FEMA and Climate Change

AK DHS&EM Workshop – Anchorage

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Federal Climate Change Authorities - *chronology*

- Presidential Executive Order 13514 – October 2009
- Federal Interagency *Climate Change Adaptation* (*CCA*) Task Force Report – December 2010
- DHS Secretary's Implementation Guidance 12/10/10
  DHS Policy for *CCA* – August 23, 2011
  DHS *CCA* Roadmap – June 2012
- CEQ Instructions for Implementing *CCA* Planning
- FEMA *CCA* Policy Statement 1/23/2012
- Presidential Executive Order 13653 – November 2013

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FEMA CCA Policy *January 23, 2012*: 7 "Initial Actions" and a CCA Plan

1. Partnerships with other Federal agencies:
   - For climate science data
   - For climate change adaptation expertise and to share best practices
2. National Flood Insurance Program:
   - Study climate change impacts on the NFIP
   - Incorporate climate change considerations
3. FEMA grants (e.g. *planning, projects, training*):
   - How can grants incorporate climate change considerations
   - Include long-term climate change risks in "cost-effectiveness" evaluations for project grants

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FEMA – 7 Initial Actions (cont.)

4. State, Local, Tribal, and Territorial governments:
   - Encourage + assist external partners to address climate change
5. Building Standards and Development Practices:
   - Update standards to address climate change considerations
   - Encourage integration of *CCA* in city planning + development
6. Risk Analysis for Planning and Operations:
   - Incorporate long-term climate change in risk analyses and plans
7. Workforce Adaptation - changing hazard events:

Lastly, develop a FEMA *CCA* Implementation Plan

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Strategic Foresight Initiative - SFI

- Emergency Management network hosted by FEMA
  - A “space” for collaboration and dialogue
  - Focus on the future of disaster management
  - Emphasis on “Whole Community” concept
- Climate Change issue paper – August 2011
  - How will communities manage projected changes?
  - Will growth continue in high-risk areas?
  - Can we afford to adapt vulnerable infrastructure?
  - How should the EM community become engaged in climate change issues?
  - How should the EM community prepare for the potential?

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ENVIRONMENT

Out of the Frying Pan

The forces of global environmental change are expected to bring major challenges and new opportunities to the United States. How we choose to cope with them may well be the biggest unknown we face.

Considering the environmental landscape, two forces are combining to increase the Nation's risks to natural hazards. First, the frequency of extreme weather is accelerating, with events like Hurricane Sandy threatening to become the norm. Secondly, fiscal pressure and political gridlock has resulted in piece-meal action to mitigate future risks and adapt to the growing dangers. Meanwhile, critical infrastructure is undermined by extreme weather and overburdened by increased use. Insurance companies are increasingly pulling out of risky areas, leaving the public to address the increased risk. This trajectory points to higher vulnerability for the Nation, unless we move now to take substantive preventive and adaptive action.

key trends

Unforeseen accelerations 2012 was the warmest year ever recorded in the contiguous United States since the first weather records began in 1895. In summer 2012, Arctic sea ice shrunk to its smallest extent on record, melting at a much faster rate than scientists anticipated. In the future, melting permafrost and thinning ice are expected to further accelerate warming by mechanisms and magnitudes that are difficult to predict with scientific models. This raises concerns that climate models underestimated the rate of warming and sea-level rise observed to date, raising prospects that climate change impacts will be felt faster.

No drive to act At the 2012 climate meeting in Doha, Qatar, negotiators were unable to forge an emissions reduction agreement that would keep global temperature increases below 2°C—a threshold that most climate scientists believe is on the outer bounds of "safe" warming. Without meaningful action to reduce emissions today, scientists believe impacts will increase in magnitude over the medium and long-term, with temperatures potentially reaching 4-6°C by the end of this century.

Background image courtesy of Flickr user gronger

VS

Making Lemonade

While severe weather remains a major threat, opposing dynamics propel the United States to make the best of a difficult situation. Recovery efforts in New York and New Jersey after Hurricane Sandy, for example, were buoyed by improved remote-sensing data and new technology that sped up the distribution of relief funds. The wide-spread damage from Hurricane Sandy forced government to seriously focus on adaptation planning and reducing risk exposure. Relatedly, research shows that growing first-hand experience with extreme weather impacts increases public support for climate action. While weather and climate are not synonymous, the public continues to link the two ideas, complicating outreach efforts. Meanwhile, states, cities, and businesses are instituting collaborative efforts to tackle climate change adaptation and improve mitigation. This path, therefore, has silver-linings: the challenges posed by climate change encourage collective, cost-effective actions, which bolster disaster resilience.

key trends

(Momentary) positives Melting sea ice opened new Arctic shipping routes and enabled extraction of useful minerals and oil deposits. Changes like increased atmospheric CO2 and a decline in the number of frost days expected to initially increase crop yields in North America (with strong variations). In the long run, food production may suffer from shifts in temperature and rainfall. Emissions in the sensitive Arctic may further accelerate the rate of melting and warming, especially with added pressures from burning oil and gas uncovered in the region. But for now, these momentary positive impacts are being exploited.

Catalyzing events Hurricane Sandy, the worst U.S. drought in a half-century, and the 2012 Colorado wildfires brought new attention to the topic of climate change. In the same vein that public opinion shifts with growing exposure to severe weather, recent events demonstrated the need to further embrace a more forward-looking and adaptive position. The drive to implement an integrated approach to reducing risk exposure now influences rebuilding decisions for housing and infrastructure. Relatedly, the modeling and management of risk is changing, and stronger design standards are being developed.

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Hurricane Sandy Recovery – 2012 - 2013

Integrating Climate Change Adaptation

- Encouraged communities to build back smarter, stronger
- Provided ABFEs - Advisory Base Flood Elevations –
  - Reflect changed conditions – available on-line
  - Not mandatory – not regulatory – not used for NFIP rating
- Sea Level Rise Planning Tool –
  - NOAA data for New York & New Jersey – on-line
- Federal Recovery Support Strategies
- “Future risks” for repair/upgrade and reconstruction projects ***funded by Public Assistance***

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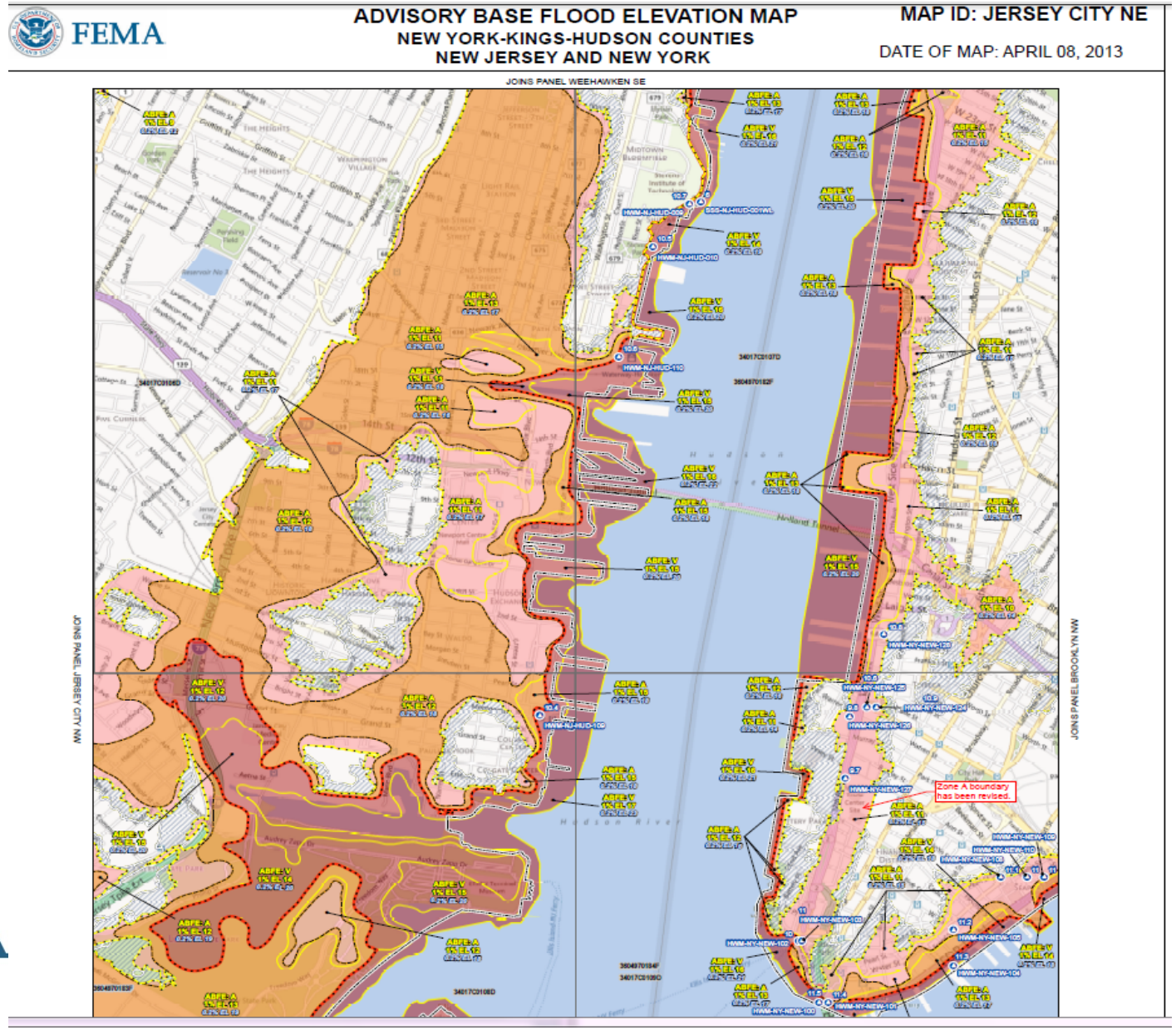
ABFE Map for Lower Manhattan & Jersey City



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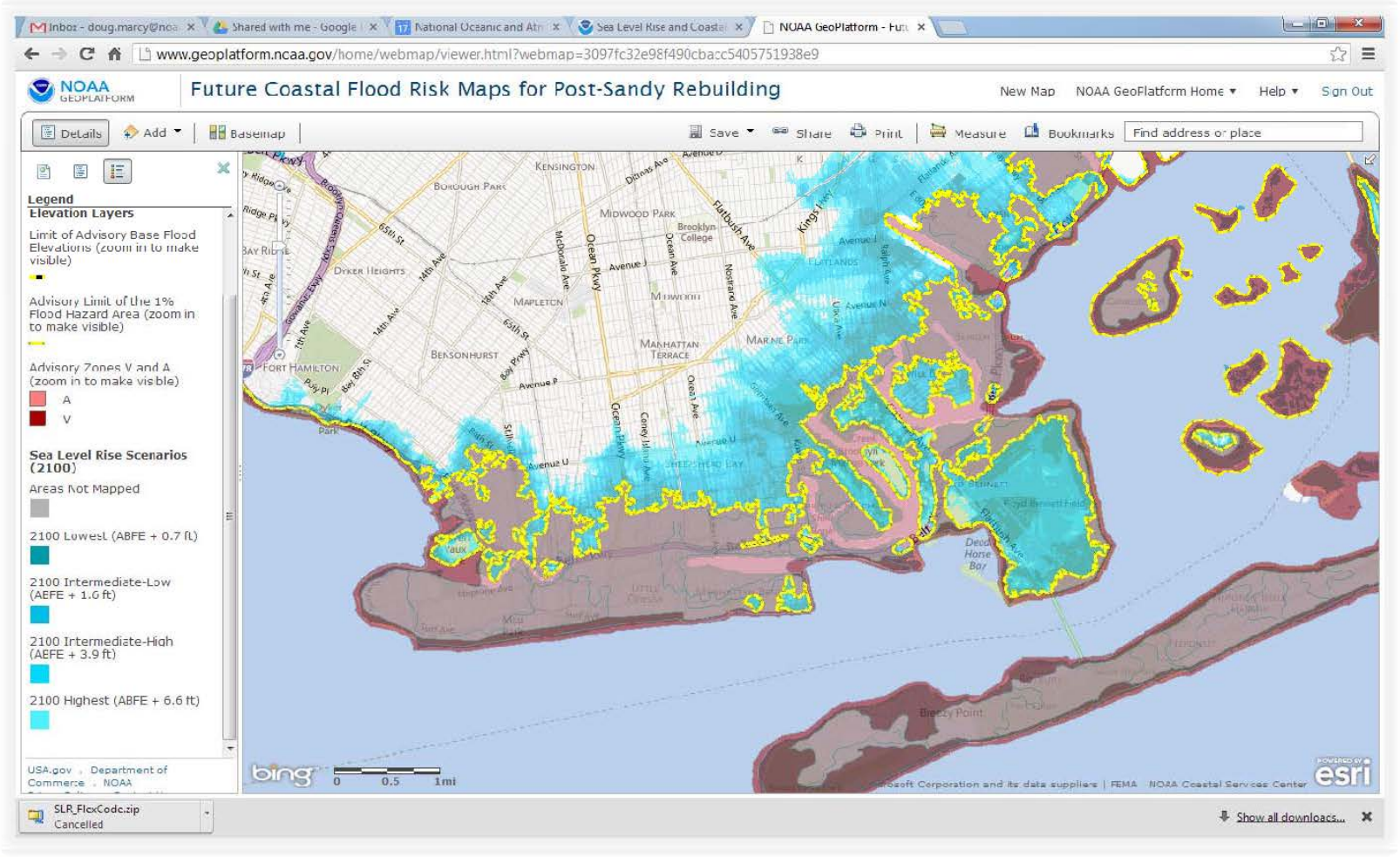
Brooklyn, New York: Future Risk Mapping



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Designing for Flood Levels Above the BFE After Hurricane Sandy

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HURRICANE SANDY RECOVERY ADVISORY *RA5, April 2013*

Purpose and Intended Audience

Flooding in New York and New Jersey extended far beyond mapped Special Flood Hazard Areas (SFHA) and exceeded base flood elevations (BFEs) by several feet in some areas. Lessons learned from Hurricane Sandy can be used to guide repair and reconstruction efforts and design of new buildings to reduce susceptibility to future flood damage.

This Recovery Advisory reviews how coastal Flood Insurance Rate Maps (FIRMs) and BFEs are established and provides guidance on elevating buildings to minimize flood damage in cases where flood levels exceed the BFE. The intended audience for this advisory is primarily homeowners and designers, but it may be helpful to anyone involved in selecting lowest floor elevations for new construction and reconstruction of buildings in areas affected by Sandy.

Key Issues:

1. Elevating to the BFE does not provide complete protection against flooding. Storms more severe than the base flood can and do occur.
2. FIRMs are only as accurate as the topography, bathymetry, and technical information used, and the technical analyses performed, to create them. FIRMs are a snapshot in time and may become outdated as physical conditions, climate, and engineering methods change.
3. Once flood levels exceed the lowest floor of a building, the extent of damage increases dramatically, especially in areas subject to coastal waves (Figure 1).
4. Design and construction practices can minimize damage to buildings, particularly by elevating the building higher than the minimum required elevation.

This Recovery Advisory Addresses:

- FIRMs, FISs, and flood risk
- Building damage when flood levels rise above the lowest floor
- How high above the BFE a building should be elevated
- Effect of building elevation on flood insurance premiums
- Additional design considerations for mitigating flood damage, inside and outside mapped flood hazard zones

Terminology

Flood Insurance Rate Map (FIRM): A map produced by FEMA to show flood hazard areas and risk premium zones. The SHFA and BFE are both shown on FIRMs.

Special Flood Hazard Area (SFHA): Land areas subject to a 1 percent or greater chance of flooding in any given year. These areas are indicated on FIRMs as Zone AE, A1-A30, A99, AR, AO, AH, V, VO, VE, or V1-30. Mapped zones outside of the SFHA are Zone X (shaded or unshaded) or Zone B/Zone C on older FIRMs.

Base Flood Elevation (BFE): Elevation of flooding, including wave height, having a 1 percent chance of being equaled or exceeded in any given year (also known as "base flood" and "100-year flood"). The BFE is the basis of insurance and floodplain management requirements and is shown on FIRMs.

Figure 1: Back wall failure due to flood level above the lowest floor of a house in Ortley Beach, NJ

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globalchange.gov
U.S. Global Change Research Program

Thirteen Agencies, One Vision: Empower the Nation with Global Change Science

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WHAT WE DO

- Study Climate & Global Change
- Prepare The Nation For Change
- **ASSESS THE U.S. CLIMATE**
  - Overview
  - Background & Process
  - Opportunities for Engagement
  - Draft Report Information
  - Previous Assessments
  - NCA & Development Advisory Committee
  - Production Team
  - Indicators System
  - Coastal Resilience Resources
- Make Our Science Accessible
- Link Climate Change & Health
- Provide Data and Tools
- Coordinate Internationally

Sea Level Rise Tool For Sandy Recovery

Hurricane Sandy is a vivid reminder that coastal communities are vulnerable to the risk of damage from storms and flooding. Sea level rise increases the frequency and severity of coastal flooding in human and natural systems, even if storm patterns remain the same. FEMA provides information about risk based on current conditions. By statutory requirement, FEMA's Flood Insurance Rate Maps (FIRMs) and other mapping products depict today's flood risk. Addressing flood risk based on current conditions has immediate, short-term benefits to communities, but does not adequately account for increasing flood risk resulting from sea level rise.

Post-Sandy recovery provides an opportunity to reduce vulnerability and increase resilience further into the future by incorporating sea level rise information into decisions about how and where to rebuild, or to start new development. Using the best available science and data, federal agencies have jointly developed this tool to help state and local officials, community planners, and infrastructure managers understand possible future flood risks from sea level rise and use that information in planning decisions.

> ***Disclaimer:*** *Please contact your local floodplain manager for assistance in interpreting this information. Professional engineers and surveyors can assist in translating this information for recovery planning. These maps and tools have no regulatory implications and do not affect National Flood Insurance Program requirements or rates.* For FAQs click here.

Sea Level Rise Maps

NOAA, in partnership with FEMA and the U.S. Army Corps of Engineers, has created a set of map services to help communities, residents, and other stakeholders consider risks from future sea level rise in planning for reconstruction following Hurricane Sandy.

These map services (click here for NJ and NY State counties and click here for NYC) integrate the best available FEMA flood hazard data for each location with information on future sea level rise from two different peer-reviewed sources (click here for a visual guide to the data sources used in the tool):

- A NOAA-led interagency report prepared as input to the National Climate Assessment, Global Sea Level Rise Scenarios for the United States National Climate Assessment. Scientists from multiple federal agencies and academic

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Public Assistance in Disasters

- NEW PUBLIC ASSISTANCE GUIDE January 2016
- No direct mention of “future conditions”, “climate change”, Sea Level Rise, etc. *in spite of what happened with Sandy Recovery*
- However, ***higher*** LOCAL CODES AND STANDARDS will still apply
  - extra costs to repair to HIGHER local/state standards are eligible costs
  - Standards must have been in effect by law at the time of disaster event
- FEMA reserves the right to require repair and rebuild to higher standards than are in effect at the local level

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National Flood Insurance Program

- Commissioned a NFIP Climate Change Impact study that was issued June 11, 2013, by AECOM – *40% expansion of SFHAs*
- Community Rating System (CRS)
  - Added NFIP rate reduction incentives for Climate Change Adaptation measures – "*higher regulatory standards*"
- *Coastal Construction Manual* FEMA P-55 was updated to address Sea Level Rise (8/2011)
  - Refers design engineers to USACE *Sea Level Change Considerations* for buildings, roads, utility systems, etc.
  - Shows how to determine SLR and incorporate in design plans
- Technical Mapping Advisory Committee – TMAC – for floodplain maps
  - Charged with evaluating how climate change could be incorporated into NFIP maps

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Coastal Construction Manual

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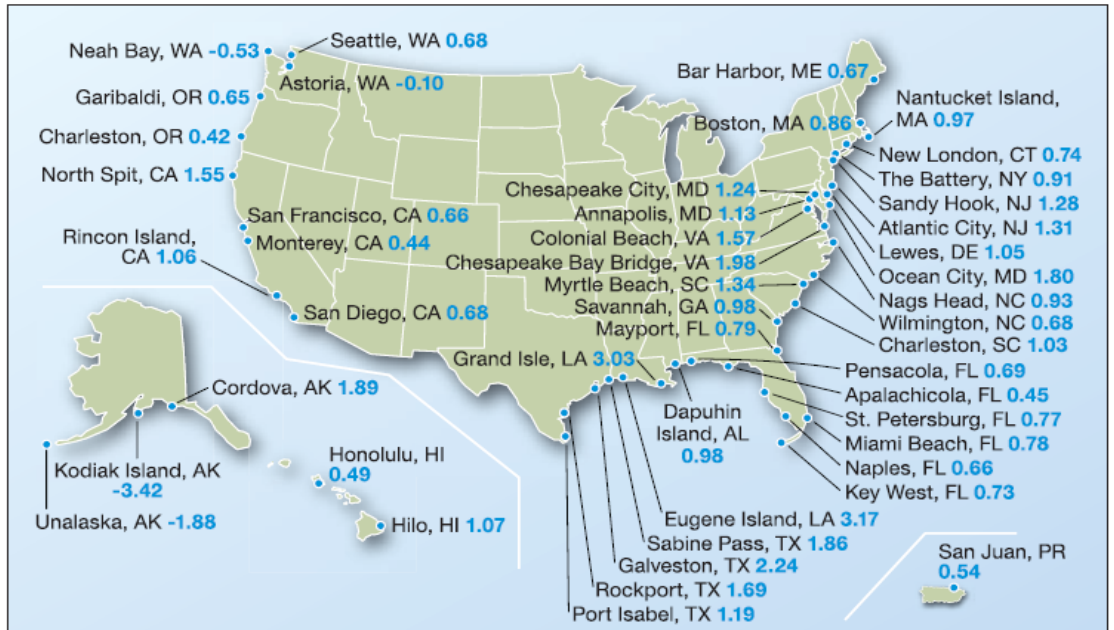
3.3.4.1 Sea and Lake Level Rise

Coastal flood effects, described in detail in Section 3.4, typically occur over a period of hours or days. However, longer-term water level changes also occur. Sea level tends to rise or fall over centuries or thousands of years, in response to long-term global climate changes. Great Lakes water levels fluctuate both seasonally and over decades in response to regional climate changes. In either case, medium- and long-term increases in water levels increase the damage-causing potential of coastal flood and storm events and often cause a permanent horizontal recession of the shoreline.

Global mean sea level has been rising at long-term rates averaging 1.7 (+/-0.5) millimeters annually for the twentieth century (over 6 inches total during the twentieth century) (Intergovernmental Panel on Climate Change [IPCC] 2007). Rates of mean sea level rise along the Louisiana and Texas coasts, as well as portions of the Atlantic coast, are significantly higher than the global average (as high as 3.03 feet per century in Grand Isle, LA). Records for U.S. Pacific coast stations show that some areas have experienced rises in relative sea levels of over 1 foot per century. Other areas have experienced a fall in relative sea levels; Alaska's relative sea level fall rate is as high as 3.42 feet per century (see Figure 3-13).



NOTE
Rates of change in mean sea level are given in feet/century. Negative values indicate falling mean sea level.

TMAC Recommendations 12/2015

THAT FEMA PROVIDE…

1. NON-regulatory *future conditions* mapping + tools
2. For *future conditions* mapping to address Climate Change - Define accuracy of projections assumptions – provide multiple scenario mapping
3. *Future conditions* coastal erosion and SLR maps
4. *Future conditions* for riverine – CC and urbanization – asserts there is "*no actionable science*" to model and project CC impacts on rivers
5. Clear *future conditions* messaging to public

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FEMA “Hazard Mitigation”

- “Mitigation” means different things for different professions
- For FEMA, “Mitigation” is ***not*** the same as *Mitigation* (i.e. “reduction”) of Greenhouse Gases, as in normal *Climate Change* parlance
- For FEMA, “Mitigation” is ***not*** the same as *Mitigation* (i.e. “compensation”) for loss of wetlands, as in highway projects
- **HAZARD** Mitigation in FEMA terms:
  - Reduce human and financial cost of future disasters
  - Taking action NOW, before the next disaster
  - Foster community resilience – bounce-back-ability
  - Mitigation is a FEMA Priority
  - Climate change adaptation is part of community resilience

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FEMA Hazard Mitigation Assistance Grants

- FEMA has three *hazard mitigation assistance **(HMA)** grant programs*:
  - Fund hazard mitigation projects, as well as planning activities.
  - Most are cost-shared at 75/25. Projects must be cost-effective.
- Flood Mitigation Assistance program (FMA)
  - Funded by NFIP; to reduce flood insurance claims.
  - Assists individual buildings, via grants through govt. sponsors.
- Hazard Mitigation Grant Program (HMGP)
  - Via a Presidential Declaration:15-20% of total Federal cost
- Pre-Disaster Mitigation Grant Program (PDM)
  - Annual appropriations by Congress. National competition.

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FEMA Hazard Mitigation Grants
Typical types of projects

- Flood buyouts – conversion to Open Space
- Tornado and Hurricane “Safe Rooms”
- Elevation of flood-prone buildings
- Wind and seismic retrofits of public facilities
- Retrofit/upgrade public utility systems
- Stormwater management + localized flood control
- Wildfire – defensible space, structural retrofits

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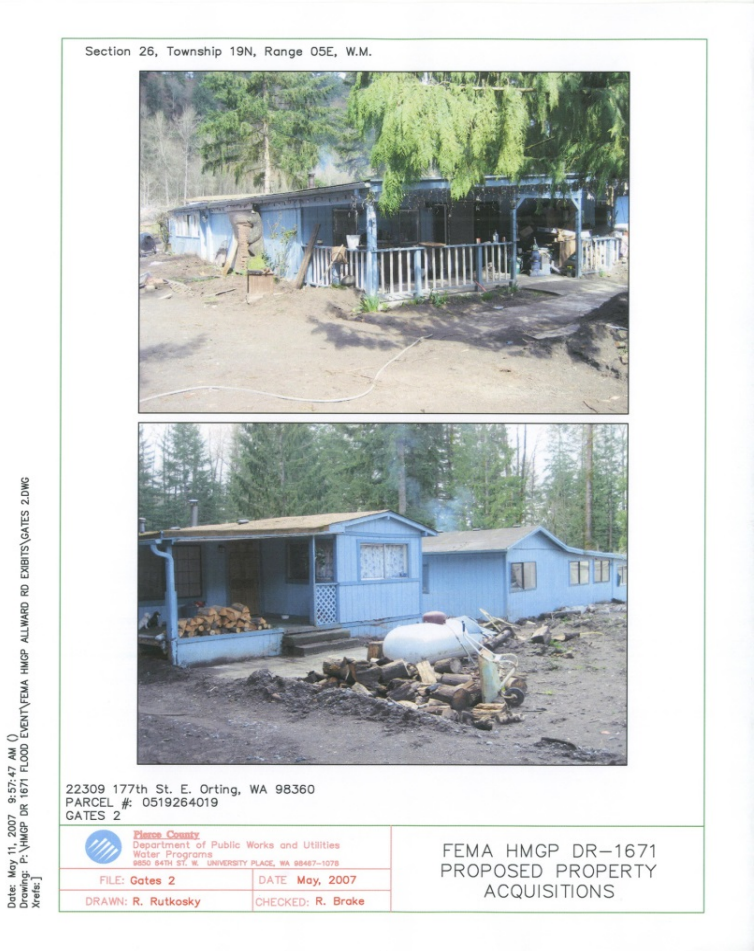
Flood buyout – before and after



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SAFE AREAS – to save LIVES not property

- Tornado
- Hurricane
- TSUNAMI – YES!!
  - Vertical Evacuation Areas
  - Open air – natural ground
  - Open air – raised berms
  - On top of new buildings

Best Practices | Federal Emergency Management Agency/Region IV | August 2011

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Best practices

Promoting Mitigation Successes in Alabama

Safe Room Withstands EF-4 Tornado

The safe room, also the master closet, was the only portion of the house left standing. Photo by Gabriele Javier/FEMA

William Blakeney grew up in Tuscaloosa County, and is well aware of the effects of disasters in the area. In an effort to prepare for disasters like the tornadoes in mid and late April 2011, he built a safe room in his grandparents' home. Although they weren't home when the storms devastated the area, the only portion of their home left standing was the multipurpose safe room.

Blakeney and his construction company built a few safe rooms in the past, mainly in their family members' homes. While not built according to the design criteria of Federal Emergency Management Agency's publication *FEMA 320: Taking Shelter from the Storm*, this safe room was able to withstand the strong winds of the EF-4 tornado that ravaged the area.

The *FEMA 320* publication includes the construction plans and cost estimates for building individual safe rooms. A safe room, built according to the standards outlined in *FEMA 320*, in a home or small business helps to provide "near-absolute protection" for its occupants.

"We were not familiar with FEMA specifications, but we had built a few before," said Blakeney. "I was actually at the office and used the safe room we built there when the tornado came through."

A picture of the home before the EF-4 tornado devastated the area. Photo by William Blakeney

1

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Seismic bracing – Fire Station

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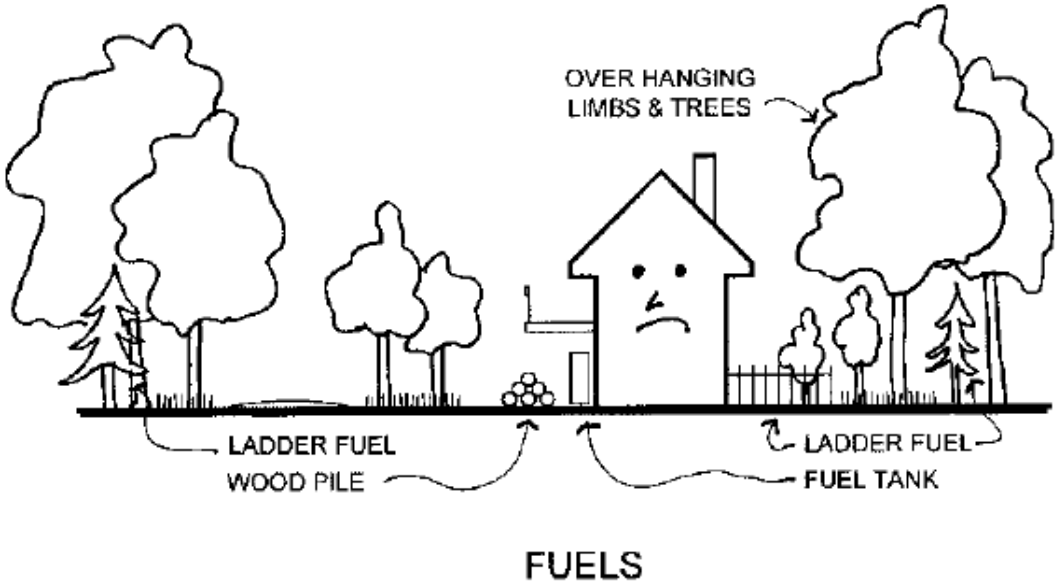
Wildfire – defensible space



NFPA®
www.nfpa.org

FIREWISE COMMUNITIES
www.firewise.org

Guide to Landscaping

The primary goal for Firewise landscaping is fuel reduction — limiting the level of flammable vegetation and materials surrounding the home and increasing the moisture content of remaining vegetation. This includes the entire 'home ignition zone' which extends up to 200 feet in high hazard areas.

Use the Zone Concept

Zone 1 is the 30 feet adjacent to the home and its attachments; Zone 2 is 30 to 100 feet from the home; Zone 3 is 100 to 200 feet from the home.

Zone 1 (All Hazard Areas) *This well-irrigated area encircles the structure and all its attachments (wooden decks, fences, and boardwalks) for at least 30 feet on all sides.*

1) Plants should be carefully spaced, low-growing and free of resins, oils and waxes that burn easily.
2) Mow the lawn regularly. Prune trees up six to ten feet from the ground.
3) Space conifer trees 30 feet between crowns. Trim back trees that overhang the house.
4) Create a 'fire-free' area within five feet of the home, using non-flammable landscaping materials and/or high-moisture-content annuals and perennials.
5) Remove dead vegetation from under deck and within 10 feet of house.
6) Consider fire-resistant material for patio furniture, swing sets, etc.
7) Firewood stacks and propane tanks should not be located in this zone.
8) Water plants, trees and mulch regularly.
9) Consider xeriscaping if you are affected by water-use restrictions.

Use grass and driveways as fuel breaks from the house.

Use faux brick and stone finishes and high-moisture-content annuals and perennials.

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FEMA Hazard Mitigation Grants

- **Climate Change Adaptation accommodations:**
  - Including Sea Level Rise in project cost-effectiveness analyses
  - Including Environmental Benefits in project cost-effectiveness analyses; e.g. buyouts of flood prone structures
- Incorporating *CCA* techniques in standard hazard mitigation projects, for example:
  - Additional project elevation to address Sea Level Rise
  - “Green engineering” for stormwater management and erosion
  - On-site stormwater detention and infiltration, incl. rain gardens
  - Re-establishing native vegetation on flood buyout properties

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Risk Analysis and Planning

- **THIRA – Threat Hazard Identification and Risk Assessment** – required for emergency management
  - Incorporate future climate conditions - ***mandatory***
  - THIRA Toolkit provides resources and links to analytical tools
- **Hazard Mitigation Planning**
  - Encourage Local planning efforts to address future climate conditions
  - REQUIRE State and Tribal plans to address climate change
  - Updated "***Mitigation Ideas***" guide includes Sea Level Rise & Extreme Heat Events; also Wildfires, Floods, and severe storms
- **Emergency Operations Plans**: Encourage preparation for changes in the magnitude or frequency of severe weather events as well as indirect impacts

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Effects of Climate Change

- Changing sea levels
  - Mainly sea level rise
- Precipitation changes
  - Heavy downpours (“rain bombs”)
  - Timing – more in winter, less in summer
  - Less snowpack; drought
- Temperature changes
  - Heat waves and extreme heat
  - Urban Heat Island Effect
  - Higher low temperatures – milder winters
- Changes in winter storm and hurricane intensity and frequency

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Assess Risk from Climate Change

- Damage
  - What is the level of damage?
  - Can it be repaired? Replaced?
  - Is there a threat to public health and safety?
- Disruption
  - Is there a disruption in service?
  - If yes, how long (e.g. hours, days, weeks?)
- Cost
  - What is the cost to repair or replace?
  - What are the economic (or health and safety) costs associated with disruption?
  - Are there additional secondary costs (e.g. costs to other sectors)?

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Mitigation Ideas

A Resource for Reducing Risk to Natural Hazards

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Topics from Public Discussion *"Mitigation Ideas" - January 2013*

- **Ideas** for Hazard Mitigation activities to fulfill mitigation plans
  - Also ideas for *Climate Change Adaptation*
- *NOT regulatory –not mandatory –not always grant fundable*
- Drought, Extreme Temperatures, and Wildfire
- Sea Level Rise and Storm Surge
- Severe storms: wind, hail, lightening, winter
- Floods, including flash flooding and urban stormwater management

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“Mitigation Ideas” for Extreme Temperature Events – *an example*

- *All these are just suggestions - ideas to consider*
- Reduce the Urban Heat Island Effect.
  - Urban tree planting
  - Green roofs, green walls, and rain gardens
  - “Cool roofing” technology to reduce heat gain
  - Open space preservation – pocket green spaces
- Educate residents
  - Their own yards, patios, and balconies.
  - How to protect themselves from extreme heat and cold

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Thank you for your attention. For further information:

http://www.fema.gov/climate-change

http://www.fema.gov/strategic-planning-analysis-spa-division/strategic-foresight-initiative

http://www.fema.gov/pdf/about/programs/oppa/climate_change_paper.pdf

http://www.region2coastal.com/sandy

http://www.fema.gov/.../fema_mitigation_ideas_final508.pdf

http://www.fema.gov/mitigation-best-practices-portfolio

http://www.globalchange.gov/what-we-do/assessment/coastal-resilience-resources

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