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**U.S. HOUSE OF REPRESENTATIVES
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SUBCOMMITTEE ON OVERSIGHT AND MANAGEMENT EFFICIENCY**

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Good afternoon Chairman Duncan, Ranking Member Barber, and Members of the Subcommittee. My name is Jeffrey Payne, and I am the acting director of the National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management. Thank you for the opportunity to testify today about the cooperation and coordination of communications between federal, state, and local emergency preparedness partners as communities consider how to better prepare for the impacts of natural hazards and other emergencies. My testimony today will cover 1) an understanding of our vulnerability to storms like Hugo, 2) NOAA's collaborations in support of communities in South Carolina and the rest of the Nation as we prepare for, respond to, and recover from hazardous events and the potentially compounding effects of longer-term changes, and 3) the importance of coordinating effectively after an event, during the response and early recovery phase, to promote wiser long-term recovery and resilience decisions. This final point is critical to how we as South Carolinians, and Americans, are able to become more resilient in the face of future events, from small accidents to major disasters.

A 2005 study by the National Institute of Building Sciences on Federal hazard mitigation grants estimated that \$1 spent on hazard mitigation potentially saves \$4 in disaster relief costs and lost Federal tax revenue. A community that spends its recovery dollars on investments designed to provide resilience, rather than simply plugging a hole or building back to the same level of vulnerability, will be better poised both economically and socially to withstand another hazard event.

Hurricane Hugo: Understanding why we are still vulnerable

Twenty-five years ago, between September 10 and 22, 1989, Hurricane Hugo made its way across the Caribbean Islands and up the southeastern coast of the United States. Hurricane warnings for coastal South Carolina, issued at the then-standard three days in advance, led to the safe evacuation of more than 250,000 people. By the time the storm had passed through Canada and into the North Atlantic, it had resulted in 49 deaths and widespread damages and losses estimated at \$7 billion in the United States. At the time, Hugo was the strongest storm to strike

the U.S. in the previous 20-year period, and it was the Nation's costliest hurricane on record in terms of monetary losses (~\$7 billion in damage). A week after Hurricane Hugo hit, nearly 60,000 people were homeless, as 5,100 homes were destroyed and 12,000 homes deemed uninhabitable.

Since Hurricane Hugo, NOAA has improved its hurricane forecasts: the 2012 Hurricane Sandy track was more accurate five days out than the Hugo forecast was at three days. Coastal South Carolina has been rebuilt and continues to be a popular place to live, work, and vacation. The Port of Charleston is the fourth largest U.S. Atlantic port and generates over a quarter of a million jobs in South Carolina alone. This area is a strong economic driver in the Southeast region of the U.S., including the very significant positive economic impacts of tourism and recreation. However, the long recovery from Hugo is a reminder of the region's vulnerability, as population grows and new structures in the coastal zone continue to be built. The South Carolina Emergency Management Division has estimated that had a similar storm struck in 2009, there would have been \$8 billion in damage, and more than 4 times the number of homes destroyed.

Since 1989, the United States as a whole has weathered 17 tropical cyclones and 6 drought events with at least seven billion dollars in estimated damage, as well as wildfires costing up to \$6 billion in damages and up to 28 lives lost. Nearly 90 percent of all Presidentially-declared disasters are weather and water-related, and our vulnerability to the impacts is increasing as our population grows. Demographic trends, population growth, and an increased reliance on technology, coupled with extreme weather events, have made our society more vulnerable to high impact events. There is growing recognition that the frequency of (low magnitude/high probability) 'nuisance' types of coastal flooding events will increase dramatically with rising sea levels (e.g. Firing and Merrifield, 2004; Sweet et.al., 2014), and that these events are likely to have the greatest cumulative impacts on built, social-human, and natural systems over the coming decades. As a result, many agricultural, business and urban planners are looking for ways to increase community resilience now. For instance, in the Hampton Roads area of Virginia, where 'nuisance' flooding now happens monthly, Old Dominion University is working with the community and its largest federal partner, the Department of Defense and Naval Station Norfolk, to develop a whole community approach to sea level rise preparedness and resilience planning. Norfolk, among many other cities, recognizes the need to understand changes and trends in weather patterns, and to apply this to planning that may reduce vulnerability to high-impact natural or man-made hazard events. Their recognition for the need to reduce their vulnerability is an important first step.

Not only is our coastal infrastructure vulnerable, but our population is as well. Social vulnerability looks at indicators such as population demographics (race, class, age, ethnicity, etc.) and density, and determines where additional or targeted response efforts may be necessary to address the needs of the elderly, the young, or those without access to transportation in case of evacuations. Communities already living below the poverty line will face different challenges

than wealthier communities, as we saw in the aftermath of Hurricane Katrina. Through a partnership with the University of South Carolina (USC) and funding via NOAA's South Carolina Sea Grant Program and the NOAA Office for Coastal Management, the Social Vulnerability Index (SOVI) method of measuring the social vulnerability of U.S. counties to environmental hazards has now been applied to Census 2000 block groups and Census 2010 tracts for all coastal states, providing a more detailed look at a community's social vulnerability for improved disaster response preparedness.

While these efforts and others are providing the groundwork for addressing vulnerability, there is much more that needs to be done in other sectors of our economy and with the general public to comprehensively increase our resiliency to the impacts of these events.

A Big Job: We can't do it alone

NOAA is one of many Federal Agencies that has a critical role in preparing for and responding to disasters. The Department of Commerce Strategic Plan includes a significant coordinated effort amongst NOAA, the National Institute of Standards and Technology (NIST), the U.S. Economic Development Administration, and the Small Business Administration to enhance the resilience of communities. For example, NOAA has been engaged with NIST's disaster resilience framework, which will provide local communities with a systematic approach to plan for disasters and other disruptive events. NOAA also works collaboratively with other agencies, including the United States Geological Survey (USGS), the United States Army Corps of Engineers (USACE), the Environmental Protection Agency (EPA), and agencies within the Department of Homeland Security, primarily the Federal Emergency Management Agency (FEMA) and United States Coast Guard (USCG) to ensure a coordinated approach to preparedness. An example is the Partnership for Sustainable Communities, where NOAA is working with FEMA, DOT, EPA, and HUD through the Partnership for Sustainable Communities to provide information and services to States for State Hazard Mitigation Plans. The Hazard Mitigation Plans identify risks and risk reduction measures in a State – and in communities – and is an all hazards preventative approach designed to prevent loss of life and damage from future disasters.

Furthermore, NOAA's role in Presidential Policy Directive 8 on National Preparedness supports science and technology in disaster mitigation, as well as promoting coordination of pre-disaster preparations and investments at the federal level to support community resilience efforts. In this effort, NOAA works with both federal agencies and representatives from states, localities, territories and tribes to help encourage and coordinate a shift in the culture of disaster preparedness, to embed risk management and mitigation in all planning, decision making and development to the greatest extent possible.

As a part of this National Preparedness work, NOAA also worked with FEMA to develop a National Disaster Recovery Framework (NDRF) which is implementable at the regional or

community level. An interagency group is looking at how Federal efforts can be better coordinated with partners at the community-level in advance of disasters, so that plans and working relationships are in place before a community is threatened. This type of planning will allow response efforts to move towards more efficient “precovery,” where planning for the next event is taken into consideration during the response phase of the past event.

The Silver Jackets Program for South Carolina works to increase coordination and efficiency between state and federal governmental agencies in developing comprehensive and sustainable solutions to flood and coastal risk management in South Carolina. It serves as a catalyst in developing comprehensive and sustainable solutions to flood hazard issues, including mitigation planning, flood hazard mapping, risk reduction activities, and response and recovery planning.

In addition to its support of national level science and technology policy, NOAA also works with state and local officials, emergency managers and other partners to determine their needs for data, information, tools, training and other services that lead to better understanding and communicating risk, and strengthening a community’s resilience. NOAA and its partners, such as the National Sea Grant network, use integrated research, training, and technical assistance to enhance the ability of communities to prepare for, respond to, and rebuild after disasters strike. For example, we are developing a Coastal Resilience Index that provides a tangible way for communities to identify gaps and examine how prepared they are for storms and storm recovery, and provide guidance on how to increase resilience through measures including strengthening infrastructure or adopting stricter building codes.

Since Hurricane Hugo struck, NOAA has worked with the U.S. Army Corps of Engineers and FEMA to update the South Carolina Hurricane Evacuation study twice, most recently in 2012. NOAA used enhanced elevation data using LIDAR and updated the SLOSH (Sea, Lakes, and Overland Surges from Hurricanes) models. New storm surge evacuation zones were created and used for hurricane evacuation planning. The South Carolina Emergency Management Division promotes community understanding of these new plans through their Know Your Zone campaign.

The *Potential Storm Surge Flooding* map is an experimental NOAA National Weather Service (NWS)/National Hurricane Center product being used to show areas that could be affected by storm surge and potential water depths during a land-falling tropical storm or hurricane. Social science research was conducted with key partners and customers (broadcast media, emergency officials, and the public) to develop the map and inform outreach efforts. A marketing plan, videos, and tipsheets developed based on risk communication best practices are helping to ensure a consistent message about the map across the weather enterprise.

Effective risk management and forward-thinking resiliency requires a broad coalition of vested and knowledgeable federal, state, non-governmental organization, and industry partners. It is

critical that these sectors continue to engage and build partnerships to better manage risk moving forward. The time is now to forge sustainable partnerships.

Preparing and Responding

Communicating

As the federal government's sole official voice for issuing warnings during life-threatening weather events, and as an established reliable and trusted source, NOAA provides the Nation's alerts and warnings for severe weather and other near term hazards (tornadoes, hurricanes, severe thunderstorms, winter storms, most floods, chemical spills, volcanic ash, tsunami, space weather, etc.). These messages are delivered through multiple mechanisms, including: NOAA Weather Radio, which triggers the Emergency Alert System; NWSChat, which focuses on real-time coordination with local core customers in the broadcast media and emergency management; the Emergency Managers Weather Information Network (EMWIN), a system for distributing a live stream of weather information in the United States transmitted over NOAA Geostationary Operational Environmental Satellites (GOES); the Internet; and, through our private sector partners, commercial television and radio, which communicate critical information to much larger audiences and effectively inform those in harm's way to take appropriate action. Emergency messages are also transmitted by cellular phone companies via text messages through the Wireless Emergency Alert system, which uses warning and emergency information from the NWS, FEMA, and others.

Coordination of science and technology

NOAA's mission to provide science, service, and stewardship to the Nation in support of community resilience is fundamentally dependent on observations of our environment. These observations are the backbone of NOAA's predictive and service capabilities. NOAA must ensure operational weather, ocean, climate, and space weather data, including tides, water levels, geodetic positioning, and accurate nautical charts, are available at all times to address our Nation's critical needs for timely and accurate forecasts, warnings of solar storms and severe weather including hurricanes, flash floods, tsunamis, and wildfires, and to ensure the flow of commerce and the safety of lives and property.

NOAA partners with other federal and international agencies to support satellite observations, including NOAA's Polar-orbiting Operational Environmental Satellite (POES), Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, NASA Earth Observing Satellites (EOS), and the European Metop satellites. GOES satellites, along with Doppler Radar, assist operational weather forecasters with current and short-term forecasting abilities and severe weather warning forecasts. NOAA also participates in regional ocean observing networks. For example, the Southeast Coastal Ocean Observing Regional Association (SECOORA) supports the Governors' South Atlantic Alliance priorities in providing ocean observations to NOAA and other regional researchers to improve forecasting of storm surge, inundation, and coastal circulation. This modeling component provides real-time forecasting to support operational management of water

control structures and utility infrastructure, and to support emergency managers during hurricane season.

Often after a coastal disaster such as a hurricane or other incident, new mapping data is essential for situational awareness both on land and offshore. NOAA and its sister agencies use aircraft and ships to survey and map the impacted area in order to support response partners such as the state and FEMA, as well as to update critical safety products like nautical charts and notices to mariners to allow the USCG, relief ships and cargo vessels to move in and out of ports. We work closely with our mapping partners such as the USACE and USGS to coordinate mapping efforts using an Integrated Ocean and Coastal Mapping approach, where we strive to map once and meet multiple missions with the same datasets. These datasets help the state and our partners with recovery from an event and to begin preparing for the next one. For example, seafloor sonar surveys completed and charted by NOAA ships and small boats helped reopen Baltimore and the Virginia ports after Hurricane Sandy, quickly restarting commerce and allowing Navy ships to return to port. Similarly, NOAA assisted in rapidly reopening New York and New Jersey ports so that emergency fuel and other crucial supplies could reach some of the hardest-hit areas. Hours after the storm, NOAA planes and scientists conducted aerial surveys of the affected coastlines, and published the photos online immediately, allowing emergency managers and residents to examine the damage even before ground inspections were permitted. These surveys are also vital to FEMA assessment teams and other on-the-ground responders and those managing oil spill clean-up and damage assessment.

After any large natural disaster, the scientific community comes into the impacted area from all over the world seeking to collect rare and time-sensitive post-disaster data and information, before the evidence disappears or degrades over time. This data is essential to understanding physical and socio-economic causes and impacts of the event, and developing better response, recovery and mitigation plans. Recognizing the strain that an influx of scientists can have on the state and local governments and emergency response agencies, NOAA and USGS, through the Pacific Risk Management `Ohana (PRiMO), helped develop a joint scientific protocol to coordinate the collection and sharing of physical, engineering, social science and other data and information and promotes coordination, communication and respect in regards to the community, the emergency managers and impacted region. The protocol helps keep data and information flowing, and the community focused on recovery.

NOAA also monitors chemical safety threats to our community and environment. We are upgrading tools used by local, state, and federal responders to safely and effectively respond to such emergencies. The CAMEO (Computer-Aided Management of Emergency Operations) software suite delivers critical information for emergency responders and planners about chemicals that are stored and shipped in their local communities. These tools are often used as a common platform to help facilitate the exchange of information between first responders, emergency planners, industry, environmental groups, and academics. The CAMEO program has

a long history of close contact with our end users both emergency responders (firefighters) and state and local planners.

Much like the train derailment in Abbeville, South Carolina, several real-world incidents over the last year have highlighted emerging risks from transportation of hazardous materials by rail. NOAA, working with the Department of Homeland Security, is also in the final stages of integrating a new chemical source estimation model, called Railcar, into NOAA's chemical air dispersion model, ALOHA (Areal Locations of Hazardous Atmospheres). Railcar was developed by the U.S. Navy, based on large-scale field tests of chlorine and ammonia releases from tanks. ALOHA models chemical releases for emergency responders and planners. It can estimate how a toxic cloud might disperse after a chemical release, and estimates a threat zone, where a hazard has exceeded a user-specified Level of Concern (LOC).

In the aftermath of Hurricane Sandy, NOAA's Atlantic Environmental Risk Management Application (ERMA) served as the common operational picture for the Hurricane Sandy pollution response. ERMA is an online mapping tool for US coasts and the Great Lakes that integrates static and real-time data in a centralized, easy-to-use map for environmental responders and decision-makers. Atlantic ERMA integrated these response efforts with environmental data to give responders a better idea of how to deal with pollution threats while minimizing environmental damages. As the common operational picture, ERMA provided a single platform for responders to view all of the storm-related data and imagery as well as various cleanup efforts by the states and other federal agencies. Our team of Geographic Information Systems (GIS) specialists working on ERMA helped provide data management support in tracking the progress made by the pollution response field teams, allowing state and local environmental and emergency managers to make informed decisions.

NOAA's Gulf of Mexico Disaster Response Center (DRC) also brings together NOAA-wide resources to improve preparedness, planning, and response capacity for natural and manmade disasters. Intended to serve as a safe and ready command center during major disaster responses in the Gulf, the DRC also hosts drills, trainings, workshops, and planning activities. For example, last spring the DRC partnered with the National Weather Service to assess the capabilities of NOAA partners in the region with a hurricane response exercise.

On the ground coordination

In order to better coordinate with federal and state partners and customers, NOAA has begun to embed its specialists in the centers of command during events. National Weather Service meteorologists now work side by side with FEMA, National Security Staff, and at the Department of Homeland Security Operations Center during emergency weather events and maritime traffic resumes more quickly when NOAA regional navigation managers work within command centers. In the wake of Hurricane Sandy, as the extent of the storm impacts became clear, NOAA meteorologists were assigned to regional and municipal emergency operations

centers and coastal management specialists worked in post-Sandy Joint Special Operations Command centers, alongside interagency and state partners, including representatives from governors' offices and state emergency management divisions. These working relationships will strengthen future coordination efforts and helped streamline communications during and after Hurricane Sandy, including for the important accurate assessment of damages and development of strategies for long-term recovery.

These tools, information and close working relationships allow federal, state and local officials and managers to make critical decisions when faced with realistic exercises and real-time events. To take preparation and response to the next level, where communities can become resilient, NOAA is helping support interagency and community-level "blue skies planning," or considering mitigation in all aspects of recovery and to do so before an event, essentially working on the elements of "precovery". This forward thinking can lead to wise investments of time and resources, seeking to keep the impacts of a hazard from becoming a disaster, or recovering more effectively and quickly should a disaster occur.

"Precovery" Thinking: Being ready for next time

NOAA is focused on providing services to enhance community resilience. Our prospects for success in this role, and of achieving our vision of resilient communities, lie in our unique enterprise capabilities. The goal of disaster resilience is to enhance the capacity of a community exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. The preparedness challenge remains essentially the same across all hazard events: public awareness, education, and plans of action to mitigate impacts on the personal, community and regional scales provide the best protection against potential disasters. NOAA has long-held and strongly established ties to the emergency management community, through state, local and tribal officials, which help ensure appropriate action is taken to prepare communities for weather and water events.

Community Preparedness

NOAA's Coastal Storms Program (CSP) is a nationwide effort to reduce loss of life and mitigate impacts of storms on coastal communities and the environment. CSP provides dedicated resources and expertise from across NOAA to deliver capacity-building tools, training, data, and other products and services to enhance hazard resilience in coastal communities in particular. For example, NOAA has worked with communities along the Gulf of Mexico to provide a simple, inexpensive method for leaders to perform a self-assessment of their community's resilience to coastal hazards. The results help communities prioritize what needs to be addressed before the next extreme event. Through these various community resilience efforts, NOAA is placing an increased focus on social science to better understand how and why decisions are made at the state and local levels and how NOAA can improve its efforts to communicate risk and uncertainty to the public at large.

Through the NOAA Climate Program Office's Carolinas Integrated Sciences and Assessments (CISA) team at the University of South Carolina, researchers are engaging local stakeholders in resilience planning in the coastal Carolinas. CISA works with South Carolina Sea Grant to develop science-based, participatory planning exercises for South Carolina communities to plan for sea level rise and climate adaptation. For example, CISA and Sea Grant partnered with the Beaufort County, SC Planning Department to produce a report containing recommended adaptation actions. While this project was originally intended to help inform Beaufort County's update of its Comprehensive Plan, several other opportunities have arisen from this work. For example, the County's Disaster Recovery planner has asked for help in updating the Disaster Recovery Plan with sea level rise projections. The County is also creating a list of Capital Projects they will prioritize and fund.

On September 5, 2014, the National Academies' Resilient America Roundtable announced its first two American communities that will be the focus of pilot projects to develop a community disaster resilience strategy, based on the Research Council report Disaster Resilience: A National Imperative. The two communities are Charleston, South Carolina, and Linn County/Cedar Rapids, Iowa. Over an initial two-year period, Resilient America Roundtable teams will work with decision makers, local organizations, businesses, and citizens in Charleston and Cedar Rapids, along with federal partners, to better understand the risks each community faces and design strategies to bolster resilience to these risks. Lessons learned in each of the pilot communities will be shared broadly with other communities across the Nation.

A complementary effort kicked off this summer in Charleston. The Department of Homeland Security's Office of Infrastructure Protection, FEMA and NOAA piloted a Climate Change Adaptation Exercise in June 2014. This exercise was an important first step in developing strategies and coordinating stakeholder planning efforts related to climate preparedness and resilience for critical infrastructure in the Charleston area. State and local partners, including the S.C. Sea Grant Consortium, the SC Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management, the SC Emergency Management Division, the City of Charleston's Emergency Management, and the College of Charleston, took part in the planning and implementation of this exercise.

While the topic of this exercise was climate change, the benefits will be reaped in the aftermath of another Hurricane Hugo or other hazard event that has the potential to strike at the heart of the South Carolina economy including our businesses, lives, and livelihoods. A core group of partners has formed an after-action committee to develop a Charleston Resilience Network. While the scope of this network is still being refined, the overall goal will be to create a defensible and repeatable decision-making process that will support the region in making smart decisions and investments during times of response and recovery. Components will include identifying hazard vulnerabilities and consequences, assessing the costs of risk mitigation action and inaction, identifying investment opportunities and developing the plans in which to make

those investments. This effort and the Resilient America Roundtable pilot will complement one another with a strong network of federal, state, Tribes, and local partnerships, and serve as a model for other community resilience networks.

NOAA has also been active in working alongside the DHS/FEMA-funded National Domestic Preparedness Consortium's National Disaster Preparedness Training Center (NDPTC) at the University of Hawai'i. This effort, which is national in scope, is providing a wide range of training to thousands of emergency and disaster managers, community planners, and other officials to improve their level of preparedness and capacity to deal with events. NDPTC develops and delivers FEMA-certified training courses, and a partnership with NOAA has resulted in the co-development and delivery of several course offerings. The overall focus is on disaster preparedness, response, and recovery, with a specific focus on natural hazards, coastal communities, and the special needs and opportunities of Tribes, islands and territories.

Summary

Although nothing can eliminate the physical threat that severe weather and natural hazards pose, NOAA has demonstrated success in better predicting hurricanes and storm surge, communicating the impacts of weather and other hazards, providing science and technology data, information, tools and services to reduce the impacts of hazards, and helping vulnerable communities become more resilient to their devastating effects. Such hazards include those that are episodic, such as extreme events, but also those that tend to be chronic and will affect future risk considerations, such as rising sea levels leading to more common (nuisance) flooding in low lying coastal areas and cities.

Presidentially and state-declared disasters trigger vast amounts of available funding to help federal agencies deliver critical data, information and services to impacted states, finance small business loans to keep the economy afloat, and allow communities to clean up destroyed areas, rebuild damaged infrastructure and provide housing for displaced families. However, to spend such funds wisely, it is critical to understand the complete nature of damages and to consider how well-developed recovery strategies can inform both the necessary community rebuilding efforts as well as actions to improve resilience to future events.

Developing lines of communication and cooperation with partners now will enhance pre-disaster planning efforts. Once a disaster strikes, it is too late if such advance work has not been accomplished. The goal should be to ensure that coordinated and informed decision making can begin in the immediate wake of a disaster, enabling states and communities to respond effectively and rebuild in a more resilient manner. To ensure that fiscally-wise and economically and environmentally sound decisions are made, the Federal government and its state and local partners need to continue coordinated pre-planning efforts at the national, regional and state levels. Wise "precovery" decisions will ensure that we are able to remain resilient in the face of future events, from the next chemical spill to the 21st century Hugo.

Thank you for the opportunity to appear before you today. I would be happy to answer any questions you may have.