Executive Summary

The Northeast Regional Ocean Council (NROC) was established in 2005 by the New England Governors to facilitate the development and implementation of coordinated and collaborative regional goals and priorities to improve governmental and socio-economic responses to issues and challenges that are inherently regional, and to increase accountability of government actions. Membership includes the six New England states and six federal agencies (NOAA, Department of Interior, Environmental Protection Agency, US Army Corps of Engineers, US Department of Agriculture, and the US Coast Guard). NROC was designed as an umbrella organization to bolster those existing issues requiring additional support and to tackle regional issues not yet addressed. Non-government partners are encouraged to become involved in NROC's three working committees to advance a regional approach to addressing its three priority issues: ocean and coastal ecosystem health, offshore energy siting and planning and coastal hazards resilience. (For more information about NROC, check out http://community.csc.noaa.gov/nroc/)

One of NROC's goals is to "Render New England a Coastal Hazards Ready Region." To advance this goal, NROC and NOAA's Coastal Services Center (NOAA CSC) hosted the Northeast Region Coastal Hazards Workshop on November 19-20 2008, which included a diversity of stakeholders from throughout the Northeast region. The purpose of the workshop was to gain a better understanding of the state of the region's resiliency and how the region might work collaboratively to improve its ability to withstand both severe coastal hazard events and more gradual impacts from climate change.

NROC has made improving coastal hazard resilience a priority because New England coastal managers and emergency responders face several related challenges to minimizing the damage and impact of a major coastal storm. Over the past several decades there has been a significant increase in the population along the coast. New England has not experienced a devastating hurricane since the 1950s, which has resulted in a coastal population that is relatively unprepared and underestimates the risk of such an event. Additionally, scientists predict that the New England coast will experience sea level rise and an increase in hurricane frequency. NROC has recognized that collaboration is critical in order for the region to efficiently and effectively address these related and serious challenges.

Ultimately, NROC hopes to "Render New England a Coastal Hazards Ready Region" by providing existing federal, state, and municipal programs with state-of-the-art data and tools to advance planning and response to storms, shoreline erosion, and coastal inundation due to projected sea-level rise from global warming (New England Governors' Coast and Ocean Action Plan, 2007)." Those data and tools will help NROC to assess regional vulnerabilities of facilities like major infrastructure to coastal hazards and accelerated sea level rise to support the formulation of a climate adaptation plan. A major goal of the Northeast Region Coastal Hazards Workshop was to garner input from

those working on coastal hazards resiliency at various scales to inform future actions that would be most effective. A second goal was to enable networking across the multi-state geography, across agencies, and across disciplines, recognizing that it will take concerted coordinated efforts of all involved to reap true success.

Nearly 60 stakeholders from diverse backgrounds participated in the workshop. Presenters provided important inspiration and background on issues like storm events and climate change impacts, as well as valuable opportunities and lessons learned from specific efforts to improve coastal hazards resiliency.

With this foundation in hand, participants offered input on how they can work collaboratively with each other and regional bodies such as NROC, the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS), Mid-Atlantic Coastal and Ocean Observing Regional Association (MACOORA) and the Northeast Sea Grant Consortium to address the greatest needs surrounding coastal hazards resiliency.

Workshop Background

NOAA CSC contracted with the Gulf of Maine Ocean Observing System (GoMOOS) to organize the Northeast Region Coastal Hazards Workshop in coordination with a Steering Committee of individuals representing the NROC Hazards Working Committee. (See Appendix A for a list of Steering Committee members). This committee determined workshop goals, outlined the agenda, and recruited presenters and participants.

The Steering Committee decided that there would be value in including regional planning exercises in this workshop, recognizing that there are local lessons that likely have regional implications, and that there are infrastructure (railways, roads, etc.) that are shared regionally. Thematic areas included determining impacts of past hazard events, learning the effects of climate change on the intensity and frequency of future events, and understanding the region's current resiliency to better gauge existing preparedness and improve future capacity.

The committee also desired to demonstrate tools and resources at this workshop as a professional development opportunity for managers and other participants. Ultimately, the workshop included presentations on tools and other resources, followed by discussions regarding how to take those ideas and create greater effectiveness and efficiency at a regional level.

To that end, the workshop could be divided into four general themes:

1. Understanding impacts of past storms and implications of climate change on future storms.
2. Examining whether the region is preparing appropriately for these impacts.
3. Exploring existing tools and processes that might help with this response and discuss how to coordinate regionally to be more resilient.
4. Recommendations to NROC and other regional entities on actions that will improve regional resilience.

The target audience for the workshop was a combination of state, federal, and private interests from throughout the region in order to enable more communication between jurisdictions. Target audiences included, but were not limited to:

- Hazard mitigation officers
- Coastal managers
- Emergency managers
- Local level planners
- Meteorologists or experts in weather
- Industries, such as insurance
- Academia

A full list of participants is in Appendix A.

Summary of Outcomes

Considering Climate Change Impacts in a Resilience Context

To ensure workshop participants had a common understanding of the term "resilience," the following definitions and explanations were provided to the group:

"Resiliency" refers to the pliability, flexibility, and plasticity of a system. More specifically, "…Resilience for social-ecological systems is often referred to or is related to three different characteristics:

a. the magnitude of shock that the system can absorb and remain within a given state;
b. the degree to which the system is capable of self-organization; and
c. the degree to which the system can build capacity for learning and adaptation (Folke et al. 2002)."

When it comes to coastal hazards, "resiliency" to severe weather events is critical in order to minimize property damage, flooding, loss of infrastructure, and threats to public safety and health.

As **David Vallee** with the National Weather Service put it, "We really need to know what has happened in the past or we're doomed to repeat it. With the coastal development in the past 50 years and the changes in climate, we need to understand how things are changing."

Hurricanes affecting the Northeast United States are considered low frequency but tremendously high impact events. In his presentation, David examined the behavior of these devastating tropical cyclones and addressed aspects of the heavy rainfall and riverine flooding, high winds, and storm surge and coastal flooding. The impacts of these events include snapped power lines, structural failures, wiped out neighborhoods, and loss of commerce. It was noted that few people in southern New England have knowledge of the potential devastation from hurricanes as the last major hurricane occurred in 1954!

David asked workshop participants to consider whether the region is prepared to deal with the ramifications of these events, and whether building codes are adequate and evacuation plans are in place. He suggested that the greatest obstacle to dealing with the risks appropriately is an inexperienced and complacent population. A second compounding factor is the massive increase in coastal populations, placing many people and structures in harm's way.

Based on the work of **Cameron Wake** with the University of New Hampshire Climate Change Research Center and other climate change researchers, it is vital to proactively address coastal resiliency to severe weather events, given the impending changes in sea level and weather events due to climate change. Data over the past 60 years reveals that

precipitation events are increasing. Meanwhile, sea level has risen about 15 inches over the last 150 years, which is a result of increasing volume of ocean water as it warms (and hence expands) and as the world's glaciers melt.

Cameron reminded workshop participants that the effects of climate change will impact the basic elements of life for people, including our access to water, food production, health, and the environment. While the upfront costs of resiliency efforts could be as much as 1% of GDP each year, the cost of inaction would be equivalent to at least 5%, and as much as 20%, of GDP per year in perpetuity. "The people of this country have not been asked to do anything, make any sacrifice," said Cameron. "Every decision in our daily lives should be made with a climate lens."

Rating the Region's Resiliency to Coastal Hazards

To better understand the status of coastal resiliency in the Northeast, **Pam Rubinoff** with the University of Rhode Island Coastal Resources Center, in partnership with NOAA's Pacific Services Center, has developed a coastal community resilience guidebook that describes eight elements indicative of coastal hazards resiliency.

Pam reviewed the elements, including their meaning and examples, as well as a rating scheme that was applied to the New England region for each of the resilience elements based on a literature review (no interviews) of current resilience capacity in New England. For the purpose of familiarizing workshop participants with the applicability of the rating system, she provided a range of ratings from good to poor (Table 1: Coastal Hazards Resiliency Elements). The ratings in this table are preliminary ratings and were presented to help initiate a dialog about the elements and stimulate feedback on how the region could increase our resiliency element by element, improve the information used to develop the ratings, and track our collective progress over time. Follow-up with practitioners across the region is necessary to get a more informative and meaningful analysis.

Table 1: Coastal Hazards Resiliency Elements. From the *Report on Coastal Hazard Resiliency Capacity in the Northeast US Region* (available for download at http://www.crc.uri.edu/download/Northeast_Literature_Review.pdf).

Coastal Hazards Resiliency Elements	New England's Rating
Governance: Leadership, legal framework, and institutions provide enabling conditions for resilience through community involvement with government.	Fair
Society and Economy: Communities are engaged in diverse and environmentally sustainable livelihoods resistant to hazards.	Good
Coastal Resource Management: Active management of coastal resources sustains environmental services and livelihoods and reduces risks from coastal hazards.	Good
Land Use and Structural Design: Effective land use and structural design that complement environmental, economic, and community goals and reduce risks from hazards.	Fair
Risk Knowledge: Leadership and community members are	Fair

aware of hazards and risk information is utilized when making decisions.	
Warning and Evacuation: Community is capable of receiving notifications and alerts of coastal hazards, warning at-risk populations, and individuals acting on the alert.	Good
Emergency Response: Mechanisms and networks are established and maintained to respond quickly to coastal disaster and address emergency needs at the community level.	Fair
Disaster Recovery: Plans are in the place prior to hazard events that accelerate disaster recovery, engage communities in the recovery process, and minimize negative environmental, social, and economic impacts.	Poor

Note: These ratings were not a product of a formal rating system, but rather an initial exercise to understand the applicability of a rating system to the New England region.

In small-group discussions, workshop participants used the information provided in the Coastal Hazards Resiliency Elements Table to discuss potential areas for improvement in most of the elements.

To improve the region's rating in **Governance**, participants suggest identifying and breaking down barriers that exist within governments by inviting the community into the decision-making process and making it more transparent. Leadership on the part of elected officials, as well as clear communication and strategic direction are important to improving the Governance element.

It is also important that political entities look at the issue from a broader regional perspective. To that end, federal agencies should align their regions to have consistent borders. Regional bodies, such as NROC and the New England Governors' Conference can help by providing opportunities for communication and coordination.

Participants expressed the need for goals to be shared between municipal, state and federal levels of government. When entities from a diversity of backgrounds with varying responsibilities and levels of authority speak the same message and carry through on actions in sync, the likelihood of having a positive impact is far greater.

Further, regional entities, such as NROC, the New England Governors' Conference, and federal agencies must have a shared definition of resilience, shared priorities, and a systematic "closed loop" process for sharing information. Finally, dedicated funding and resources, including staff time and focus, are critical to realizing coastal hazards resiliency.

Regarding **Society and Economy**, workshop participants felt unarmed with important information in order to provide some understanding of the current level of resiliency for that element. They observed that economic drivers and the need to deal with natural resources can often be in conflict with one another in that short-term economics often

drives decisions without having the long-term perspective. They suggested that information on the real value of what beaches and marshes are worth would be very helpful in informing this element.

Workshop participants suggested that a regional organization could help by assimilating data that includes the value – both economic and intrinsic – of the coastal economy and the potential losses if no action to increase resiliency is taken.

Participants agreed with the "good" rating for **Coastal Resource Management**, with the exception of sea level rise, which they said would be "fair" given the changes on the horizon. A big problem is the town-by-town approaches with respect to funding and decision-making, which a more regional approach would help to mitigate. In the present situation, there is a great deal of variability from one place to the next in codes and requirements along the coast. Maine, for example has no mandatory building code.

An opportunity for improved resilience through coastal resource management is in Special Area Management Plans (SAMPs), which enable a coordinated ecosystem approach across town boundaries. There remain issues crossing state lines, however. Habitat restoration projects have been similarly successful, yet changes in sea level rise could negate this work resulting in lost resources.

Once again, stronger leadership and funding at the state and federal levels is important to improving on this element. In addition, greater collaboration among government personnel, academics, and citizens can have positive impacts.

More specifically, workshop participants suggested regional building codes for vulnerable areas in order to strengthen their enforceability. Securing multi-state funding (similar to the old Coastal Zone Management Act, Section 309, which encouraged regional projects) for these sorts of efforts remains a clear need.

With a great deal of experience along the developed coast with construction, workshop participants felt that the "good" rating for **Land Use/Structural Design** was accurate. These policies are developed at the state level and implemented at the local levels. A concern is the inability for municipalities to fight challenges to codes and other requirements, making them vulnerable to pressure from developers for leniency. This issue further emphasized the need for greater coordination between municipalities and states so that all are speaking with one voice, making challenges to regulations more difficult. For example, enhanced guidance and substantiation for elevating development above base level of 2-5 feet would be very helpful.

Some issues facing the success of this element include grandfathering properties and enabling new septic systems in coastal areas. Both need to be reevaluated for their effects on development.

Participants agree with the "fair" rating given to **Risk Knowledge**. The general sentiment is that we are not doing a good job communicating risk to individual communities. A

good deal of improvement can be made by developing more strategic partnerships for communicating risk through marketing materials.

While there is a lot of information pertaining to **Warnings and Evacuations**, participants felt it is not well distributed. A more effective system of getting information to the general public should be developed. Yet there needs to be sensitivity to not sharing too much detail so as not to overwhelm. There is also a fear of sharing warnings or predictions in case they are slightly inaccurate, thereby threatening credibility.

An issue relating to warning and evacuation success includes the need to improve on the relatively short warning time for hurricanes making landfall in New England. The region also needs to be cognizant of the infrastructure that is threatened by sea level rise, including roads and other transit, water treatment, and power supply. Further, there is seasonal variation in these events, perhaps warranting different evacuation plans for different seasons. There are some basic feasibility issues around warnings and evacuation as well. Simply put, trying to evacuate all of Boston would be near impossible.

The "poor" rating for **Disaster Recovery** demonstrated for participants the difference between current experience with recovery from hurricanes and historic information about past recovery efforts. It was recognized that the emergency management agencies in the states have vast experience in this area. One recommendation was to develop stronger working relationships between the coastal zone managers and the emergency management organizations. Additionally, participants wanted more information from private companies and utilities to learn how they have established plans for recovery after a severe weather event. Ultimately, the region should develop standards and best practices that integrate the needs for ecological service recovery and human community recovery.

Overall, it's important to understand the regional scale appropriate for addressing coastal resiliency. There is a home-rule culture in the Northeast, which creates problems with implementation because there is no consistency or control at a larger scale. There are some models for taking a regional approach that we can learn from, particularly from utilities.

An important note regarding the current status of these elements is that the ratings may change with changes in sea level and the rate and severity of coastal storms. Additionally, there are episodic storm events, such as Nor'easters and hurricanes, as well as chronic changes associated with climate change. The key will be to focus on the efforts that have worked well in the region and apply them more broadly. Yet, what works today might not be relevant in ten years.

There was interest expressed by participants to refine the resilient element ratings by better qualifying and quantifying them with additional information sources and interviews with appropriate management, regulators and planners. A regional effort to solidify this baseline, identify gaps, needs, and obstacles in improving our resiliency, and

track our collective progress should be considered as a next step for NROC's Hazard Committee.

Programs, Processes, and Tools to Aid Coastal Resiliency

A primary goal of this workshop was to provide overviews of projects or processes that have worked well in specific areas to improve resiliency. These presentations provided ideas for efforts that could either be transferred to other geographic locations or expanded as regional efforts.

Presenters were asked to address the following questions:
1) How does your project/tool make progress towards achieving the resilience element specified?
2) In thinking about moving towards regional resiliency, is your project/tool transferable to other states or communities?
3) What are some words of advice or lessons learned for duplicating or expanding your project/tool?

Daisy Sweeney with the Federal Emergency Management Agency (FEMA) presented on FEMA's Community Rating System (CRS) as a mechanism to motivate appropriate building and development through financial incentives, particularly reduced insurance rates. This program uses monetary savings on insurance costs to motivate property owners to be more proactive in making their properties resilient to coastal hazards. Because of the built-in incentive, this program helps advance the *Risk Knowledge* metric, as it makes landowners aware of the risks where they live and what they can do to mitigate against them. This region-wide program already has applicability across geographies, but there remain some challenges to implementation. While the cost savings for those who have insurance policies for severe storm events can be up to 45%, New England won't typically see better than 10%. A challenge with implementation is the lack of a state-wide or even county-wide CRS coordinator, thus putting the burden on local building, planning, or zoning offices in municipalities. A current challenge for FEMA is to find the funding to support implementation of the program, particularly through staff to help coordinate activities.

As an example of effective local activity that effectively engages many stakeholders to improve the coast's resiliency, *Grover Fugate, Executive Director of the Rhode Island Coastal Resources Management Council*, presented on their process for developing Special Area Management Plans and sea level rise guidance. His presentation focused on the challenges around building an urban coastal buffer policy that leads to consistency in the process, increases public benefit, and protects or restores coastal habitat. Because their program includes extensive communication between local and state officials, private developers, and citizens, it was included as a good example of advancing the *Society and Economy* metric. Further, with so many obvious outcomes of the program, including revitalized natural areas along the state's most urban waterways, this program is certainly

successful in developing appropriate programmatic changes and tools to enable implementation of new regulations. Hence, it was also touted as advancing *Coastal Resource Management*. While such a program is inherently local, given the nature of the community involvement, other communities with the right leadership could certainly learn from and replicate their work. Moreover, Special Area Management Plans are a tool familiar to all state coastal zone management programs and encouraged for use as a participatory, ecosystem approach to management by NOAA's Office of Ocean and Coastal Management.

In order to provide sufficient prediction and warning regarding the effects and timing of storm events, and hence advance the *Warning and Evacuation* metric, the National Weather Service (NWS) and the Gulf of Maine Ocean Observing System (GoMOOS) are developing coastal inundation forecasts that predict the timing and severity of storm events' effects. *Bob Thompson with the NWS Office* in Taunton, Massachusetts and *Riley Young Morse with GoMOOS* described their work developing prototype tools for Scituate, Massachusetts and Saco, Maine. Both have proven effective in the pilot towns in predicting the timing and extent of coastal inundation, and are replicable to other areas in the region as long as the necessary data is available. For example, the coastal storm damage tool GoMOOS developed in partnership with the National Weather Service requires some historic accounting of previous storm damage, combined with information on the timing and severity of winds and waves.

In Massachusetts, the Coastal Zone Management (CZM) program and NOAA CSC have partnered to develop the Storm Smart Coasts program. *Daniella Hirschfeld with Massachusetts CZM* presented the program's information resources geared at enabling communities and individuals to take action to improve coastal resiliency. The program includes a web site that acts as an information hub to provide developers and communities what they need to advance appropriate land use policies and building standards. Additionally, they have pilot programs for which they provide technical assistance for low impact development approaches and evaluation metrics for success. While this effort began with a Massachusetts focus, program coordinators have already begun to expand the content to other states, and NOAA's Coastal Services Center is assisting in taking it region-wide. Soon they will begin more thoroughly evaluating how well it's advancing resiliency.

Improving the Region's Resiliency

Participants brainstormed the biggest challenges facing resiliency to coastal hazards and discussed actions that can be taken to address them. Following are the needs and related actions that surfaced.

Communication/coordination across the region
Stakeholders acknowledge the importance of communicating and coordinating efforts across state lines to realize efficiencies and effectiveness. However, given that

coordination from one municipality to another is often challenging, realizing an even broader interstate network is downright daunting.

In addition to the logistical challenges of building a functioning interstate network, there are often conflicting regulations or responsibilities from one agency to another that impede collaborative efforts.

Some Answers

- An information network that enables dialogue so that communities may share information resources and lessons learned – The Storm Smart web portal is a good start along these lines.
- More workshops with more people from a greater diversity of sectors, including FEMA, state transportation, utilities, wastewater/drinking water operators, etc.
- Shared best practices, regulatory principles, and messaging to ensure that the region is speaking with one voice.

Information/data to persuade and inform resiliency efforts

Overall, participants agree that there is a great deal of available data on inundation and weather impacts to inform resiliency efforts, perhaps even more than can be processed or communicated very effectively. An example is the revised flood plain maps that FEMA has developed. Accessibility to this new information is limited. Further, the maps haven't been developed for future points in time. A remaining critical gap in information relates to economic impacts of hazards on employment, properties, infrastructure, and commerce.

Some Answers

- Comprehensive vulnerability analyses and assessments that are consistent across the entire geography, along with information on how improved resiliency saved dollars and lives.
- Work with FEMA, other regulatory agencies, academia, industry, and others to make the latest information available and easy to absorb.

An educated society

Sometimes the most difficult aspect of creating or enforcing appropriate rules or regulations is a lack of understanding of the risks. Communities, and particularly local decision makers, need to have a better understanding of the potential damage and severity of hazardous coastal events. Given the amount of time that has passed since previous severe events, there is presently little institutional memory of the horrific consequences of not being prepared. In particular, coastal property owners need to have a better understanding of the risks and mitigation actions they can take.

Some Answers

- Develop shared messaging and communication materials to engage communities and media that communicate the benefits of taking actions today, even in the midst of a tough economic climate.

- Target youth through schools, recognizing that movements in the past (e.g., no smoking, recycling, etc.) have begun with students.

Ability to take action

Efforts to improve resiliency are often hindered by the lack of public funds and by a lack of leadership at multiple levels of decision-making. Along these lines, participants noted that the political cycle doesn't align with hazard concerns, making the ability to have influence even more difficult.

Some Answers

- Improve regional coordination to leverage impacts on decision-making and improve communication to decision makers.
- Leverage existing funding mechanisms, even if tangentially related to "coastal hazards resiliency."
- Create regional efficiencies by establishing regional coordination positions for resilience programs including FEMA's Community Rating System and Massachusetts' StormSmart Coasts.

NROC's Role Going Forward

As a regional coordinating body that has the ear of the states' leadership through its connection with the governors, its own membership of high-ranked state government employees and a suite of relevant federal agencies, NROC is particularly well suited to follow through on some important next steps to improve the region's resiliency.

Convene Partners

NROC's role in convening multiple players from throughout the region is incredibly important. To the greatest extent possible, NROC should strive to host more workshops like this with greater stakeholder representation. Future workshops should include FEMA, state transportation, utilities, wastewater/drinking water operators, and insurance providers. Participants feel strongly that the opportunity to connect with others who are working on similar issues is critical in advancing coordination, and hence effectiveness, in the future. Additionally, workshops like this keep coastal hazards resiliency top of mind for people, which is particularly important with so many demands competing for time.

Shared Messaging

As NROC convenes multiple stakeholders from throughout the region, it should take the lead in developing shared messaging for any local, state, or federal person to use when communicating about coastal hazards resiliency. In addition to talking points for stakeholders to use when speaking with the community, media, or each other, NROC should facilitate the development of shared Best Practices and regulatory principles that

are relevant across the geography. Enabling the region to speak with one voice will strengthen the effectiveness of the message overall. This is important in combating the inconsistencies from one community to another, which weaken the ability to enforce existing regulations. Further, a single message repeated consistently is more memorable and believable than one that is disjointed.

Information Network

While workshops are important intermittently, an information network that provides a constant opportunity for dialogue would be particularly helpful to coastal hazards resilience stakeholders. A web portal or listserve that enables stakeholders to post information resources, updates on efforts, and lessons learned would be a great opportunity for everyone to keep in touch between workshops. This is a need NROC could help address.

Increased Funding

Because of its ties to state and federal government, NROC is particularly well positioned to help improve decision makers' understanding of the importance of improving coastal hazards resiliency. NROC can provide the consistent voice that is often lacking when administrations and elected officials transition. Public funds are clearly necessary to advance coastal hazards resiliency, and improving decision-makers' support of those efforts is critical to securing important funds.

Appendix A: Steering Committee Members and Workshop Participants

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Appendix B: Workshop Agenda

November 19, 2008 12:30 – 5:00pm

12:30 – 1:00 Registration and a light lunch with refreshments

1:00 Welcome and Introductions

- Defining Resiliency: A review of the work of NOAA Coastal Services Center and the Coastal Resources Center
    - Susan Russell-Robinson with the U.S. Geological Survey

Part 1: Understanding impacts of storms past, and implications of climate change on storms of the future

- Overview of storms of the Northeast and their effects on the coast
    - David Vallee with the National Weather Service
- Implications of climate change for storm intensity and frequency in the Northeast
    - Cameron Wake with UNH Climate Change Research Center

BREAK

Part 2: Exploring resilience at a regional scale

- Presentation of the Assessment of Resiliency Capacity for the Northeast Region
    - Pam Rubinoff with the University of Rhode Island Coastal Resources Center
- Facilitated working session to discuss the usefulness of this evaluation and planning tool, how the region might improve its ratings, and what might be the role of NROC going forward
    - Workshop Participants

November 20, 2008 8:00am – 12:30pm

8:00 – 8:30 Continental breakfast with coffee and juices

8:30 Welcome to Day Two

Part 3: Exploring existing tools and processes and discussing how to coordinate regionally to be more resilient

- FEMA's Community Rating System and the coastal series of credit activities. *Risk Knowledge*
    - Daisy Sweeney with the Federal Emergency Management Agency

- Engaging stakeholders to improve the Ocean State's Resilience: Sea Level Policy, Urban Buffer Policy, and SAMPs. *Society and Economy*, *Coastal Resource Management*
    - Grover Fugate with the RI Coastal Resources Management Council
- Real-time storm surge prediction tools. *Warning and Evacuation*
    - Bob Thompson with the National Weather Service
    - Riley Young Morse with the Gulf of Maine Ocean Observing System
- Massachusetts Storm Smart Program. *Governance, Land Use and Structural Design*
    - Daniella Hirschfeld with Massachusetts Coastal Zone Management

BREAK

Part 4: Developing an action plan for the future

- Overview of the Hazard Committee's Work Plan and remaining questions.
    - Susan Russell-Robinson, Adrianne Harrison, and Ron Rozsa
- Facilitated discussion on the regional implications of existing resources, NROC's role, and next steps.
    - Workshop Participants
- Overview and Next Steps

Appendix C: Speaker and Sponsor Biographies

Grover Fugate
Grover Fugate graduated from the University of Connecticut in 1976, with a degree in Natural Resource Management. After graduation Mr. Fugate worked in Canada in a series of positions including Forester, Land Use Planner, with the Department of Agriculture, Regional Resource Planner, with the Crown Lands Branch, and Director of Shore Zone Management. In 1984, Mr. Fugate completed his MBA from Memorial with a program specialization in resource policy analysis.

In 1986, Mr. Fugate moved to Rhode Island to assume the duties of the Executive Director of the Coastal Resources Management Council. The council is an independent state agency, set up to be the principle planning and management agency for the state's coastal areas. Mr. Fugate's current duties include, the day to day administration of the Rhode Island Coastal Resource Management Program for the State of Rhode Island. As part of his duties Mr. Fugate is the council's and states representative to a number of boards, commissions, task forces, and other coastal related organizations. Mr. Fugate also holds an adjunct faculty position at the University of Rhode Island and is a guest lecturer at Brown University and Roger Williams University Law School. He is also a trainer at the Coastal Resources Center for Integrated Coastal Management.

He is the recipient of several citations from the Governor and the Legislature for his work in Coastal Management and Community Service. Mr. Fugate has published articles on various issues in coastal and natural resource management.

Daniella Hirschfeld
Daniella Hirschfeld is a NOAA Coastal Management Fellow working with the Massachusetts Office of Coastal Zone Management. She is dedicated to the enhancement and implementation of their StormSmart Coasts program. The program's main goals are to help communities address the challenges arising from storms, floods, sea level rise, and climate change. She started this two-year fellowship in September after completing her master's degree in environmental management at Duke University's Nicholas School of the Environment. At school she concentrated on global environmental change and did her thesis work on Jordan's future water resources. In addition to her graduate work, Daniella was a Doris Duke Conservation Fellow and on the executive committee of the Duke Chapter of the Coastal Society.

Betsy Nicholson
Betsy Nicholson received her Bachelor of Arts degree from Williams College (1995) and her Masters in Coastal Environmental Management from Duke University (2001). Nicholson came to NOAA as a Sea Grant Fellow in 2000 with the National Centers for Coastal Ocean Science, focusing on incorporating social science into competitive research grants. She served as the National Ocean Service representative to the NOAA leadership team for 3 years, and as the NOAA Policy Advisor to the Secretary of

Commerce for 8 months before moving north. She is now positioned as the NOAA Northeast Regional Lead for the Coastal Services Center based at UNH where her efforts focus on matching partner needs to NOAA expertise. Nicholson's coordination role includes serving as NOAA's regional point of contact on Integrated Ocean Observing System initiatives, representing NOAA on the Northeast Regional Ocean Council and the Gulf of Maine Council Working Group, and conducting "NOAA in New England" forum among managers based in the region.

Ron Rozsa
Ron Rozsa is a coastal ecologist with the Coastal Management Program of the Department of Environmental Protection in Connecticut. He supervises the Technical Services Section which is responsible for coastal hazard and coastal climate change issues. This program is currently developing inundation scenarios using 2006 high resolution LIDAR derived elevation data and a coastal hazards website with the assistance of a NOAA CSC coastal fellow.

Pamela Rubinoff
Pamela Rubinoff is an Associate Coastal Manager for the Coastal Resources Center, University of Rhode Island. Her specialty is coastal community resilience, advancing efforts that link coastal management and natural hazards. Pam works in both US-based initiatives and International Programs focusing on sustainable coastal community development through capacity building, policy creation, and technical assistance to government and non-government partners. She has worked in Mexico, Ecuador, Central America, as well as Thailand and the Indian Ocean. Rubinoff currently leads the Center's effort to develop a Coastal Adaptation Guidebook for a global practitioner audience in partnership with the US Agency for International Development. Together with an international team, she recently completed development of a resilience assessment tool as a US contribution to the Indian Ocean Tsunami Warning System Program. The tool includes a methodology to identify strengths and weaknesses of community resilience, which has been core to training and mentoring Indian Ocean managers in assessment and enhancement of community resilience.

As Sea Grant extension specialist, she works with Rhode Island communities to promote community resilience and adaptation through planning, capacity building, and outreach activities. Activities include the development of a state sea level rise policy and implementation of hazard mitigation initiatives for the Providence Metropolitan area, and coordination of the Smart Hurricane Recovery initiative for southern Rhode Island. Before coming to Rhode Island Pam coordinated the state's coastal management efforts on Cape Cod and the Islands, working with the communities and citizens of the region on key issues related to coastal hazards, shoreline management, and regional planning.

Ms. Rubinoff has a master degree in Marine Policy from the University of Rhode Island and a Bachelor of Civil Engineering from the University of Delaware.

Susan Russell-Robinson

Susan Russell-Robinson currently serves as the Associate Program Coordinator for the U.S. Geological Survey (USGS) Coastal and Maine Geology Program, working with science centers in Santa Cruz, CA; St. Petersburg, FL; and Woods Hole, MA. Based in Reston, VA, Susan is the USGS Ocean lead for the Northeast, serving on the Gulf of Maine Council as U.S. chair for the Ecosystem Indicators Partnership and on the Northeast Regional Ocean Council as co-chair of the Coastal Hazards Resilience Standing Committee. Additionally, she is the team leader for the U.S. Fish and Wildlife Service Connecticut River-Long Island Sound Ecosystem Team.

Susan has extensive experience with communicating the risks associated with natural hazards. She authored a wildly popular series of posters and photo cards to assist teachers with leading discussions about natural hazards. She chaired the U.S. Work Group for the annual International Awareness Day of International Decade for Natural Disaster Reduction (IDNDR). In 1993, she co-produced with Fairfax County (Va.) Public Schools an electronic long distance learning field trip titled about "Kids Take Charge." The live broadcast focused on preparedness for earthquakes, hurricanes, and other severe storms. Susan is one of the founding members of the Coalition of Organizations for Disaster Education (CODE). Susan fosters engaging science-attentive citizens in collecting and reporting on changing conditions in coastal and marine areas.

Daisy Sweeney
Daisy Sweeney is the Regional Insurance Program Specialist at FEMA Region I, Boston, MA, where she has worked in various FEMA programs since 1990. She has a B.A. from the University of Massachusetts.

Bob Thompson
Bob Thompson is the Meteorologist-in-Charge of the Southern New England National Weather Service Forecast Office in Taunton, MA. Bob grew up in Cohasset, Massachusetts. He received a Bachelor of Science in Meteorology from Florida State University (just prior to the tenure of Bobby Bowden) and a Masters Degree in Atmospheric Science from the University of Washington (in Seattle). Bob's career with the National Weather Service started as a summer student trainee at the Boston office during the early 70s. Subsequent National Weather Service assignments have taken him and his family to Albany, NY, Anchorage, AK, Silver Spring, MD, and Reno, NV before returning to the Boston area in November 1989. Bob is a widower with two grown sons and resides in Westborough, MA.

Brian Thompson
Brian Thompson is the Director of the Office of Long Island Sound Programs in the Connecticut Department of Environmental Protection, where he is responsible for implementing Connecticut's federally-approved coastal management program. He is also currently chair of the Northeast Regional Ocean Council. Before joining the DEP in 2006, Mr. Thompson worked in various environmental management capacities in private industry and the federal government. He is a native of the Connecticut shoreline and long-time beneficiary of all that Long Island Sound has to offer. Mr. Thompson holds a Bachelor's Degree in Geology and a Master's Degree in Marine Affairs.

David Vallee
David Vallee is the Hydrologist-in-Charge of the National Weather Service's Northeast River Forecast Center. The center provides detailed water resource forecasting information to weather service offices and other collaborative agencies throughout the Northeast and New York.

Prior to becoming the Hydrologist-in-Charge, David served as Science and Operations Officer, and Hurricane Program Leader at the NWS Weather Forecast Office, in Taunton, MA from 2001 through 2006, and as Senior Service Hydrologist from 1993 through 2000. David has extensive experience leading hydrometeorological forecast and warning operations and directing weather research and training programs. David has conducted research on a variety of topics including flooding, severe weather forecasting and radar detection, orographically enhanced heavy rainfall in southern New England, coastal flood climatology and the behavior and characteristics of New England Tropical Cyclones. David has served as the NWS lead investigator with the State University of New York, at Albany, on a multi-year project addressing Land Falling Tropical Cyclones in the Northeastern United States. This multi-faceted project is aimed at improving the forecasting of heavy precipitation associated with these land falling tropical cyclones, as well as developing a better understanding the mechanisms which lead to the recurvature and rapid acceleration of tropical cyclones as they approach the Northeast.

David is a graduate of Lyndon State College. He is a life long resident of the Rhode Island, now living in the northeast part of Cumberland***, with his wife and two sets of twins!*** He considers it a tremendous privilege to be serving the people of the very region he calls home.

Cameron Wake
Cameron Wake is a research associate professor with the Institute for the Study of Earth, Oceans and Space and the Department of Earth Sciences at the University of New Hampshire. Cameron directs an active research program investigating regional climate and environmental change through the analysis of ice cores and instrumental records. As part of the Northeast Climate Impact Assessment (NECIA), he co-lead research detailing past and future climate change in the US Northeast. Cameron serves on the New Hampshire Climate Change Task Force and directs Carbon Solutions New England™ (CSNE) a regional collaboration for a low carbon society. The goal of CSNE is to unite leaders from the public, private, and non-profit sectors to collaborate at an entirely new level to build a clean energy future while sustaining our unique natural and cultural resources.

Riley Young Morse
At the Gulf of Maine Ocean Observing System, Riley is primarily responsible for specifying functional and technical requirements for current and future ocean information products by conducting market research that focuses on customer needs, including the coastal inundation user needs assessments and associated feasibility work. She works closely with development teams composed of marine scientists, web designers and IT

professionals to produce web-based information products, and has worked directly with NROC's Hazards Committee. Riley also plays a key role on the development staff contributing to the design of prototypes and user interfaces as well as maintaining content on GoMOOS.org and other partner websites.

Before joining the team in 2006, Riley was the Director of Product Development for a Maine-based online job board company. She brings over eight years of experience designing and developing web-based applications, with a focus on front-end design and user interaction. She also brings the experience of a formal undergraduate and graduate education in marine biology and fisheries science and 5 years experience in research and program management.

Appendix D: Presentation Descriptions

Presentations are available at http://community.csc.noaa.gov/nroc/

Overview of storms of the Northeast and their effects on the coast
David Vallee with the National Weather Service

The Realities of Hurricanes in New England
Hurricanes affecting the Northeast United States are considered low frequency but tremendously high impact events. The region is fortunate in one sense; we do understand the behavior of these systems as they race toward us and we must use that understanding to our advantage in continuing effort to make our communities as resilient and best prepared as possible. David's presentation will examine the behavior of these devastating tropical cyclones and will address aspects of the heavy rainfall and riverine flooding, high winds, and storm surge and coastal flooding.

Implications of climate change for storm intensity and frequency in the Northeast
Cameron Wake with UNH Climate Change Research Center

Climate Change in the Northeast: Past, Present, and Future
Climate Changes. It always has and always will. What is unique today is that human activities are also causing our climate to change. A wide variety of climate indicators show that the northeast United States has been warming over the past four decades and that this warming has already begun to impact a variety of ecosystems and economic sectors. The recently completed Northeast Climate Impacts Assessment (www.climatechoiceds.org) concludes that the decisions we make over the next decade regarding how we produce and use energy will determine the future climate of New England and the subsequent impact on, for example, marine ecosystems and coastal infrastructure. Finally, even with a significant reduction in the global emissions of greenhouse gases, regional climate will continue to be wetter and warmer over the next several decades. Lessons learned from past climate disruptions include the need to anticipate a changing climate and build in resiliency. Advance planning and investment in measures to adapt to climate change will typically result in less damage and lower overall costs to municipal and state governments.

Presentation of the Assessment of Resiliency Capacity for the Northeast Region
Pam Rubinoff with the University of Rhode Island Coastal Resources Center

Ms. Rubinoff will present the Coastal Community Resilience (CCR) framework and review some qualitative results of a cursory review of the Northeast US. As a result of the

2004 Indian Ocean Tsunami, the CCR assessment tool was developed to integrate the goals of community development, coastal management, and disaster management. *How Resilient is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Coastal Hazards.* This tool is intended to serve as a rapid assessment approach to identify strengths, weaknesses, and opportunities to enhance resilience at local and national levels. With wide application in the Indian Ocean, the tool is now being tested in Hawaii, to determine its application in a US setting. This cursory review was part of a more detailed NE Regional Assessment performed for NOAA's Coastal Services Center, where the URI Coastal Resources Center provided a Hazard Policy Inventory and Literature Review of the Northeast Coastal Community: Management of Coastal Ecosystems and Natural Hazards.

FEMA's Community Rating System and the coastal series of credit activities
Daisy Sweeney with the Federal Emergency Management Agency

The Community Rating System is a voluntary program that recognizes activities above and beyond the minimum requirements of the National Flood Insurance Program. The Goals of CRS are to: Reduce flood damage to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.

Engaging stakeholders to improve the Ocean State's Resilience: Sea Level Policy, Urban Buffer Policy, and SAMPs
Grover Fugate with the RI Coastal Resources Management Council

Narragansett Bay's largest urban waterfront, roughly 24 miles of shoreline bordering the cities of Cranston, East Providence, Providence and Pawtucket, is a largely untapped natural resource and economic engine. It was the site of industrialization and progress and over the years has become outdated and underutilized. The cities are now acting to make this region of Narragansett Bay a more appealing place to live and work by improving the economic, social and environmental resources of the working waterfront; attracting major developers with more predictable and efficient permitting; and providing recreation and access to the water.

The Metro Bay Special Area Management Plan (SAMP) aims to accomplish these goals and provide a functional framework for future environmentally and economically sensitive redevelopment of the SAMP boundary encompassing most of the waterfront in the four cities. The Coastal Resources Management Council is coordinating with the cities of Cranston, East Providence, Providence and Pawtucket, as well as government agencies and community organizations to prepare the SAMP.

This plan also represents a milestone for the CRMC, as it will update and revitalize the Providence Harbor SAMP that the CRMC developed more than 20 years ago. Since that time, the cities of the upper Narragansett Bay have prospered from economic growth and cultural renewal, as well as a renewed appreciation for the waterfront and its natural values. These changes have, of course, brought challenge, as cities struggle to balance redevelopment goals and efforts to provide public access to the water. As an outgrowth of the SAMP during the work that was done on the coastal hazards chapter it became evident the CRMC had to take a more in depth look at Climate Change and Sea Level Rise. A panel was put together to advise the CRMC on likely Sea Level Rise scenarios and based on this information the council developed its new RICRMP section on Climate Change and Sea Level Rise. The Metro Bay region is an important natural resource for Rhode Islanders. The CRMC is committed to creating a SAMP that protects this important natural and economic resource and honors the upper bay's special history and heritage.

As part of the development of the SAMP the Urban Coastal Greenway Policy is an important component of the Metro Bay SAMP. The policy was drafted in an effort to customize CRMC's coastal vegetative buffer regulations for the urban landscape of the Metro Bay Region. The Urban Coastal Greenway program is intended to balance development of the Metro Bay shoreline with environmental protection, restoration, and public access through a more flexible and streamlined regulatory structure. As part of the Urban Coastal Greenway Policy process, a Priority Lands Analysis was performed to assess the conservation, restoration, and/or scenic values of coastal Metro Bay properties. The analysis prioritized parcels for conservation and restoration based on the value of the land as habitat or as a link between important habitat areas. Parcels while being preserved also provide a buffer for storm and wave attack adding to the existing CRMC policies dedicated to hazard mitigation. Also included were special considerations for greater widths for separation on coastal embankments subject to coastal erosion. Through the Metro Bay SAMP process, major stakeholders and local and national experts (listed in the reference section) have identified specific issues, findings of fact, and proposed solutions to natural hazard threats. Their work, along with additional research, forms the basis for this paper.

Real-time storm surge prediction tools
Bob Thompson with the National Weather Service

This presentation will describe a NOAA collaborative project to enhance coastal flood forecasting and the community response to coastal flood threats. Enhancements to the science of coastal flood forecasting involve implementation of a near shore forecasting model, the ability of National Weather Service (NWS) Forecasters to adjust model surge output, and an evaluation of alternative storm surge modeling efforts. Enhancements of community response to coastal flood threats include visualization graphics and accompanying preparedness efforts such as the NWS StormReady program. The project is focused on the extratropical coastal flood threat and involves two pilot communities

along the New England east coast. The presentation will feature work to date and future plans.

Coastal Flooding and Erosion Forecast System
Riley Young Morse with the Gulf of Maine Ocean Observing System

This presentation will introduce a project developed to improve the capacity to forecast potential damage from coastal storms. In 2007, in partnership with the National Weather Service and NERACOOS, GoMOOS produced a Coastal Flooding and Erosion Forecast System. This application integrates water level and wave forecasts with empirical storm data to forecast splash-over and erosion events. The initial prototype was designed for Saco, Maine and proved valuable during the 2007 St. Patrick's Day and Patriot's Day Storms. Since then, GoMOOS has been working to improve the usability of the application by gathering input from users and additional storm data in order to make a version of the tool for Scituate, Mass, another coastal community susceptible to damage from coastal storms. This capacity is extremely important to coastal property owners and emergency responders, resulting in dollars and lives saved. The presentation will describe how the forecast works, demonstrate performance during past storm events, and detail the enhancements that are planned.

Massachusetts Storm Smart Program. ***Governance, Land Use and Structural Design***
Daniella Hirschfeld with Massachusetts Coastal Zone Management

The "StormSmart Coasts" (SSC) presentation will provide a broad overview of the program followed by a deeper look its relationship with coastal community resiliency (CCR). Specifically, the talk will explore how the program can have a positive impact in the areas of governance and land use and structural design.

The talk begins with a brief overview that explores the motivations behind the program and the goals that helped to shape it. The current status of "StormSmart Coasts" will then be discussed. The presentation will broadly explore both the program's website's design and the community partnership elements. Finally the presentation will look at specific tools that may help communities achieve the levels of resiliency they need.
