Natural Resources and Environmental Control
Ronald	Bounds	Delaware State Police
Brian	Boutin	The Nature Conservancy
Donald	Byrom	M&T Bank
Wendy	Carey	University of Delaware
David	Carlson	Delaware Emergency Management Agency
Kimberly	Cole	Delaware Department of Natural Resources and Environmental Control
Sarah	Cooksey	Delaware Department of Natural Resources and Environmental Control
Ben	Coverdale	Delaware Department of Agriculture
Kevin	Coyle	Delaware Department of Natural Resources and Environmental Control
Silvana	Croope	Delaware Department of Transportation
Jennifer	de Mooy	Delaware Department of Natural Resources and Environmental Control
Barbara	DeHaven	Delaware Economic Development Office
Mark	DeVore	State of Delaware Facilities Management Office
Gary	Drejka	Delaware Resident
Morgan	Ellis	Delaware Department of Natural Resources and Environmental Control
Molly	Ellwood	Delaware Department of Natural Resources and Environmental Control
Thomas	Ferris	New Castle County Office of Emergency Management
Victoria	Ford	Delaware Office of Management and Budget
Karen	Gelman	Amtrak
Ryan	Gergely	Delaware Department of Natural Resources and Environmental Control
Brenna	Goggin	Delaware Nature Society
Valerie	Gray	Delaware Department of Natural Resources and Environmental Control
Mary Ellen	Gray	Kent County Department of Planning
Alice	Guerrant	Delaware Division of Historic and Cultural Affairs
Susan	Guiteras	US Fish and Wildlife Service
Davis	Gwen	Delaware Division of Historic and Cultural Affairs
Edward	Hallock	Delaware Office of Drinking Water
Lorielee	Harrison	Delaware Department of Insurance
Andrew	Hayes	ForeSite Associates, Inc.

## 2014 Workshop and Implementation Plan

Lyndie	Hice-Dunton	Delaware Department of Natural Resources and Environmental Control
Patricia	Hoffman	Delaware Department of Natural Resources and Environmental Control
Jennifer	Holmes	Delaware Department of Natural Resources and Environmental Control
Virgil	Holmes	DNREC Division of Water
Karen	Horton	Delaware State Housing Authority
Jon	Hurdle	Delaware First Media/WDDE
Ruth Ann	Jones	Delaware Office of Management and Budget
Kevin	Kalasz	Delaware Department of Natural Resources and Environmental Control
John	Kennel	Delaware Department of Natural Resources and Environmental Control
Smith	Kenneth	Delaware Department of Natural Resources and Environmental Control
Stephen	King	Delaware Department of Health and Social Services
Michael	Kirkpatrick	Delaware Department of Transportation
Don	Knox	Delaware Emergency Management Agency
Susan	Love	Delaware Department of Natural Resources and Environmental Control
William	Lucks	Sperry Van Ness
Karen	McGrath	Office of Senator Carper
Kim	McKenna	Delaware Department of Natural Resources and Environmental Control
Jeanette	Miller	University of Delaware
Terry	Pepper	Delaware Emergency Management Agency
Rick	Perkins	Delaware Department of Health and Social Services
Michael	Powell	Delaware Department of Natural Resources and Environmental Control
Doug	Rambo	Delaware Department of Natural Resources and Environmental Control
Lynn	Riley	Delaware Division of Historic and Cultural Affairs
Alison	Rogerson	Delaware Department of Natural Resources and Environmental Control
Robert	Scarborough	Delaware Department of Natural Resources and Environmental Control
Drexel	Siok	Delaware Department of Natural Resources and Environmental Control
Drew	Slater	Office of Congressman John Carney
Tim	Slavin	Delaware Division of Historic and Cultural Affairs
Catherine	Smith	Delaware Transit Corporation
Brittany	Sturgis	Delaware Department of Natural Resources and Environmental Control
Bill	Swiatek	Wilmington Metropolitan Area Planning Council
Chad	Tolman	Delaware League of Women Voters
Kelly	Valencik	Delaware Department of Natural Resources and Environmental Control
Hilary	Valentine	Delaware Technical and Community College
Christina	Whiteman	Delaware Department of Natural Resources and Environmental Control
Martin	Wollaston	University of Delaware

**LAND USE WORKGROUP**

Robert	Arlett	Lorielee	Harrison
David	Bacher	Karen	Horton
Jeffrey	Bergstrom	Jon	Hurdle
Donald	Byrom	Ruth Ann	Jones
Wendy	Carey	Susan	Love
David	Carlson	William	Lucks
Kimberly	Cole	Terry	Pepper
Kevin	Coyle	Michael	Powell
Barbara	DeHaven	Tim	Slavin
Mark	DeVore	Kenneth	Smith
Mary Ellen	Gray	Chad	Tolman
Alice	Guerrant	Martin	Wollaston

**WATER WORKGROUP**

Ann	Alexander	Edward	Hallock
Tricia	Arndt	Rick	Perkins
Ben	Coverdale	Doug	Rambo
Jennifer	de Mooy	Lynn	Riley
Gary	Drejka	Kelly	Valencik
Molly	Ellwood	Hilary	Valentine

## 2014 Workshop and Implementation Plan

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### WETLANDS WORKGROUP

Bonnie	Arvay	Lyndie	Hice-Dunton
Mark	Biddle	Virgil	Holmes
Brian	Boutin	Kevin	Kalasz
Sarah	Cooksey	Kim	McKenna
Ryan	Gergely	Jeanette	Miller
Brenna	Goggin	Alison	Rogerson
Susan	Guiteras	Brittany	Sturgis
Andrew	Hayes	Christina	Whiteman

### TRANSPORTATION WORKGROUP

Bernard	Au	Jennifer	Holmes
Barry	Benton	Stephen	King
Bob	Beyer	Michael	Kirkpatrick
Silvana	Croope	Don	Knox
Morgan	Ellis	Karen	McGrath
Thomas	Ferris	Robert	Scarborough
Victoria	Ford	Drexel	Siok
Karen	Gelman	Catherine	Smith
Valerie	Gray	Bill	Swiatek
Davis	Gwen		

# Appendix B - Workshop Materials

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## 2014 Workshop and Implementation Plan

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### AGENDA

#### **Preparing for Tomorrow's High Tide: Implementing the Recommendations of the Sea Level Rise Advisory Committee**

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March 26, 2014 · 8:30-4:00

Del Tech Terry Campus Education Technology Building Conference Center  
Building 700, 100 Campus Drive · Dover, Delaware 19904

***Workshop Goal:** This workshop will result in the development of specific implementation actions that can be taken for each of the recommendations of the Sea Level Rise Advisory Committee. These actions will be compiled into one document that can be used as a guide for developing partnerships and soliciting funding for improving Delaware's preparedness for sea level rise.*

**8:30 – 9:00**  
*ETB Rm 727*

**Registration and coffee**  
*\*Pre-registration is required*

**9:00 – 9:50**  
*ETB Rm 727*

**Plenary Session**

Welcome and Introductory Remarks  
Background: Sea Level Rise and Recommendations for Adaptation  
Charge to workshop participants

**9:50 – 10:00**  
*ETB Rm 727*

**Public Comment**

**10:00 – 10:15**

**Break**  
Participants separate into breakout groups

**10:15 – noon**  
*Rm A, B, C, D*

**Breakout Sessions**  
*Four separate breakout sessions will be held concurrently: Wetlands, Shorelines & Habitat; Transportation & Infrastructure; Land Use & Socioeconomics; and Water Resources.*

**Noon – 1:00**  
*ETB Rm 727*

**Lunch (provided)**

**1:00 – 4:00**

**Breakout Sessions Continue**

**4:00**

**Adjourn**

(See Reverse for Breakout Group Agenda and Room Assignments)

**AGENDA**  
**Breakout Groups**

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**Breakout Group Room Assignments:**

Wetlands, Shorelines & Habitat – ETB Room A

Transportation & Infrastructure – ETB Room B

Land Use & Socioeconomics – ETB Room C

Water Resources – ETB Room D

<b>10:15 – 10:30</b>	<b>Welcome, Introductions &amp; Ground Rules</b>
<b>10:30 – 11:50</b>	<b>Discuss and develop list of actions necessary to implement selected recommendations</b>  <i>For each recommendation, the following questions will be considered by the breakout groups:</i> <ul style="list-style-type: none"><li>• <i>Are there any planned or completed activities related to the recommendation?</i></li><li>• <i>What are specific actions that could be taken to implement the recommendation?</i></li><li>• <i>Which actions are pre-requisites?</i></li><li>• <i>What agencies or groups should be involved in implementation?</i></li><li>• <i>What are the approximate costs for each action?</i></li><li>• <i>Are any Federal programs or policies a barrier to action?</i></li></ul>
<b>11:50 – 12:00</b>	<b>Sticky-dot vote to select additional recommendations to discuss</b>
<b>Noon – 1:00</b>	<b>Lunch (provided)</b>
<b>1:00 – 4:00</b>	<b>Continue discussions for selected recommendations</b>
<b>2:30 – 2:45</b>	<b>Break</b>
<b>2:45 – 4:00</b>	<b>Continue discussion for selected recommendations</b>
<b>4:00</b>	<b>Adjourn</b>

## 2014 Workshop and Implementation Plan

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# Delaware Sea Level Rise Adaptation Workshop:

*Implementing the Recommendations  
of the Sea Level Rise Advisory  
Committee*

*March 26, 2014*



Delaware's Sea Level Rise Initiative



## Sea Level Rise is one of the major impacts of global climate change

- Sea level rise is an increase in average tide height over time as a result of:
  - ✓ Thermal Expansion
  - ✓ Melting of glaciers & ice caps
- Influenced locally by *subsidence*



Delaware's Sea Level Rise Initiative



# Sea Level Rise has wide-spread implications for Delaware

- Increased extent of periodic flooding
- Permanent inundation of coastal areas
- Saltwater Intrusion
- Rising water tables
- Contaminant mobility
- Economic & Social Impacts

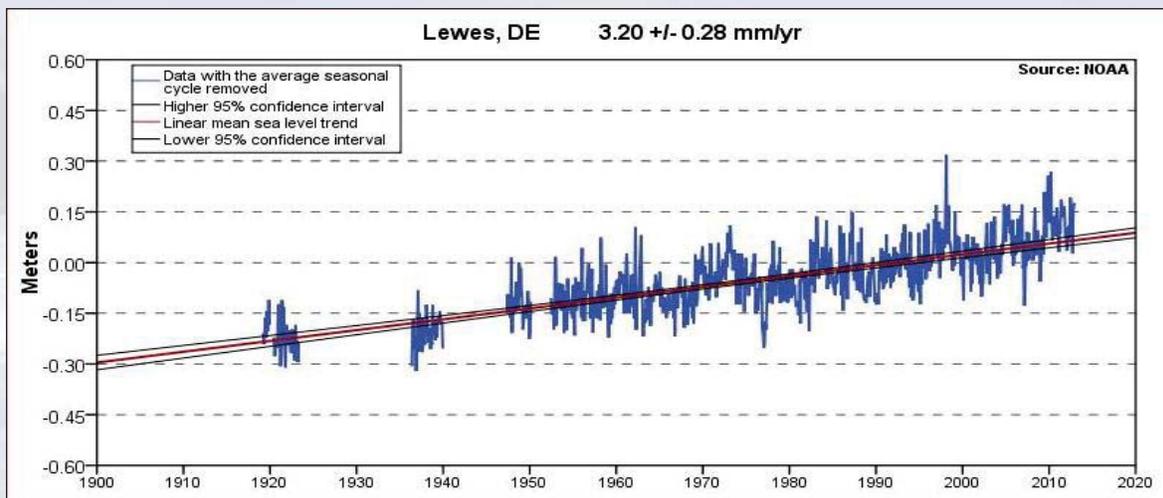


Delaware's Sea Level Rise Initiative



## Sea Level Rise is happening now

**Average annual rate in DE = 3.35 mm/yr  
(13 Inches/100 years)**



**Global rate = 1.7 mm/yr**

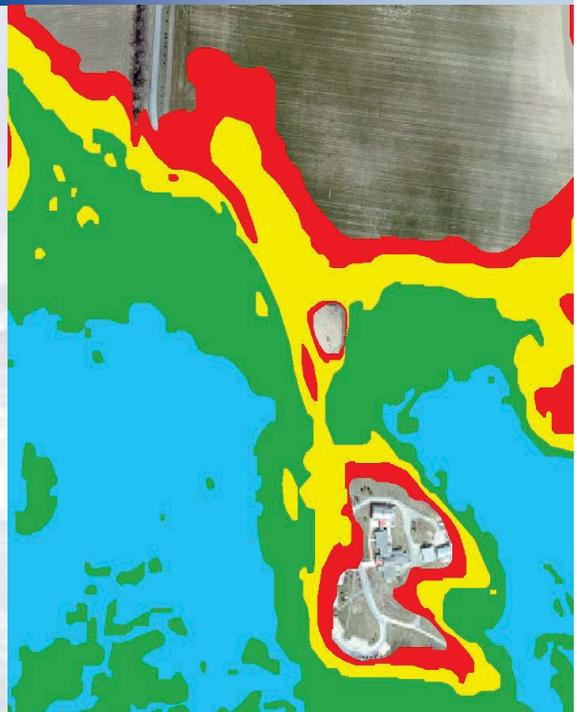


Delaware's Sea Level Rise Initiative



# Rates of sea level rise are very likely to accelerate in the future

- Scenarios for 2100
  - ✓ 0.5 meter increase (Green)
  - ✓ 1.0 meter increase (Yellow)
  - ✓ 1.5 meter increase (Red)
- Scenario Maps
  - ✓ Bath-tub Model
  - ✓ For planning purposes only
  - ✓ **Available online:**  
<http://de.gov/slrmap>

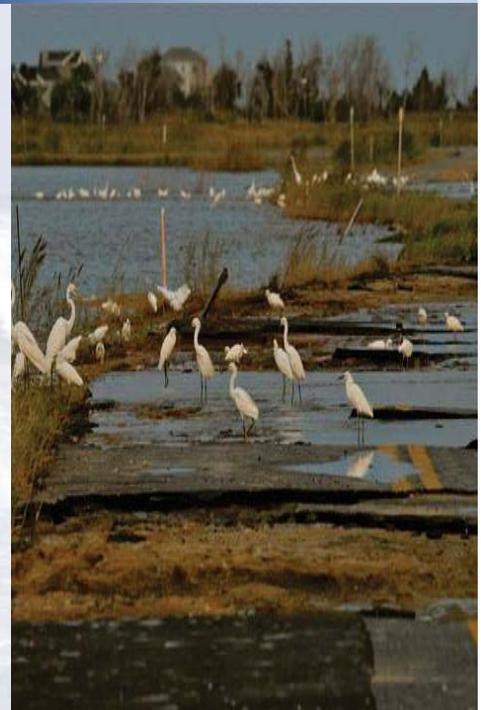


Delaware's Sea Level Rise Initiative



# Proactive Planning for Sea Level Rise is necessary

- Sea levels are rising now and expected to accelerate
- Land use & public works decisions have long life-span
- Two-for-one
  - ✓ Planning for SLR helps mitigate today's flood risk



Delaware's Sea Level Rise Initiative



# DE's Sea Level Rise Advisory Committee made Delaware a leader in climate change preparedness

Delaware Association of Realtors  
Delaware Chamber of Commerce  
Delaware Department of Agriculture  
Delaware Department of Health and Social Services  
Delaware Department of Natural Resources and Environmental Control

Delaware Department of Safety and Homeland Security  
Delaware Department of Transportation  
Delaware Economic Development Office  
Delaware Farm Bureau  
Delaware Insurance Commissioner's Office

Delaware League of Local Governments  
Delaware Legislature  
Delaware Nature Society  
Delaware Office of the Governor  
Delaware Office of Management and Budget  
Home Builders Association of Delaware  
Kent County  
League of Women Voters of Delaware  
The Nature Conservancy  
New Castle County  
Positive Growth Alliance  
Sussex County  
Tidewater Utilities, Inc.  
University of Delaware

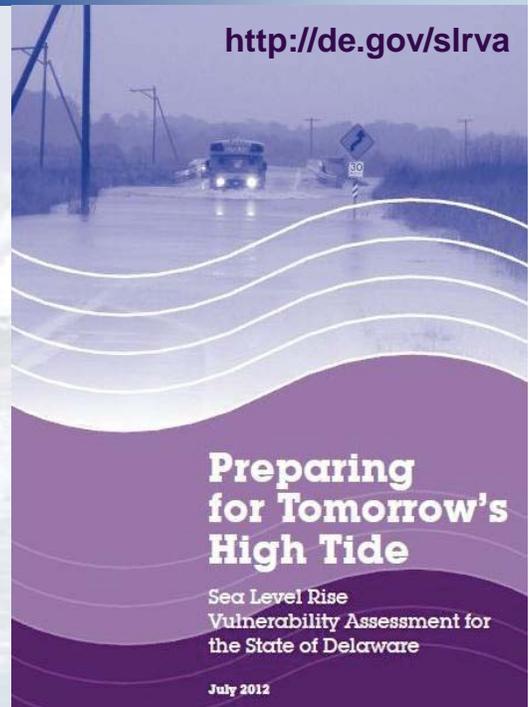


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## Vulnerability Assessment: SLR Impacts are statewide

- 8-11% Total Land Area
  - Tax assessed value \$1.5 B**
- Direct effects in all counties and 31 towns
- Highest concern statewide:
  - Industrial Areas and Port**
  - Railroads, roads and evacuation**
  - Dams and Dikes**
  - Future development areas**
  - Tourism/coastal recreation**
  - Habitats and protected lands**
  - Wells**

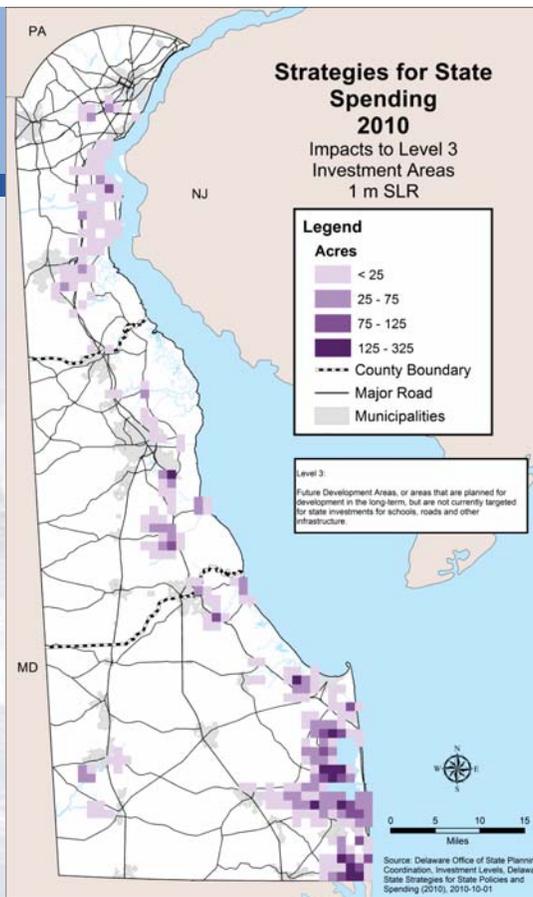


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# Future Development Areas at Risk

- 3%-7% of 152,000 acres of Level 3 areas potentially inundated
  - ✓ 4/5 in Sussex County
- Impact
  - ✓ Reduced growth zones
  - ✓ Challenge to redirect growth without limiting choice
- Statewide potential impacts for state funding, legal concerns.
- Ranked as high concern

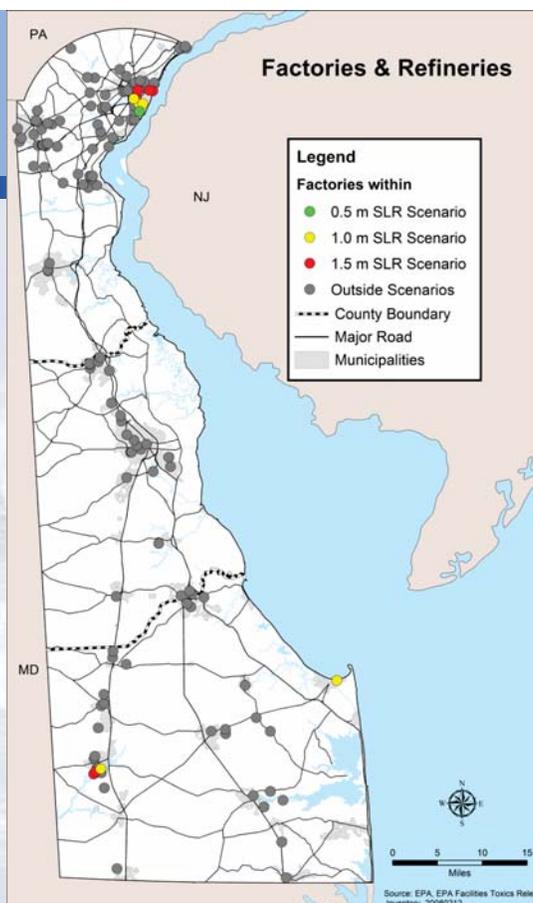


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# Industrial Areas at Risk

- 16%-25% of 4,000 acres permitted by CZA potentially inundated
  - ✓ Primary NCCo
- Impacts
  - ✓ Inundation of associated structures
  - ✓ Limited ability to relocate within state
- Statewide economic impact
- Ranked as high concern

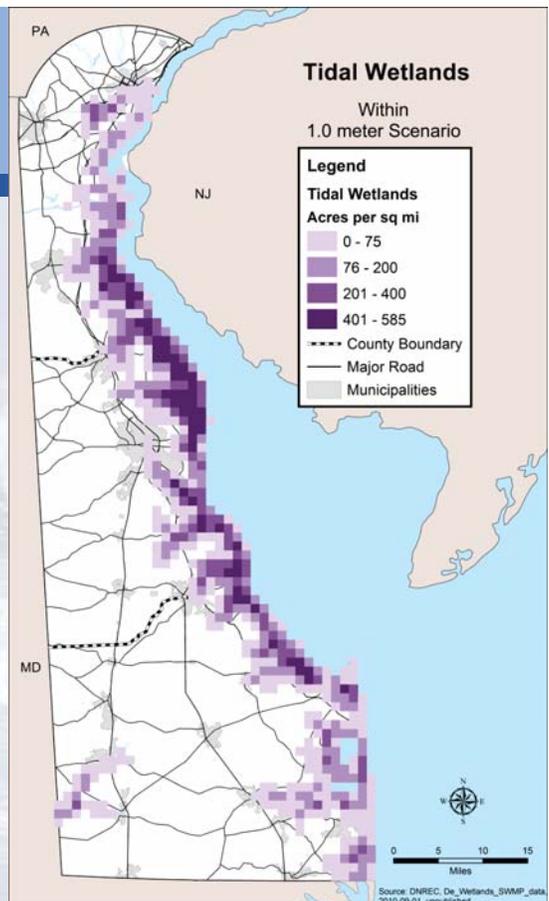


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# Tidal & Freshwater Tidal Wetlands at Risk

- Tidal
  - ✓ 97% to 99% of 73,000 acres potentially inundated
- Freshwater Tidal
  - ✓ 84% to 98% of 11,000 acres potentially inundated
- Conversion to open water
- Future salinity changes potential issue for tidal fresh
- Ranked as high concern

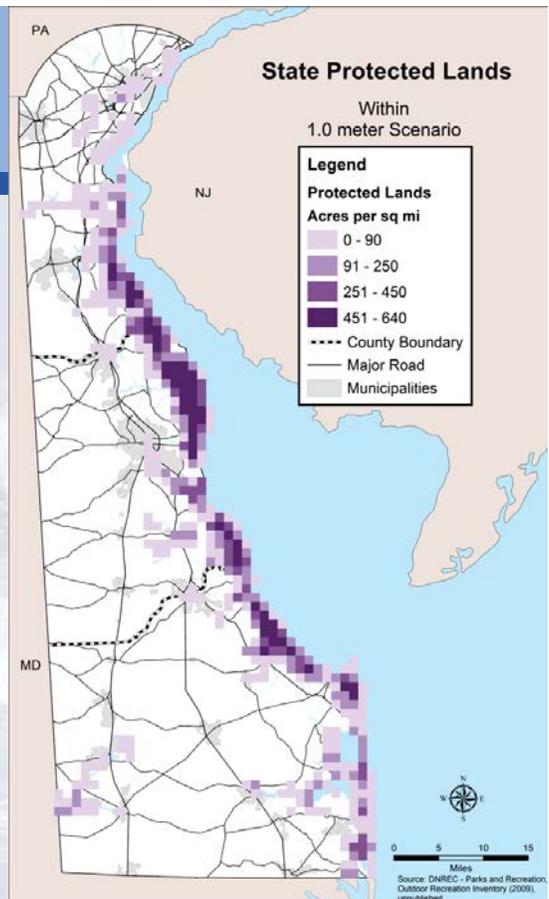


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# Protected Lands Statewide at Risk

- Includes
  - ✓ State owned lands
  - ✓ federal refuges
  - ✓ municipal holdings
  - ✓ public and private conservation easements
- 37% to 44% of 168,000 acres statewide potentially inundated
- Represent a variety of habitat types and outdoor recreation opportunities
- Ranked as high concern

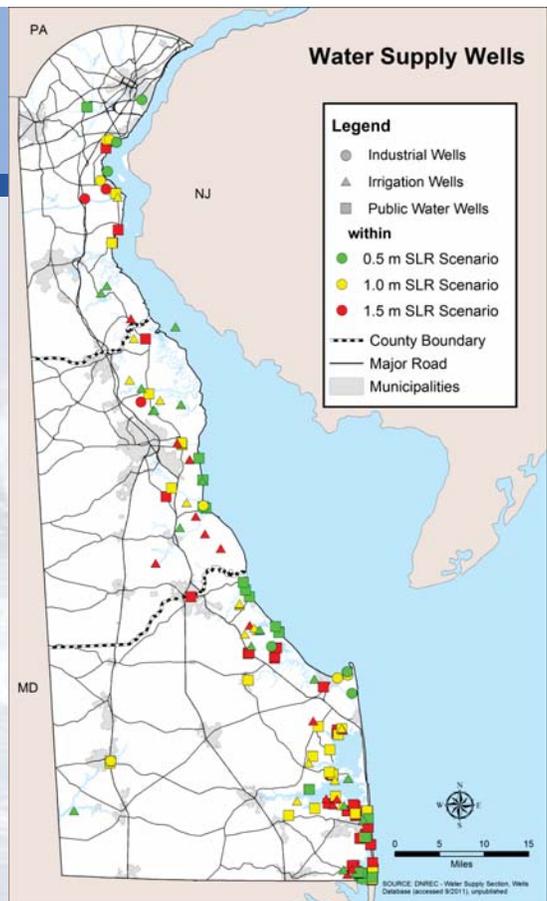


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# Wells at Risk

- Potentially inundated
  - ✓ Domestic wells: 3% - 7%
  - ✓ Industrial wells: 3% - 7%
  - ✓ Irrigation wells: 1% - 2%
  - ✓ Public wells: 2% - 10%
- Water supply concerns
- Saltwater intrusion may impact inland wells
  - ✓ Statewide concern
- Ranked as high

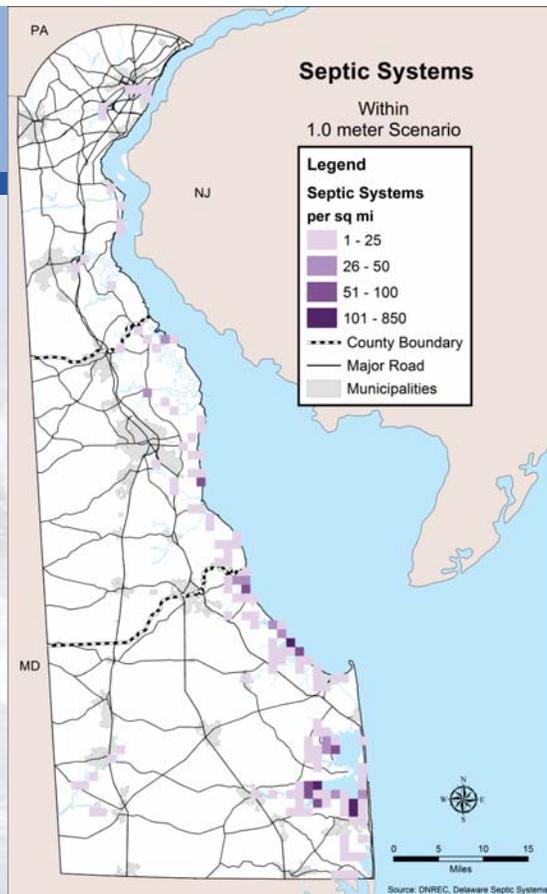


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# Septic Systems at Risk

- 1% - 4% of 78,000 potentially inundated
- Greatest exposure found in Sussex
  - ✓ High concentration along Inland Bays
- Functionality concerns before inundation
  - ✓ Rising water tables
- Ranked as moderate

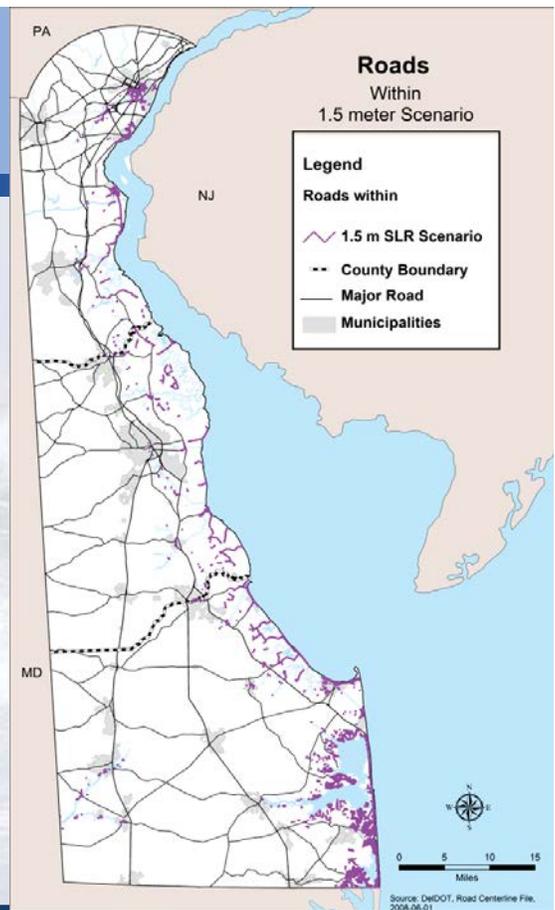


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## Roads and Bridges at Risk

- 1% - 5% state's roads and bridges potentially inundated
- Impacts to small segment has local and regional implications
- Impacts statewide, but highest in Sussex
- Ranked as high concern

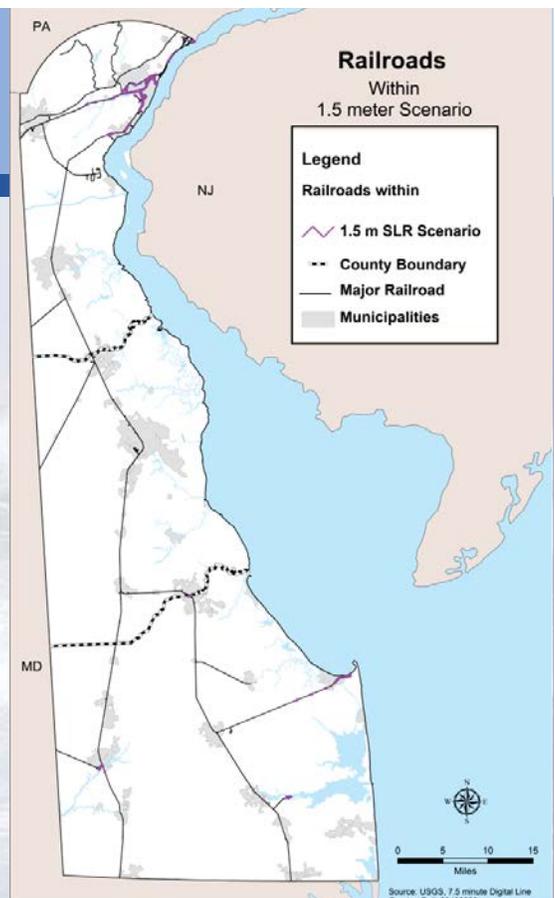


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## Railroad Lines at Risk

- 2% - 6% potentially inundated
- Impact to small segment has local and regional implications
- Impacts concentrated in NCCo
- Ranked as high concern



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# We can *adapt* to reduce our vulnerability

**Adaptation = Actions that can be taken to adjust to emerging conditions**



Protect



Retreat



Accommodate



Avoid



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## Choosing How and When to Adapt



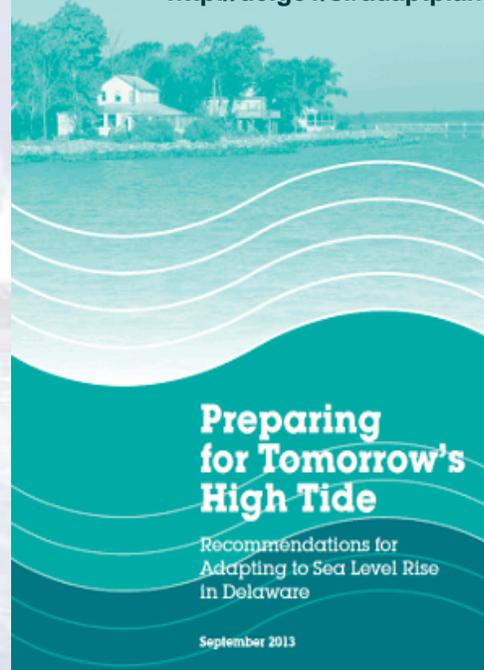
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# Delaware's SLR Adaptation Document

- Is a resource!
- Outlines recommendations to build “*adaptive capacity*”
  - ✓ *These are what we are focusing on today*
- Provides examples of on-the-ground adaptation
- Provides guiding principles for adaptation

<http://de.gov/slradaptplan>



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## Highlights: Recommendations for Wetlands, Shorelines and Habitat

- Wetlands restoration strategy
- Updates to Regulatory Tidal Wetlands Maps
- Develop Surface Water Salinity models
- Preserve areas for wetland migration
- Info and Support for land management



St. Jones River, Dover DE

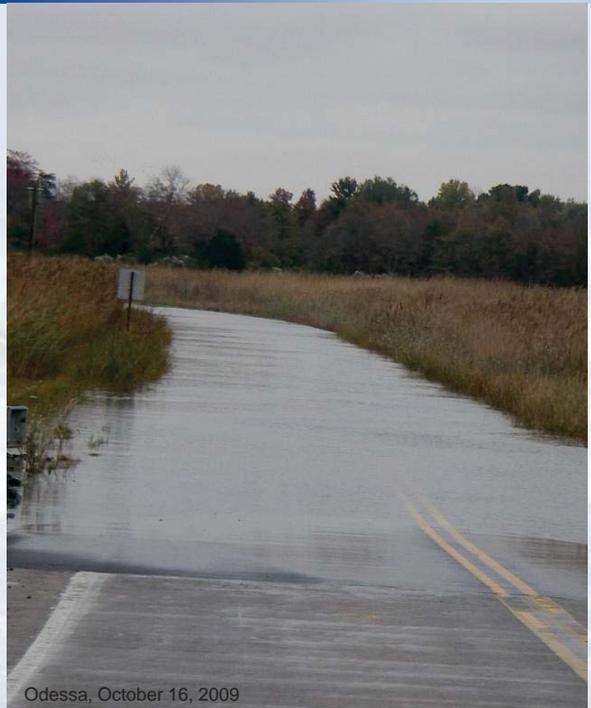


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# Highlights: Recommendations for Transportation & Infrastructure

- Fed/state planning coordination
- Conceptual designs for permitting
- Risk assessment for dikes and levees
- Legal review for disinvestment of infrastructure
- Statewide Retreat Plan



Odessa, October 16, 2009



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# Highlights: SLR recommendations for Land Use and Socioeconomics

- Incorporate SLR into Comp Plans
- Provide technical assistance to local governments and industries
- Develop a retreat plan
- Homebuyer Education
- Better understand human response to adaptation



Slaughter Beach, November 2011



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# Highlights: Recommendations for Water Resources

- Surface water salinity model
- Groundwater model
- Incorporate SLR into State Strategies
- Consider SLR in well regs
- Consider SLR in septic regs



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## Governor Markell's Executive Order 41 was a SLRAC Recommendation!

- Requires State Agencies to plan and design for SLR
- Requires development of state agency specific actionable adaptation recommendations
- Requires development of greenhouse gas emission targets



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# President Obama's Executive Order on Climate Preparedness followed on our heels

- Directs Federal agencies to support climate resiliency
- Creates State, Local and Tribal Council on Climate Preparedness
  - ✓ Gov. Markell c0-chairs Agriculture and Natural Resource Committee
  - ✓ Asks states to make recommendations on modernizing fed programs



Image courtesy of Whnyc.org



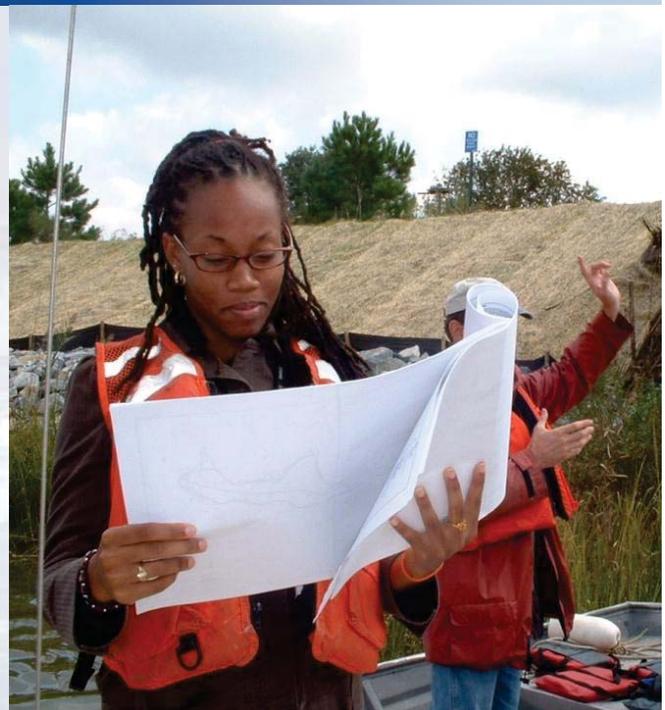
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## Our charge to you today...

Develop a list of ***specific actions*** that can be taken to achieve each recommendation of the SLRAC

***To be used by "implementers" to guide upcoming projects, grant applications, strategic plans and partnerships.***



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# Important Outcomes from today's workshop

- Implementation Plans for Recommendations
  - ✓ Helps us get to work!
- Specific Activities for E.O. 41 Response
  - ✓ Helps kick-start state agency EO 41 plans
- Recommendations for improvements to federal programs
  - ✓ Helps Feds help us help you



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## Breakout Groups

- Each Breakout Group will discuss ~9 of ~20 relevant recommendations
  - ✓ 3 have been pre-selected for morning session
  - ✓ Sticky dot voting will determine recommendations for afternoon discussion
- Many recommendations are broad and cross-cutting
  - ✓ Will be discussed in more than one breakout group
- 8 recommendations did not make any list
  - ✓ Significant implementation has already occurred
  - ✓ Recommendation was specific and straight-forward



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## Questions for Each Recommendation

- Have there been implementation activities already?
- What specific steps should be taken to achieve the intent of this recommendation?
  - ✓ Think broadly
    - *Are there data and information needs?*
    - *Are new tools and models necessary?*
    - *Will we need policy and legislative changes?*
    - *Do we need to increase public & political support?*
    - *Do we need to ID funding sources?*
    - *Are new partnerships needed?*
  - ✓ Do not constrain your ideas!



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## Additional Discussion topics for each recommendation include:

- Identify activities that are prerequisites to others
- Identify partners
- Ball-park costs
- Identify improvements in federal programs
  - ✓ President Obama Executive Order on Climate Change



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# Workshop Outcomes and Timeline

Outcome/Task	Date
Participants can send add'l info on any recommendation using template	April 11, 2014
Draft summary of action plans from each breakout group to participants	April 25, 2014
Comments from participants due	May 12, 2014
Final Workshop Proceedings Contains all info gathered from all groups	June, 2014
Delaware Coastal Programs staff will complete activities for recommendations not addressed today	Summer, 2014
Complete Implementation Plan available	Fall, 2014
Implementation activities commence!	Today!



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## Questions and Public Comment



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# Head to your breakout groups!

- Wetlands, Shorelines & Habitat
  - ✓ **Green Dot**
  - ✓ **Room A**
- Transportation & Infrastructure
  - ✓ **Red Dot**
  - ✓ **Room B**
- Land Use & Socioeconomics
  - ✓ **Yellow Dot**
  - ✓ **Room C**
- Water Resources
  - ✓ **Blue Dot**
  - ✓ **Room D**



# Appendix C – Recommendation Matrix

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## 2014 Workshop and Implementation Plan

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<b>Recommendations Discussed by Workgroups at the March 2014 Sea Level Rise Workshop</b>	<b>Land Use &amp; Socioeconomics</b>	<b>Transportation &amp; Infrastructure</b>	<b>Water Resources</b>	<b>Wetlands, Shorelines &amp; Habitat</b>
1.1: Improve coordination of permit decisions for adaptation projects between federal, state and local officials	●	○	●	○
1.2: Create new partnerships to increase resources for research and development of adaptation options	○	○	●	○
1.3: Increase opportunities for technology transfers and regional coordination for transportation issues affected by sea level rise		●		
1.4: Incorporate sea level rise into public and private sector regional planning efforts	●	●	○	●
2.1: Provide regulatory incentives that encourage sea level rise adaptation and that allow for innovative projects	○	○	●	●
2.3: Conduct a comprehensive update to the state's regulatory tidal wetlands maps and provide a way to periodically update the maps to reflect changes occurring from sea level rise				○
2.4: Consider sea level rise implications in future regulatory updates for septic systems and wells			●	
2.5: Facilitate the connection of individual septic systems to community wastewater treatment systems with excess capacity when human safety and welfare are at risk			○	
2.6: Consider sea level rise implications in future updates to the state Coastal Zone Act regulations	○			
3.1: Incorporate sea level rise considerations into the Strategies for State Policies and Spending	●	●	●	
3.2: Consider incorporation of sea level rise considerations into municipal and county comprehensive development plans	●			
3.3: Consider use of a Transfer of Development Rights tool to direct future growth away from vulnerable areas	○			
3.4: Incorporate sea level rise into Delaware's Long Range Transportation Plan (LRTP)		○		
3.5: Incorporate sea level rise into the Transportation Operations Management Plan		○		
3.6: Encourage inclusion of sea level rise in Transportation Project Design Manuals		●		
3.7: Develop a dike safety program		○	○	
3.8: Develop a framework for decision making regarding land protection and restoration strategies based on habitat vulnerability, migration potential and relative importance in the regional landscape, historical significance or other key factors				●
3.9: Develop a comprehensive wetlands restoration, protection and retreat strategy in response to sea level rise				●
3.10: Continue efforts to re-evaluate management strategies for existing coastal impoundments				○
3.11: Evaluate the benefits and risks of permitting privately owned coastal impoundments				○
3.12: Designate shoreline zones for adaptation action			●	●
3.13: Conduct a legal review for disinvestment of publically owned infrastructure and privately owned buildings	○	●		
3.14: Develop a statewide retreat plan and update it periodically	○	●	○	○
4.1: Develop a comprehensive outreach strategy to educate all stakeholders about sea level rise	○	●	○	●
4.2: Provide education and outreach for impacted communities and citizens	●			
4.3: Improve the ability of homebuyers to investigate a property's potential vulnerability to sea level prior to purchase	●			
4.4: Provide targeted outreach to water and wastewater operators and water utilities			●	
5.5: Conduct research to better understand human response to sea level rise and adaptation	○			

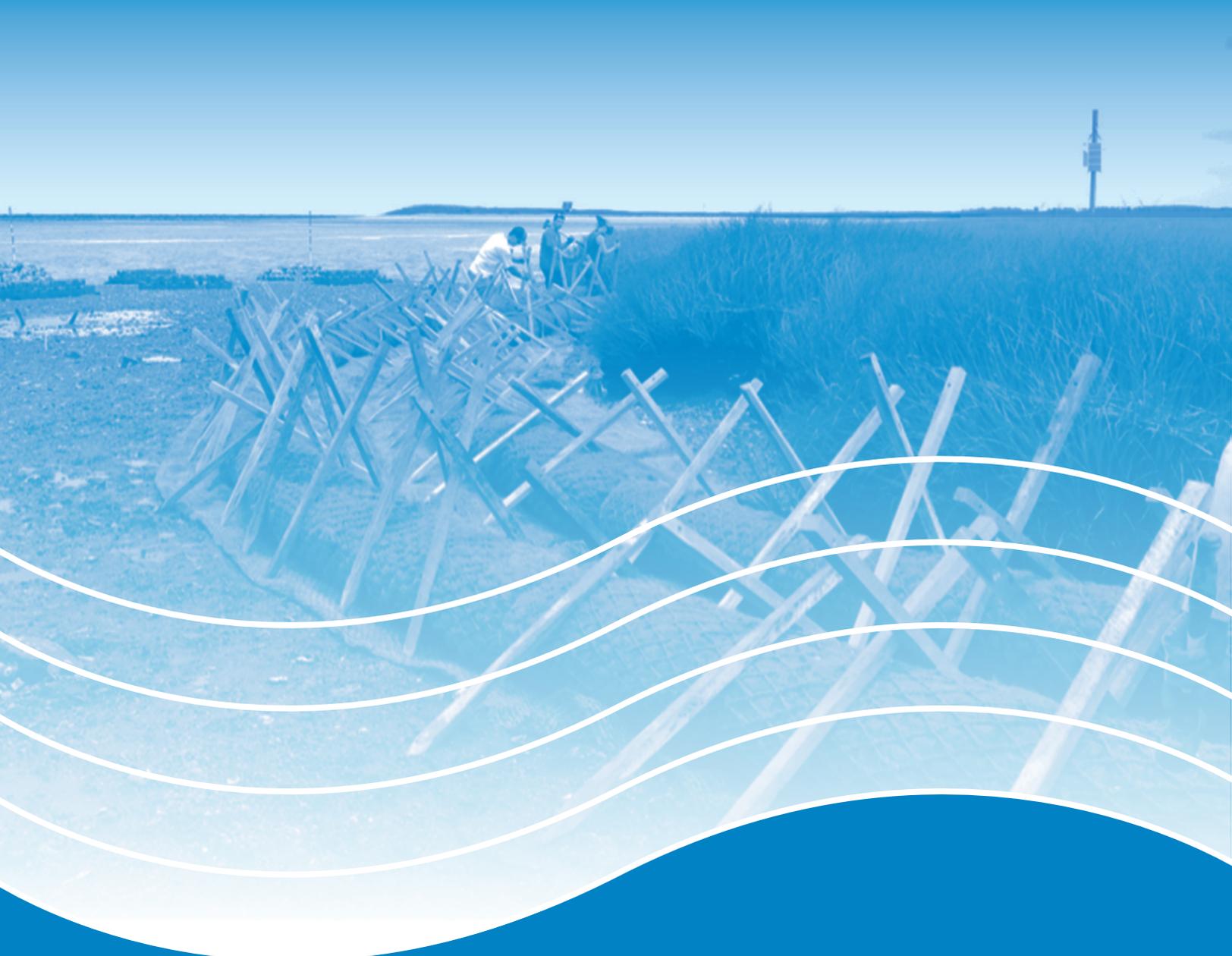
● Discussed by the Group  
○ Provided to Group, not discussed

<b>Recommendations Discussed by Workgroups at the March 2014 Sea Level Rise Workshop</b>	<b>Land Use &amp; Socioeconomics</b>	<b>Transportation &amp; Infrastructure</b>	<b>Water Resources</b>	<b>Wetlands, Shorelines &amp; Habitat</b>
5.7: Conduct a risk assessment for Delaware's system of dikes & levees		○	○	
5.8: Encourage federal agencies to integrate sea level rise planning into their flood models	○	○		
5.10: Develop a model that will predict changes to salinity in surface water that may occur under differing sea level rise scenarios			●	○
5.11: Develop a statewide groundwater model			●	
5.12: Develop and maintain a comprehensive database that contains the location and condition of all wastewater infrastructure			●	
5.13: Identify and preserve areas for potential wetland migration				●
5.14: Identify the data necessary to plan transportation investments		●		
5.15: Increase understanding of the regional implications of loss of industrial areas in coastal Delaware	○		○	
5.16: Improve understanding of impacts to adjacent properties from adaptation actions	○	○		○
5.18: Foster pilot projects that demonstrate the effectiveness of best management practices for management of agricultural lands affected by sea level rise				●
6.1: Create a coordinated effort to provide technical assistance to local governments	●			
6.2: Provide land managers, fisheries managers and farmers with the information and extension support necessary to manage lands and fisheries in areas affected by sea level rise				○
6.3: Provide technical assistance for industrial and port facilities to incorporate sea level rise into investment plans and continuity of business plans	●		●	
6.4: Develop best management practice manuals for adaptation in Delaware		○	●	○
6.5: Develop a database of costs of adaptation options for use by decision-makers and the public		●		●
7.1: Convene an expert panel to provide an assessment and analysis of funding options for adaptation	●	○	○	○

● Discussed by the Group  
○ Provided to Group, not discussed







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