



Smart Growth America
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GOVERNORS'
INSTITUTE
on community design

Building Resilient States: Profiles in Action



MAY 2017

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Introduction

In October 2015, the Governors' Institute on Community Design, a program run in partnership with the U.S. Environmental Protection Agency and Smart Growth America, released *Building Resilient States: A Framework for Agencies*, a report intended to introduce and integrate land use and transportation issues into states' conversations about resilience. The Framework was designed to help disaster preparedness professionals understand how strategic decisions about land use and transportation can make communities more resilient from the ground up. The report also included an appendix of additional resources, including federal, state, and local efforts already using the report's recommendations.

Building Resilient States: Profiles in Action is a companion to that first report and highlights several local, regional, and statewide resilience efforts in greater depth. *Profiles in Action* is meant to more deeply explore the advice provided in the Framework, provide actionable steps for implementation, and highlight examples of agencies taking action.

Profiles in Action uses the same seven steps outlined in the Framework that governors and their administrations can take to advance resilience:

1. Put someone in charge
2. Seek the advice and expertise of partners outside state government
3. Integrate future risks into a state Hazard Mitigation Plan and land use policy
4. Ensure that state investments do not increase vulnerability
5. Develop strategies to address assets that are already in high-risk areas
6. Help communities become more resilient
7. Develop a process for monitoring, measuring, and reporting on progress

Building on the recommendations discussed in the first report, *Profiles in Action* looks at implementation case studies in each of these seven areas, including examples from Colorado, Oregon, Connecticut, New Hampshire, Vermont, California, Ohio, New York, Florida, North Carolina, and Louisiana.

It is more important than ever to make sure state spending decisions about natural hazard mitigation and recovery are cost-effective in both the short- and long-terms. Thoughtful and coordinated investment decisions that reinvest in existing communities and infrastructure make sense in the short-term by creating more jobs and accelerating recovery. This approach can also limit long-term infrastructure costs and maintenance associated with inefficient land use and the environmental externalities of greenfield development.

We hope that other jurisdictions can learn from the successes and challenges of the examples included in this report, and implement and expand their own efforts around resilience, hazard mitigation, and disaster recovery.

1. Put someone in charge (focus responsibility)

Statewide resilience work requires coordination across many state agencies and decision-making bodies. To do this, there must be a clear, central authority on the issue with the capacity to work with and influence state agencies, local governments, and other stakeholders.

Putting someone in charge and creating an executive office of resilience or similar authority within a governor's administration is the first step, and sends a clear message that resilience is a state priority. A central coordinator for state resilience can convene the many state agencies that impact resilience through their investments, programs, and infrastructure projects. To be successful, this authority must have a clearly articulated mandate from the governor and a strong leader who will make state resilience his or her top priority and responsibility.

The following examples from Colorado and Oregon offer two effective ways to accomplish the above.

Creating an executive office

Case Study: Colorado Resiliency & Recovery Office

In 2013, Colorado Governor John Hickenlooper created the Colorado Recovery Office (now the Colorado Resiliency & Recovery Office [CRRO]) after unprecedented flooding in September that impacted 24 counties in the state. Parts of the state had also been impacted by record wildfires in 2012 and 2013. The CRRO executive director became a member of the governor's cabinet.

CRRO's first and foremost task coordinating the monumental flood recovery efforts in 2013. Its role has grown, however, and now also includes creating a long-term resiliency roadmap for Colorado. Today, CRRO serves a dual role coordinating the state's flood recovery efforts as well as leading the state's broader resilience work. In both roles, CRRO collaborates with interdisciplinary local, state and federal agencies and non-government partners. It is focused on the long-term needs of the State of Colorado.

In June 2014, the CRRO held a summit of state and federal leaders to identify ways to make long-term resilience part of the recovery process and beyond. Summit participants talked about what resilience meant, and how the State of Colorado could take action. As a result of the Summit, the CRRO created the Colorado Resiliency Working Group (CRWG) made up of stakeholders from government and other parties. In addition to the CRRO, the executive director (or a designated representative) from the following state agencies were named initial members of the CRWG:

- Colorado Department of Local Affairs
- Colorado Department of Natural Resources
- Colorado Department of Public Safety
- Colorado Department of Transportation
- Colorado Department of Public Health & Environment
- Colorado Department of Human Services
- Office of Economic Development & International Trade
- Colorado Energy Office
- Colorado Office of Information Technology

Numerous federal agencies are also members of the CRWG, as is the University of Colorado-Denver.¹ The CRWG identified the statewide resiliency goals and strategies and served as the steering committee preparing Colorado's Resiliency Framework.²

Colorado Resiliency Framework

The Colorado Resiliency Framework took about one year to prepare following formation of the CRWG in July 2014, and was officially adopted by Governor Hickenlooper in May 2015. It guides the CRRO's long-term resiliency mission, and focuses on the following sectors:

- Economic: Whether the economy can continue to function and rebound from a sudden shock
- Community: Whether community members and institutions are engaged and have the tools needed to make resilient decisions
- Health and Social: Whether all levels of society share in the community's health and well-being
- Housing: Whether community members have access to safe, secure and affordable housing that uses durable construction materials and is designed to limit vulnerability to natural disaster
- Watersheds and Natural Resources: Whether these resources are conserved, provide community benefit, are able to withstand disturbances and protect infrastructure and other aspects of society
- Infrastructure: Whether infrastructure is designed to resist and recover quickly from shocks

The Framework identifies shocks and chronic stresses that may impact each sector, and summarizes specific problems Colorado may face in being prepared for them. For example, the Framework summarizes the infrastructure sector as follows:

- Shocks: Numerous fires and floods in recent years; cyber attacks and other technology crimes
- Stresses: Aging infrastructure; increasing population; energy generation and distribution systems reaching capacity; climate, including Colorado's severe freeze-and-thaw cycles; changing climate trends
- Problems:
 - Communities across the state need asset risk assessments and management tools to understand the threats and vulnerabilities of infrastructure they control as well as how to prioritize opportunities to reduce vulnerabilities.
 - There is no common definition of "resiliency" and inconsistent design standards.
 - Funding limitations do not allow criteria for project evaluation or to prioritize/implement improvements.
 - Infrastructure is not seen as interconnected between jurisdictions and there are no incentives to do so.

The Framework also outlines specific strategies for the identified problems within the goals of reducing risk, increasing resiliency planning capacity, creating and streamlining policies, cultivating

1 State of Colorado. (2016, April 12). "Colorado Resiliency Framework 2016 Annual Plan." Available at

2 State of Colorado. (2015, May 28). "Colorado Resiliency Framework." Available at https://drive.google.com/open?id=0B_gHrzLAL2NTb3BiVFBaVkJtOFU.

a resiliency culture and ingraining resiliency into investments. For example, in the infrastructure sector, a recommended strategy for the goal of reducing risk is to create a centralized database for hazard data and to identify any information gaps in this data.

The Framework outlines a “resiliency roadmap”—a call to action for the State of Colorado to realize a more resilient future. The roadmap defines the roles of the governor’s office and cabinet, CRRO, CRWG, and local communities in planning for resilience. It also includes steps for implementation, including selecting priority actions through engagement of stakeholders, understanding risks and vulnerabilities, application of the Framework’s prioritization criteria, and continued CRWG guidance and oversight. Guiding principles that came out of the Framework’s engagement efforts include expanding knowledge, building community, being an advocate, and providing flexibility.

The Framework encourages resilience to be applied in two contexts. First, efforts to implement resilience can occur during response and recovery from current and future natural disasters. Second, resilience should also be incorporated into daily business to allow Colorado to proactively address shocks and stresses. To identify and prioritize those strategies most likely to provide multiple benefits and a higher return on investment, the CRWG held a series of meetings with agency stakeholders. As a result, the State of Colorado and the CRRO laid out the following first year goals:

1. Educating and engaging the public
2. Creating a geospatial tool identifying hazards, critical assets, and demographic trends
3. Providing a toolkit of resiliency strategies to local communities
4. Establishing a fund to finance resiliency projects
5. Creating mapping and land use tools to support implementation of local best practices – including model ordinances and land use code language
6. Defining statewide resiliency indicators
7. Preparing operating plans for future years (one-year and five-year)
8. Developing statewide resiliency indicators, collect baseline data, and set/track progress towards targets

Communities are also encouraged to adopt their own actions. The Framework concludes with indicators to define success in five years.

Current activities of the Colorado Resilience & Recovery Office

In 2015, the CRRO continued to help communities recover from flooding and wildfires and spearheaded coordination among state agencies. It also helped pursue additional funding at the state level, including assisting in the passage of Senate Bill 245 by the state legislature to provide funding for the most extensive modernization of hazard mapping data in state history. The data from this effort will help local communities make land use decisions in flood-impacted areas and beyond.³

The 2016 Framework annual plan, the first issued following adoption of the Framework, identifies projects that the state will undertake in each sector. For example, in the infrastructure sector, projects include formalizing interagency coordination and creation of resilience performance

3 State of Colorado. "CRRO Frequently Asked Questions." Available at <https://sites.google.com/a/state.co.us/coloradounited/crro-faq>.

standards. For each project, the annual report identifies the project benefits, lead agency, supporting partners, primary sectors and other sectors benefited, funding needs, and project goals (on a quarterly basis).⁴ In addition to the annual plan, an annual report will be provided each year describing the outcomes and successes of projects.

Other successes during the first year of implementing the Framework have included creating tools for use by local communities, floodplain map updates, and beginning to address resilience in K-12 education curriculum.

Following the adoption of the Colorado Resiliency Framework in 2015, the CRRO and the CRWG have made progress in the implementation of priority actions identified in the Framework's Roadmap to Resiliency. The CRRO partnered with communities in three of Colorado's most disaster-impacted counties (Boulder, El Paso, and Larimer) to pilot a local resiliency planning process. Through collaborative work sessions, stakeholders came together in each county to develop their vision and identify goals, strategies, and actions. Partners from local, state, and federal agencies participated in the process along with the private and non-profit sectors. Each county is completing and adopting their plan following their own schedules.⁵

To advance the priority action to educate and engage, the CRRO launched the COResiliency Resource Center⁶, which includes a wide variety of resources to provide government agencies, elected officials, community organizations, the private sector, and individual resiliency champions with knowledge and resources to understand, plan for, and act on resilience. The Resource Center includes planning guidance, case studies, templates, training modules and links to a broad range of technical information from Colorado and around the United States. The Colorado Resiliency Working Group's Community Sector, led by the Colorado Department of Local Affairs, addressed the priority action to create mapping and land use tools by developing a website and guide, *Planning for Hazards: Land Use Solutions for Colorado*⁷, aimed at counties and municipalities to help them integrate Colorado-specific resilience and hazard mitigation into their local plans, codes, and standards.

Benefits of creating an executive office of resilience

Having a cabinet-level office to coordinate and lead an interagency team has allowed Colorado to convey the urgency of this issue to residents and stakeholders. The Framework, provides a vision as well as a clear path for implementation. The CRRO's continuing leadership also means that there will be a party responsible for continuing to move the Framework, a living document, forward.

This process has also allowed individuals in diverse sectors who may not have thought about resilience before to begin to understand the issues involved across disciplines.

Challenges

The CRRO's success has required staff to overcome several challenges. The resiliency process has been similar to a startup: CRRO staff needed to learn a lot quickly about resilience issues in

4 State of Colorado. (2016, April 12). "Colorado Resiliency Framework 2016 Annual Plan." Available at <https://docs.google.com/a/state.co.us/viewer?a=v&pid=sites&srcid=c3RhdGUuY28udXN8Y29sb3JhZG91bml0ZW R8Z3g6MzMwNDg5NWlxMTJiYzZkNA>.

5 <https://sites.google.com/a/state.co.us/coloradounited/resiliency/local-resiliency-initiatives>

6 <http://www.coresiliency.com/>

7 <https://www.planningforhazards.com/>

Colorado. Funding remains a challenge—the state has approximately \$2 billion in unmet resiliency and recovery needs. The CRRO’s existing recovery funding comes from 30 different funding sources that must be tracked and spent in accordance with the funders’ requirements.

Not every community in Colorado has been impacted by a wildfire, flooding, or other natural disaster. Communities that have escaped impact may not yet see the importance of incorporating resiliency into their planning efforts. Ongoing engagement with these communities will remain a priority moving forward.

Finally, the resiliency and recovery challenges are even more complex than the staff of the CRRO originally thought at the creation of the office. Flood recovery is anticipated to last for several more years. However, there has been a lot of creative thinking and energy at all levels of government regarding how to incorporate resilience into current and future activities. The CRRO’s staff is encouraged by the level of importance many stakeholders place on resiliency planning and action.

Creating a sub-cabinet

Case Study: Oregon Resilience Task Force

On March 11, 2011, a devastating earthquake and tsunami struck Japan. Across the Pacific Ocean, leaders in Oregon quickly realized they were vulnerable to the same type of disaster.

In April that year the Oregon State Legislature passed House Resolution 3 (HR 3), which directed the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) “to lead and coordinate preparation of an Oregon Resilience Plan that reviews policy options, summarizes relevant reports and studies by state agencies, and makes recommendations on policy direction to protect lives and keep commerce flowing during and after a Cascadia earthquake and tsunami.”⁸

The resulting Oregon Resilience Plan was published in February 2013. It’s goals are to make sure “Oregon citizens will not only be protected from life-threatening physical harm, but because of risk reduction measures and pre-disaster planning, communities will recover more quickly and with less continuing vulnerability following a Cascadia subduction zone earthquake and tsunami.”⁹

To create the Plan OSSPAC created eight task groups comprising more than 150 volunteer professionals along with an Advisory Group to oversee the entire work. The eight task groups were:

- Cascadia Earthquake Scenario: Performed a review of current science to detail the likely physical effects of a magnitude 9.0 Cascadia earthquake and tsunami. The other task groups utilized this analysis when assessing the impacts on their sector.
- Business and Workforce Continuity: Assessed workplace integrity, workforce mobility, building systems performance, and customer viability to allow Oregon businesses to remain open following the scenario.

8 Oregon Resilience Plan, http://www.oregon.gov/OMD/OEM/osspace/docs/Oregon_Resilience_Plan_Final.pdf

9 The Oregon Resilience Plan—Energy. (2013, February). http://www.oregon.gov/oem/Documents/06_ORP_Energy.pdf.

- Coastal Communities: Assessed the unique risks facing Oregon’s coast, which would be impacted by both the seismic activity and any resulting tsunami.
- Critical and Essential Buildings: Examined the main classes of public and private structures critical to resilience in the event of this scenario and characterized the gap between expected seismic performance and desired seismic performance. It also provided assessments of buildings considered vital to community resilience and addressed the special challenges of certain types of structures.
- Transportation: Assessed the seismic integrity of the State’s transportation system, including bridges and highways, rail, airports, water ports, and public transit. It considered the work necessary to restore and maintain transportation lifelines after the scenario as well as how the transportation system is interdependent with other lifeline systems.
- Energy: Investigated seismic deficiencies of energy storage and transmission infrastructure in the state.
- Information and Communications: Examined Oregon’s information and communications systems, including the consequences on other sectors of service disruptions. It also considered the implications of co-locating communications infrastructure with other infrastructure such as bridges as well as what would be needed to restore service following the Cascadia earthquake and tsunami scenario.
- Water and Wastewater: Assessed vulnerabilities of Oregon’s pipelines, treatment plants, and pump stations.

Each of the groups completed the following three tasks in four affected zones of the state (from most to least expected damage from this scenario: tsunami, coastal, valley, and eastern Oregon):

1. Determine the likely impacts of a magnitude 9.0 Cascadia earthquake and tsunami on the task group’s sector, including an estimate of the need needed to restore functions in that sector;
2. Define acceptable timeframes for restoring functions after a Cascadia earthquake to the expected resilient performance level; and,
3. Recommend practice and policy changes over the next 50 years to allow Oregon to reach the desired resilience targets.

Each group identified performance targets towards resilience and provided recommendations to meet each target over the next 50 years. For example, the Critical and Essential Buildings Task Group estimated how long each building type (such as healthcare facilities and schools) might require to return to an operational state following damages in the Cascadia scenario, assuming the current infrastructure. The Task Group then provided recommendations for what the target recovery timeframe should be. This Task Group also provided recommendations by building sector as well as overall recommendations for resilient buildings.

Task Force on Resilience Plan Implementation

Following completion of the Plan, Oregon Senate Bill 33 (SB 33) passed the state's legislative assembly, creating the Task Force on Resilience Plan Implementation.¹⁰ The Task Force, which met until 2014, included volunteer members from both the public and private sectors. Because it was at the governor's level, it provided oversight over all state agencies and facilitated "a comprehensive and robust plan to implement the strategic vision and roadmap of the Oregon Resilience Plan for responding to the consequences of naturally occurring seismic events associated with geologic shift among the Cascadia subduction zone."¹¹

SB 33 required the Task Force to review the completed Plan and make recommendations about the following as part of its implementation of the Plan:

- A. Education and training of community leaders in emergency management and resilience practices
- B. Coordination of investments in equipment, facilities and systems critical for enhanced resilience and survivability in the near, intermediate and far terms¹²

Responding to this charge, the Task Force submitted a final report to the Oregon Legislative Assembly in October 2014 detailing how the Plan will be implemented.¹³ It studied the more than 140 recommendations provided in the Plan and recommended the most critical to implement during the 2015-17 biennium within the following categories:

- Oversight
- Transportation
- Land Use
- Energy
- Critical Facilities and Seismic Rehabilitation Grant Program
- Research
- Training and Education
- Water/Wastewater

For example, the Oversight category recommends the establishment of a Resilience Policy Advisor to the Governor. This was the Task Force's most critical recommendation.

SB 33 also directed numerous state agencies to designate one individual to liaise with the state's Office of Emergency Management. This individual would have the authority during an emergency to allocate the agency's resources and assets. They must also coordinate emergency preparedness and response with the Office of Emergency Management.

Post-Task Force efforts

To further prepare for a potential Cascadia earthquake and tsunami disaster, Oregon created the Cascadia Playbook, a nine "play" emergency response guide to how state agencies will work

10 <https://www.oregon.gov/OMD/OEM/Pages/Resilience-Taskforce.aspx>

11 http://www.oregon.gov/OMD/OEM/docs/resilience_tf/SB33.pdf

12 http://www.oregon.gov/OMD/OEM/docs/resilience_tf/SB33.pdf

13 https://www.oregon.gov/OMD/OEM/docs/resilience_tf/2014_percent2009_percent2029_percent20ORTF_percent20Report.pdf

together in the event of a major disaster.¹⁴ The document, now in its second draft, is an ongoing effort expected to take several years to complete as state agencies prepare implementation plans.

One of the recommendations of the Task Force was to create a statewide Resilience Officer. In 2015 the state legislature created and funded the position and in May 2016, the Oregon State Senate confirmed Michael Harryman as Oregon's first State Resilience Officer. In this role, Mr. Harryman is responsible for "directing, implementing, and coordinating seismic safety and resilience goal-setting, which includes working with state agencies to improve Oregon's seismic safety and resilience."¹⁵

About half of the recommendations made by the Task Force are moving ahead. One example is funding to retrofit Oregon's K-12 schools to be resilient in the event of a Cascadia earthquake. The state legislature has funded \$175 million for this purpose.

The Task Force also recommended completing the most important routes identified in the Oregon Department of Transportation's Seismic Options Report within 10 years through an ongoing pay-as-you-go funding system, as well as a private-industry-matched \$1 million annual research initiative at the state's public universities for improving earthquake resilience. These efforts have not moved forward.

The state has made progress in other areas. It is currently updating its tsunami inundation maps and has been performing outreach to coastal communities. Other legislation to help residents in the event of a Cascadia earthquake is moving forward such as a bill allowing residents to obtain more than 30 days' supply of prescription drugs at a time. A consortium of utilities has been funding applied research on a Cascadia earthquake. While great efforts are being made, Oregon is challenged by its relatively small size combined with the billions of dollars in resiliency investments required.

2. Seek the advice and expertise of partners outside state government

Several state governments have turned to partners outside of state government for their resources and expertise on resilience. These external partners include local governments, non-profit organizations, businesses, regional institutions, universities, and community leaders that assist the states with advancing resiliency policies.

Engaging these stakeholders also builds deeper in-state organizational capacity around resilience, and can help build public support for the issue as well. The following examples from Connecticut, New Hampshire and Vermont offer concrete examples of this step in action.

14 https://www.oregon.gov/OMD/OEM/Pages/Cascadia_Playbook.aspx

15 <http://www.oregon.gov/newsroom/Pages/NewsDetail.aspx?newsid=1122>

Case Study: Connecticut Institute for Resilience & Climate Adaptation

Founded in 2014, the Connecticut Institute for Resilience & Climate Adaptation (CIRCA) is an interdisciplinary collaboration between the University of Connecticut and the Connecticut Department of Energy and Environmental Protection (DEEP). Its mission is to “increase the resilience and sustainability of vulnerable communities along Connecticut’s coast and inland waterways to the growing impacts of climate change on the natural, built, and human environment.”¹⁶ The Institute received an initial grant from the Connecticut DEEP and the National Oceanic and Atmospheric Administration (NOAA).

CIRCA came about in part through recommendations related to erosion and other aspects of shoreline protection included in the Connecticut House Democrats’ Shoreline Preservation Task Force Report for dealing with impacts from climate change and sea level rise. The report called for “engaging Connecticut academic institutions and non-profits, in conjunction with DEEP and federal agencies, to conduct research and guide development of technology and best management practices from Connecticut municipalities and other states to enhance the resilience of coastal communities to coastal hazards and a rise in sea level, and investigate incentives to become more resilient.”¹⁷ The University of Connecticut also had reaffirmed its own Climate Action Plan, including the approval for adding an Adaptation section to its plan.¹⁸

Another impetus for the creation of CIRCA was Connecticut Senate Bill 1013 (Special Act 13-9). This legislation required DEEP and the University of Connecticut to jointly create a Connecticut Center for Coasts. On the executive side of the state government, Connecticut was still dealing with the aftereffects of Hurricane Irene and Superstorm Sandy. Governor Dannel Malloy’s administration was also directly involved in conversations regarding establishment of CIRCA.

Most of the initial funding for CIRCA came from a plea agreement brought by the State of Connecticut against a plaintiff for clean water violations related to wastewater treatment. Additional funding included a grant from the NOAA Office for Coastal Management, Coastal Resilience Networks program funded by the federal fiscal year 2013 Sandy disaster relief appropriations.^{19,20} The University of Connecticut provided a matching grant. Once formed, the Institute has actively pursued funding for a variety of projects and has received grants from Connecticut DEEP for resiliency planning, from NOAA to advance coastal forecasting and living shorelines, and from the U.S. Department of Housing and Urban Development to enhance resiliency through the creation of wetlands.

CIRCA brings together interdisciplinary experts from the natural sciences, engineering, economics, political science, finance, and law to offer workable solutions to problems relating to a changing climate. It focuses its efforts on coastal and inland floodplain communities in Connecticut and elsewhere in the Northeast. CIRCA helps these communities adapt to climate change by helping their infrastructure become more resilient while protecting fragile ecosystems and the community benefits they provide.

16 <http://circa.uconn.edu/about/>

17 http://www2.housedems.ct.gov/Shore/pubs/Task_Force_Report_Final.pdf

18 <http://today.uconn.edu/2014/01/new-institute-to-focus-on-adapting-to-climate-change/>

19 <http://today.uconn.edu/2014/01/new-institute-to-focus-on-adapting-to-climate-change/>

20 <http://circa.uconn.edu/crest/>

Goals of CIRCA’s research, engagement, and implementation activities include:

- Improving scientific understanding of the changing climate system and its local and regional impacts on coastal and inland floodplain communities;
- Developing and deploying natural science, engineering, legal, financial, and policy best practices for climate resilience;
- Undertaking or overseeing pilot projects designed to improve resilience and sustainability of the natural and built environment along Connecticut’s coast and inland waterways;
- Creating a climate-literate public that understands their vulnerabilities to a changing climate and which uses that knowledge to make scientifically informed, environmentally sound decisions;
- Fostering resilient and sustainable communities—particularly along the Connecticut coastline and inland waterways—that can adapt to the impacts and hazards of climate change; and
- Reducing the loss of life and property, natural system and ecological damage, and social disruption from high-impact events.²¹

CIRCA’s projects include the following:

- Advocating for “living shorelines”—nature-based shoreline protection strategies that enhance natural habitat and ecosystems, which are engineered to reduce both human-caused and natural erosion. CIRCA’s efforts in this area have included review of design guidelines and site assessment tools to understand where to apply this tool, creation of an online map viewer, identification of policy barriers and solutions to the use of living shorelines, and a national conference on this topic.
- Measuring and modeling current and future impacts of climate change and extreme weather on critical infrastructure in Connecticut, such as wastewater treatment plants, power stations, transportation networks, and emergency services. This includes identifying which critical infrastructure is at risk, measuring their vulnerability, and how to reduce the vulnerability. As part of this effort, CIRCA is developing quantitative climate change impacts for Connecticut, including predictions of current and future flood risk from precipitation changes, as well as models for sea level rise, storm surge, and waves.
- Creating a hydrologic model for inland river flooding under current and future climate scenarios, taking into account various factors known to contribute to the risk of flooding, such as land use. The riverine flooding model can be combined with the storm surge modeling to predict the combined impacts of these events on flooding during a storm. This modeling and mapping of flood risk helps determine whether Connecticut’s existing and future flood control mechanisms will be sufficient as well as which areas and infrastructure are at greatest risk.
- Investigating the effects of coastal flooding on Connecticut’s shoreline including how projections for extreme weather and climate change will affect coastal municipalities taking into account differences based on varied physical features. For example, Connecticut’s coastline has marshes with tide gates to control flooding. The man-made tide gate and the shape and geometry of the marsh both impact the frequency of flooding in that marsh and on surrounding infrastructure.

21 <http://circa.uconn.edu/about/>

- Updating sea level rise scenarios and projections for Connecticut. Currently Connecticut uses the NOAA global average sea level rise projections for planning purposes.
- Developing decision support tools for local communities to better incorporate sea level rise projections and flooding risk into planning and infrastructure decisions
- Providing small grants to work directly with municipalities on resilience projects
- Performing policy analysis including the development of model policies such as zoning ordinances and financing tools as well as opportunities to connect low-lying coastal communities. CIRCA supported the development of Connecticut's application, involving 9 state agencies, to the National Disaster Resilience Competition. This application resulted in the state receiving \$54.3 million for a pilot project in Bridgeport to protect a low-income community from storm surge and better connect that community to the Metro North rail line. This concept of resilient transit-oriented development along coastal Metro North stations will be further implemented through the development of a coastal resilience plan for New Haven and Fairfield counties funded by the grant as well. These projects will become a blueprint for a statewide Resilience Roadmap called for by Governor Malloy in Executive Order 50, which created the State Agencies Fostering Resilience (SAFR) Council from the 9 state agencies that came together as part of the competition.²²

Case Study: New Hampshire Coastal Risk and Hazards Commission

In 2012, leaders in New Hampshire were concerned that neither the state nor coastal municipalities were adequately prepared for projected coastal flooding risks associated with climate change. Rather than waiting for disaster to strike, in July 2013, the state legislature passed State Senate Bill 163 and created the New Hampshire Coastal Risk and Hazards Commission (CRHC), a statewide commission that brings together representatives of state and local governments, regional non-profits, regional planning bodies, and professional associations to help communities address concerns over storm surge, sea level rise, and extreme precipitation.

CRHC is charged with recommending "legislation, rules, and other actions to prepare for projected sea level rise and other coastal and coastal watershed hazards such as storms, increased river flooding, and storm water runoff, and the risks such hazards pose to municipalities and state assets in New Hampshire," as well as reviewing scientific agency projections of coastal storm inundation, and flood risk to determine the appropriate information, data, and property risks.²³

The CRHC meets monthly and its 37 appointees²⁴ include representatives of the state legislature, state agencies, the New Hampshire Sea Grant Program, the University of New Hampshire, and New Hampshire's 17 coastal communities. State legislator participation in the CRHC includes bi-partisan representation, and their support is imperative because some actions will require legislative action for implementation. The Commission provides the governor and legislators with an annual report late in the year of its findings and recommendations for proposed legislation.

22 http://portal.ct.gov/Departments_and_Agencies/Office_of_the_Governor/Press_Room/Press_Releases/2015/10-2015/Gov_Malloy_Permanently_Establishes_State_Council_on_Storm_Resiliency/

23 <http://www.gencourt.state.nh.us/ras/html/L/483-E/483-E-3.htm>

24 http://nhcrhc.stormsmart.org/files/2016/06/crhc_draftreport_ppt_062816.pdf

The CRHC is in the process of preparing its final report, *Preparing New Hampshire for Projected Storm Surge, Sea-Level Rise, and Extreme Precipitation*.²⁵ The report provides a summary of current climate science and vulnerability information as well as recommendations for action. Much of the technical information in the report comes from the CRHC's Science and Technical Advisory Panel (STAP). The STAP reviewed existing science, analyzed historic trends, as well as projections for 2050 and 2100 in coastal New Hampshire. Their sea level projections for 2050 are 0.6 to 2 feet over 1992 levels and, for 2100, 1.6 to 6.6 feet.

The final report outlines four goal areas for a resilient New Hampshire:

1. Science: To research, understand, establish, and use the best available science
2. Assessment: Identify vulnerable assets and evaluate existing policies
3. Implementation: Implement strategies that protect and sustain assets
4. Legislation: Recommend legislation that reduces vulnerability and adapts to current and future coastal hazards

The report also provides a summary of potential vulnerabilities and risks to coastal communities, including scenarios based on sea level rise, storm surge, and extreme precipitation. The report focuses on these key topic areas:

- Economy: the systematic and productive exchange and flow of goods, services, and transactions that must be intact, functioning, and resilient to coastal risks and hazards in order to create and sustain a high quality of life in coastal New Hampshire. Thousands of parcels with an assessed value of more than \$3 billion in New Hampshire's coastal communities are at risk from sea level rise and storm surge flooding, including key tourism destinations in the state.
- Built landscape: the network of structures and facilities owned by state and local governments and private entities in coastal New Hampshire. The built environment must be prepared, adaptive, and responsive to coastal risks and hazards. State and local roadways will be vulnerable to storm surge, sea level rise, and extreme precipitation – potentially magnified by tidal, storm-related or freshwater flooding. Other public infrastructure and critical facilities may also be impacted.
- Natural resources: the natural systems that support important species and biodiversity in coastal New Hampshire and provide critical and important services to coastal New Hampshire like food, flood protection, fresh water, raw materials, and recreation opportunities. Coastal habitats will be impacted by sea level rise and extreme precipitation events, including salt marshes and estuaries, habitat availability, as well as seabird nesting and migration. Coastal dune sediments will be driven inland and reduced, potentially lost to developed areas.
- Heritage: the abundance of recreational, cultural, and historic resources, including economic assets and elements of the built landscape, in coastal New Hampshire that our state and communities wish to protect in the face of coastal risk and hazards. Limited areas of the New Hampshire coast have been investigated for architectural or archaeological resources. Some of these resources are already located below mean sea level.

25 <http://www.nhcrhc.org/final-report/>; <http://www.preventionweb.net/publications/view/48305>

The report suggests several guiding principles, including a need to act early. By starting now, the normal cycles of reconstruction, replacement, and redevelopment can be utilized to introduce more resilient design into structures and facilities, often at minimal additional cost and resulting in long-term cost savings. Further, an incremental response will provide an opportunity to refine and correct actions as understanding of future coastal hazards improves, given current uncertainties. As the science becomes clearer, it is imperative that officials revisit and revise their projections and assumptions so they can modify their actions as needed. The State of New Hampshire and its coastal municipalities share assets and infrastructure on the coast that are systematically and functionally linked, and as such, they need to collaborate and coordinate to align policies, assumptions and responses about future coastal hazards.

The acceptable loss or damage to an asset should be considered in determining the most appropriate design standards for protection with more critical or expensive structures and facilities having low risk tolerance. Based on the criticality, cost, ease of replacement, or other factors, a level of risk tolerance in design must be incorporated. Finally, the report's authors felt that decisions should be made now with "no regrets", even if future hazards are less extreme than anticipated.

Prior to the public release of the report, the state legislature has already approved two pieces of related legislation. The first is SB 374, requiring New Hampshire's Department of Environmental Services to update the storm surge, sea level rise, precipitation, and other projections impacting coastal flooding trends every 5 years. The second, SB 452, requires state agencies to audit and update their policies and procedures incorporating any changes needed to prepare for flood risks due to projected storm surge, sea level rise, and precipitation events.

The report makes numerous other recommendations under the four goals that will be implemented at a later date. For example, under the assessment and implementation goals, built landscape recommendations include "implement regulatory standards and/or enact enabling legislation to ensure that the best available climate science and flood risk information are used for the siting and design of new, reconstructed, and rehabilitated state-funded structures and facilities, municipal structures and facilities, and private structures".

As part of the legislation that created it, the CRHC sunset on December 1, 2016.²⁶ NOAA provided New Hampshire with additional funding to start working to implement some of the recommendations of the CRHC. State agencies established a climate change working group that will continue focusing on these issues, and many coastal communities in New Hampshire are already taking steps to increase their resiliency and incorporating the CRHC's recommendations into their long range planning efforts.

Case Study: New Hampshire/Vermont Upper Valley Adaptation Workgroup

New Hampshire and Vermont's bi-state Upper Valley Adaptation Workgroup (UVAW), started in December 2011, assembles state and local officials, non-profit leaders, public health networks, regional planning commissions, academic institutions and business representatives to address

²⁶ <http://nhcrhc.stormsmart.org/sample-page/>

climate concerns in the Upper Valley region. That area spans the Two Rivers Ottauquechee Regional Commission in Vermont and the Upper Valley Lake Sunapee Regional Planning Commission in New Hampshire. Tropical Storm Irene and the flooding that followed significantly impacted this area. UVAW's mission is to build climate resilient communities through research, information sharing and education.²⁷

UVAW shows community leaders how to better work with the Federal Emergency Management Agency (FEMA); techniques for community engagement techniques; economic impacts and opportunities.²⁸ They also help community leaders learn from local case studies.

As many small communities in New Hampshire and Vermont have limited professional staff, UVAW provides them with educational forums and opportunities for networking to learn from each other and begin to make their communities more resilient to climate change impacts. UVAW hosts public education forums on flooding and preparedness using data from a climate assessment of Southern New Hampshire. These forums enable communities to understand the projected impacts, begin to think about their vulnerabilities and plan for future impacts.

Climate Solutions New England²⁹ prepared the climate assessment that forms the backbone of UVAW's work in both New Hampshire and Vermont. *Climate Change in Southern New Hampshire: Past, Present, and Future*,³⁰ published in 2014, examines the changes already experienced by the region over the past 100 years, including:

- Temperature changes and extremes
- Length of the growing season
- Precipitation changes, including more extreme events
- Snowfall and snow covered days
- Lake ice-out
- Impacts of weather disruption, particularly financial costs of disasters

The assessment considers future projections for these same impacts and offers strategies for communities to respond to these impacts, focusing on:

- Mitigation, through implementing actions recommended in New Hampshire's Climate Action Plan and other mitigation efforts that have already been launched, such as the Regional Greenhouse Gas Initiative, and the New Hampshire Energy Efficiency Core program.
- Adaptation strategies that protect the built environment such as protecting and fortifying existing assets, accommodating extreme weather events in structure design and retrofits, and retreating development to other, less hazardous areas. These actions can be taken in the short-term or they may be identified early and the situation monitored to allow action to be taken at a later time.

27 <http://uvaw.uvlsrc.org/>

28 http://uvaw.uvlsrc.org/files/8814/2722/9426/UVAW_one_pager.pdf

29 <http://www.climatesolutionsne.org/>

30 http://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh_climateassessment_june_4_2014.pdf

UVAW has been involved with the Granite State Future project, which offers a statewide framework of planning issues that New Hampshire communities face around the issue of climate change and other planning issues.³¹ UVAW has also worked with Vital Communities, a bi-state organization that helps strengthen communities.³² Vital Communities has convened, with the Two Rivers Ottauquechee Regional Commission and Upper Valley Lake Sunapee Regional Planning Commission, a gathering on the topic of climate adaptation.

UVAW's partner, the Public Health Council of the Upper Valley, secured funding from the New Hampshire Department of Health and Human Services to focus attention on the impacts of extended periods of heat on the elder community. The outcomes of this project include education to agencies and organizations that work with elders. By educating caregivers they can help elders understand how they can better prepare for extended periods of heat. UVAW, through the Upper Valley Lake Sunapee Regional Planning Commission, has also secured support from the National Association of Development Organizations to work with small business and non-profits to focus on business continuity after extreme weather events. By getting local businesses and non-profits talking together they can support each other, work together and share experiences to make them more resilient to extreme weather events.

Communities in Vermont have also begun to adapt and have recovered and responded smarter after being impacted by Tropical Storm Irene. In early 2015, UVAW partnered with University of Vermont students studying climate change adaptation to help Upper Valley businesses strengthen their resiliency to climate events. The project included site visits, interviews, and consultations with the business owners. UVAW partnered with East Central Vermont: What We Want³³ to provide education around climate change resiliency through a HUD Sustainable Communities Regional Planning Grant.

Both New Hampshire and Vermont offer examples of local communities demonstrating proactive planning and resilience thinking. Communities need technical assistance, funding and support from collaboratives like UVAW to continue their planning efforts and to get to action.

In UVAW's work with communities, they suggest communities incorporate climate change into their existing planning efforts. Because many rural communities in the Upper Valley do not have the capacity to take on a separate planning initiative, incorporating climate change and adaptation strategies into existing Master Planning, Hazard Mitigation Planning and Capital Improvement Planning makes it more possible for communities to engage in this work. As the science progresses and we learn more about future projections, these plans will need to be continuously revised and updated.

31 <http://www.granitestatefuture.org/>

32 <http://vitalcommunities.org/>

33 <http://ecvermont.org/>

3. Integrate future risks into a state Hazard Mitigation Plan and land use policy

As of September 2016, all 50 states, the District of Columbia, and 5 U.S. territories have in place state Hazard Mitigation Plans that have been approved by FEMA. In addition, 22,601 local governments and 140 tribal governments have plans in place.

Of the 50 state Hazard Mitigation Plans, 12 are enhanced plans (EHMPs), allowing these states to receive additional funding following a disaster under the Hazard Mitigation Grant Program.³⁴ A state with an enhanced plan receive Hazard Mitigation Grant Program funds at the rate of 20 percent of the total estimated eligible Stafford Act disaster assistance, while states with non-enhanced plans receive only 15 percent.

In order to be approved for this increased assistance, EHMPs must show the integration of mitigation into a broad range of state programs and agencies, a comprehensive resilience strategy that is both hazard-specific and considers future risk, a vetted prioritization process for project implementation and funding, and successful management of previous FEMA Hazard Mitigation Assistance grants. The full requirements of both the standard plan and EHMP are available in FEMA's State Mitigation Plan Review Guide.³⁵

California is one state with a FEMA-approved EHMP in place. The following section describes details of that plan.

Case Study: California Multi-Hazard Mitigation Plan³⁶

California first released its State Hazard Mitigation Plan in 2004 as a non-enhanced plan. An enhanced plan update soon followed in 2007. The plan's mission is to "integrate current laws and programs into a comprehensive, multi-hazard mitigation system that will guide the state in significantly reducing potential casualties and damage as well as physical, social, economic, and environmental disruption from natural and human-caused disasters." The plan has continued to be updated every few years since then, most recently updated in 2013, and will be updated again beginning in 2016 for release in 2018.

A State Hazard Mitigation Team, representing more than 80 agencies and organizations, was responsible for creating the 2013 plan. Following completion of the 2010 edition, the Team began meeting again in early 2013 to begin that year's update. Members of the Team prepared updates to each chapter that were provided to a faculty-student team at California Polytechnic State University in San Luis Obispo. This team prepared an administrative draft of the updated plan during the first half of 2013 and a public review draft in July 2013 incorporating all revisions. The

34 <https://www.fema.gov/hazard-mitigation-plan-status>

35 http://www.fema.gov/media-library-data/1425915308555-aba3a873bc5f1140f7320d1ebeb18c6/State_Mitigation_Plan_Review_Guide_2015.pdf

36 http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

plan was finalized by September 2013. The California Governor's Office of Emergency Services' holds the primary responsibility for implementation of the plan.

Public participation

Preparation of the 2013 update to the State Hazard Mitigation Plan also included a public participation component between January and September of that year. The collaborative process utilized prior public participation efforts solicited for the California Earthquake Loss Reduction Plan, California Fire Plan, and State Flood Hazard Mitigation Plan to inform the State Hazard Mitigation Plan updates. In addition, the 374 FEMA-approved Local Hazard Mitigation Plans as of December 2012 – including cities, counties and special districts – also contributed to public participation for the state-level plan. The State Hazard Mitigation Team's Cross-Sector Communications and Knowledge-Sharing Working Group assessed challenges in public and private sector interaction, focusing on designing custom messaging to associations, local governments, and metropolitan planning organizations.

Besides the Working Group's outreach efforts, other outreach efforts included the implementation of the MyPlan online Geographic Information System (GIS) mapping tool in 2012 for cities, counties, and special districts to improve their hazard mitigation planning. The Working Group also used the Governor's Office of Emergency Services' "Hazard Mitigation" web portal for public comment of the draft 2013 California State Hazard Mitigation Plan which also includes a version of MyPlan targeted at the public. These tools are described in more detail later in this report.

Components of an Enhanced State Hazard Mitigation Plan

California's plan includes the components that comprise an enhanced plan, as recognized by FEMA. As noted above, achieving this designation results in a greater amount of FEMA funding available to the state for disaster recovery. The following list indicates the requirements for an enhanced state Hazard Mitigation Plan as written in FEMA's State Mitigation Plan Review Guide, and briefly describes how California's plan meets them.

Standard State Mitigation Plan Requirements

Meet all requirements for a standard state mitigation plan

FEMA's State Mitigation Plan Review Guide details the specific requirements for a standard plan. California's plan meets these initial requirements.

Integrated planning

Does the plan demonstrate integration to the extent practicable with other state and/or regional planning initiatives and FEMA mitigation programs and initiatives?

California's plan outlines how these efforts are being implemented through emergency management, legislative and policy, institutional, content, functional, and financial integration. For example, it notes that California made a number of policy and legislative updates as a result of disasters in other parts of the world. In 2005, Hurricane Katrina raised concerns about the potential for levee failure around San Francisco and Sacramento. The following year, California voters passed \$4.9 billion in levee strengthening bonds. In 2006, the California legislature passed Assembly Bill 2140 which integrates state- and local-level hazard mitigation planning by providing financial incentives to counties and municipalities to adopt Local Hazard Mitigation Plans.

State mitigation capabilities

Does the state demonstrate commitment to a comprehensive mitigation program?

California's plan notes the following aspects of the state's mitigation program that demonstrate its comprehensiveness:

- Support for Local Hazard Mitigation Planning
- Statewide hazard mitigation program
- State provision of a portion of the non-federal match for mitigation projects
- Promotion of nationally applicable model codes and standards
- Statewide green building code
- Post-disaster mitigation of building risks
- Integration of mitigation with post-disaster recovery
- Major state hazard mapping efforts
- State Hazard Mitigation Team working groups (4)
- Relation to Threat and Hazard Identification and Risk Assessment and National Mitigation Framework

Does the enhanced plan document capability to implement mitigation actions?

California's plan describes the state's eligibility for numerous federal grant programs that are administered through the Office of Emergency Services' Hazard Mitigation Grants branch. Staff in this office reviews and rates proposed activities for cost effectiveness, eligibility, and effectiveness.

Is the state effectively using existing mitigation programs to achieve mitigation goals?

The California plan notes that the Office of Emergency Services has used all obligated federal mitigation grant funding over the three years prior to the 2013 plan's release. FEMA grant funds were used on 87 projects between 2010 and 2012 across the state.

Hazard Mitigation Assistance Grants Management Performance

With regard to Hazard Mitigation Assistance, is the state maintaining the capability to meet application timeframes and submitting complete project applications?

California's plan notes that the Office of Emergency Services has a large number of full time staff who review, approve, process, oversee, monitor, and pay federal grants to state and local agencies through its Office of Grants Management. It has been administering Hazard Mitigation Assistance grants for more than 20 years and has a successful track record.

Is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses?

California's plan indicates that the State requires applicants to include necessary environmental information and benefit-cost analyses. This is tracked by the Office of Emergency Services. FEMA regional staff conducts environmental reviews for construction projects seeking Hazard Mitigation Assistance funding. These projects must comply with state and federal environmental laws.

Is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time?

California's plan specifies that the Office of Emergency Services is responsible for receiving quarterly grantee reports. These are compiled and entered into their database prior to being sent to FEMA.

Is the state maintaining the capability to complete Hazard Mitigation Assistance projects within established performance periods, including financial reconciliation?

California's plan states that the Office of Emergency Services Hazard Mitigation Grant Branch tracks and manages mitigation grant activities through its Mitigation Grant Management database and its financial ledgers. It has standardized procedures for closing out mitigation projects. Grantees must submit "Accomplishment Reports" at closeout. The Hazard Mitigation Grant branch reviews these for accuracy and completeness. It may also perform site inspections and audits.

Implementation

The goals of California's 2013 plan are to:

1. Significantly reduce life loss and injuries
2. Minimize damage to structures and property, as well as minimizing interruption of essential services and activities
3. Protect the environment
4. Promote hazard mitigation as an integrated public policy and as a standard business practice

California sets the priority of different mitigation actions using several criteria:

- Consistency with the mitigation goals above
- Federal criteria (Section 206.435(b)(2) of Title 44, Code of Federal Regulations) for selecting mitigation actions, such as:
 - Potential loss of life
 - Loss of essential services
 - Damage to critical facilities
 - Economic hardship on the community
- New legislation passed and executive orders issued to reflect emerging priorities following a disaster.
- Budget adoption including shortfalls for funding mitigation programs
- Federal mandates, such as requirements for spending federal funds

Local efforts also factor into California's plan, as states are required by federal law to review Local Hazard Mitigation Plans as part of this process. This enables the state to gather local level information for use in state-level mitigation planning, ensures coordination of state and local planning, and ensures that local jurisdictions are aware of the hazards and vulnerabilities within their jurisdiction.

California's plan provides a summary of applicable federal, state, and local disaster mitigation and emergency management laws. However, the bulk of the document considers risk assessment and mitigation, primarily focusing on specific risks in California.

California is a large and diverse state containing 12 percent of the U.S. population. The State Hazard Mitigation Plan's focus on risks begins by examining California's demographics, natural history, and disaster history. This is followed by a review of more specific hazards, including:

- Location within the state
- Previous occurrences
- Probability of future events

Primary hazards identified by the State Hazard Mitigation Plan include earthquakes, floods, and wildfires. These hazards have generally caused the most loss and disruption in California and resulted in the adoption of statewide plans for their mitigation due to their potential for future impacts. Hazards are considered secondary if they can be triggered by primary hazards. Secondary hazards include levee failure, landslide, tsunamis, climate change impacts, and volcanoes. The plan also covers other types of hazards not considered primary or secondary such as agricultural pests, disease epidemics, and terrorism.

The plan defines key terms and describes a GIS-based multi-hazard risk assessment for primary hazards on a county level. It makes observations regarding local vulnerability and loss based on a review of Local Hazard Mitigation Plans. Finally, it also describes progress on mitigation since 2010.

For each primary, secondary, and other hazard, the plan provides:

- Characteristics of the hazard
- A profile of the hazard including where it is found and what effects it has
- An assessment of California's vulnerability and potential loss due to the hazard – the populations and facilities at risk
- An assessment of local vulnerability and losses due to the hazard
- Current mitigation efforts

California's State Hazard Mitigation Plan establishes the State Hazard Mitigation Officer as the state's point of contact with FEMA and the individual who is responsible for monitoring, evaluating, and updating the plan. In California, the plan notes that there are two individuals with this title who are responsible for updating, implementing and evaluating the plan.

The state Office of Emergency Services has established a team that is responsible for measuring the success of the plan and of mitigation projects. This includes projects funded by the State of California and other projects. Socialization of the plan into the activities of the public and local jurisdictions along with tracking its implementation and monitoring its success are critical goals.

Challenges to plan implementation

California is a large state geographically. This makes outreach across the state a challenge. The right individuals and stakeholders at the local level must be involved with planning and implementation. Each local jurisdiction must be encouraged to adopt climate change adaptation and mitigation into their local plans. Explaining to each one why these issues are critical is extremely important. To help local stakeholders understand how to incorporate adaptation into their practices, the Office of Emergency Services offers several guidebooks on its website.³⁷

Another challenge to implementation is that emergency and disaster response teams tend to approach their work with a short-term view. Mitigation and adaptation require a long-term view over several decades. Helping these professionals change their outlook is important for the successful implementation of the state plan.

37 <http://www.caloes.ca.gov/for-individuals-families/hazard-mitigation-planning/documents-publications-videos>

2018 update of the State Hazard Mitigation Plan

The next update of California's State Hazard Mitigation Plan will be released in 2018. The Office of Emergency Services plans to follow a similar process to that followed in the preparation of the 2013 edition. The 2018 plan will have a greater emphasis on drought and climate change activities, given the weather patterns seen in the state over the past few years. The authors also hope to increase the State Hazard Mitigation Plan integration with other statewide plans.

4. Ensure that state investments do not increase vulnerability

Every year states fund housing, roads, water systems, and other important infrastructure. Unfortunately, these investments are sometimes made in locations that are at high risk from natural hazards or encourage growth in high-risk areas and as a result, increase a state's vulnerability to natural hazards and drastically reduce the return on state investments.

Several states have created a web-based repository with a goal of providing the most complete and up-to-date available regarding resilience. This section profiles the efforts made by both Ohio and California. Other states had codified requirements into law that require certain proposed projects to be reviewed for risks they may pose to the climate. New York State, through its Climate Risk and Resiliency Act, is one such example.

Statewide resilience database

Case Study: Ohio State Hazard Analysis Resource and Planning Portal³⁸

Ohio's State Hazard Analysis Resource and Planning Portal (SHARPP), administered by the Ohio Emergency Management Agency's (EMA) Mitigation Branch, serves as the State of Ohio's web-based repository for state and local mitigation information.³⁹ The resource includes the following types of information:

- Grants: This portion of the website describes available grants and their requirements that communities in Ohio can pursue to pay for projects.
- Hazards: This portion of the website identifies and provides a risk assessment for numerous natural disasters that are possible in the State of Ohio. For each, it provides a reference to the relevant section of the State Hazard Mitigation Plan and links to other Internet resources on the hazard.
- Planning: This portion of SHARPP provides the State Hazard Mitigation Plan as well as Local Hazard Mitigation Plans for counties and communities across the state. It also includes areas of mitigation interest, as provided by local jurisdictions, and other resources to communities and the public.
- Mitigation Projects: This section of the web portal provides a database and mapping tool for mitigation projects searchable by county, community, address, or latitude/longitude.

38 <https://ohiosharpp.ema.state.oh.us/ohiosharpp/>

39 https://ohiosharpp.ema.state.oh.us/OhioSHARPP/Documents/OhioMitigationPlan/2014/Appendix_J.pdf

- Reports: This portion of the site provides reports on mitigated properties, status of local hazard mitigation plans, and other topics

SHARPP enables the State to:

- Easily integrate local hazard mitigation plan details into the State's Plan
- Generate a historical record of mitigation projects
- Answer inquiries more efficiently
- Generate reports
- Monitor and provide reporting to FEMA on status of properties acquired using Hazard Mitigation Assistance (HMA) funds

SHARPP includes past, present, and future versions of the State Hazard Mitigation Plan (SHMP) as well as all local mitigation plans issued by jurisdictions in the state of Ohio. When a new version of the SHMP is available for public review, comments may be submitted throughout SHARPP. The local plans are sorted on the site by county and by community.

Local officials also upload a summary of their community's Hazard Identification and Risk Assessment (HIRA). Because there is no national or statewide methodology for preparing a HIRA, the web tool prompts the local official for information based on the methodology utilized by the State of Ohio which the local officials complete based upon their local mitigation plans. This enables the state to collect local data on hazards analyzed in the state's Hazard Mitigation Plan. One challenge has been getting localities to complete their HIRA summary since the contractor who created SHARPP entered many of the local hazard mitigation plans into the system rather than the locality itself. This is being rectified as local officials are trained and local mitigation plans are updated on SHARPP. The website currently has PDF versions of all local mitigation plans in the state and 41 of the 88 counties have entered their local HIRA summaries in SHARPP.

Examples of information collected by SHARPP from local officials include local mitigation action item details such as project lead, cost, funding sources, and estimated start and end dates. Those jurisdictions that have received FEMA grants to update their plans (which must be done every five years) must upload their data to SHARPP as a condition of the grant.

SHARPP also assists the state in loss avoidance studies that calculate the effectiveness of mitigation through measuring the actual cost savings. The web tool provides a conduit for collecting project-specific data. It is also able to calculate the aggregate dollar amount of losses avoided for each mitigated structure based on FEMA benefit-cost analysis software and the "useful life" of the project.

Reports

The information uploaded to SHARPP can be searched in a number of ways. The system is able to generate reports in PDF format. Examples of reports that it can generate include:

- Status of statewide local hazard mitigations including information such as: FEMA approval date, local adoption date, and plan expiration date.
- Status of mitigation actions proposed in local hazard mitigation plans statewide, sorted by county and community
- Status of mitigated properties statewide, able to be sorted by several variables

Funding

The FEMA Pre-Disaster Mitigation grant program from fiscal year 2007 funded the web portal with the 25 percent non-federal share provided by the State of Ohio. The State of Ohio is paying for the continued operation of the SHARPP portal. However, state officials are considering applying for a FEMA grant to pay for a redesign of the site in order to improve its functionality.

Benefits

Ohio EMA officials cite the public outreach aspects of SHARPP as one of its benefits. The tool helps the public as well as local officials understand the need for mitigation and adaptation. SHARPP allows the public to be more informed about the natural hazard risks facing their communities as well as the actions these communities plan to address them. It allows residents to see the projects occurring in their own communities.

Access

Access is available at different levels for the general public, local and state officials, and state emergency management administrators. The system is designed to allow three levels of access:

- Tier 1 – Public:
 - View-only access to local planning, project information, and web portal content; able to create and print reports of this data
- Tier 2 – County EMA Director/Local Mitigation Plan Keeper/Local Project Managers/State and Federal Agencies:
 - Ability to upload local mitigation planning information – mitigation plans, local HIRA summary, action item summary, vulnerability analysis summary, plan Crosswalk
 - Ability to upload local mitigation project information for awarded projects such as project or structure specific data, before- and after photos, deeds with open space restrictions
 - Ability to create and print reports of the above
- Tier 3 – Ohio EMA Administrator(s):
 - Administrative functions for the tool
 - Ability to enter, update, and delete local planning and project information for all communities
 - Review and approve information uploaded by Tier 2 users prior to availability to Tier 1 users
 - Ability to create and print specialized reports

Web Portals

Case Study: California MyPlan and MyHazard Mitigation Web Portals

The California Emergency Management Agency (now the California Governor's Office of Emergency Services [OES]) produced several web tools offering disaster preparedness planning and resources. One tool targets technical audiences and another tool provides information to the public.

California MyPlan allows city, county, special district, state and tribal users to access GIS data on natural hazards in the state.^{40,41} It is an Internet mapping tool that creates hazard maps for Local Hazard Mitigation Plans or for applying for federal grant programs. Users can specify the view shown on their maps, visible layers, as well as the opacity of layers relative to each other. The maps generated by MyPlan can be exported to other websites or for offline use. They can be used for federal grant applications, mitigation plans, or other purposes.

MyPlan provides data on several disaster types including earthquake and tsunami risk, with shaking hazards and fault lines; landslides; fire hazards; and flooding risk.

An advantage of the MyPlan tool is that it consolidates GIS hazard, risk, and vulnerability datasets created by various federal and state agencies onto a single website. This tool provides all needed hazard, risk, and vulnerability data in one place and eliminates the need for local jurisdictions to purchase GIS software, which can be a financial burden. Further, the tool facilitates the grant process by helping provide information and data to make grant proposals more effective.

For those agencies with access to ArcGIS Online, they may import private and public maps into MyPlan in order to customize the data provided.

Funding for MyPlan came through a federal grant under the Disaster Mitigation Act of 2000. In addition to California OES, other partners include the California Natural Resources Agency, FEMA, and California Polytechnic State University-San Luis Obispo. This resource was designed as a model for a similar national tool.

California MyHazards offers similar information to MyPlan, but is targeted at the general public, particularly home and business owners.^{42,43} It allows users to map the potential for hazards in their area (including earthquakes, flooding, fire, and tsunamis) and learn how to reduce their personal risk through adequate preparation.

Like MyPlan, MyHazards generates maps of any location within the State of California. After entering an address, the tool provides a severity rating for each type of hazard, if the address is within a risk area (moderate or high). Based on the results, the user receives a checklist of required, recommended, or optional actions for each of the four hazards targeted by the tool. Additional details, including explanations of the hazard, preparedness materials, and resource links accompany the checklists.

Advantages of MyHazard include helping to save money through effective hazard mitigation. The tool also plays a valuable public education role among individuals, businesses, and local governments to identify hazards in their areas for incorporation into their Hazard Mitigation Plans as well as for grant applications.

40 http://www.caloes.ca.gov/HazardMitigationSite/Documents/02-FINAL_percent20MyPlan_percent205-10-16_percent20v1.pdf

41 <http://myplan.calema.ca.gov/>

42 <http://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/myhazards-internet-mapping-tool>

43 <http://myhazards.caloes.ca.gov/>

The **California Hazard Mitigation Web Portal** hosts the above tools and provides a variety of other resources to both the general public and local government users. It also provides more information on specific hazards, links to other resources, and describes available state and federal programs. The Portal provides the 2013 State Hazard Mitigation Plan for download, described elsewhere in this document, in addition to the previous edition. It also provides details on various funding programs available through the State of California and FEMA.

Integrating resilience into state spending

Case Study: New York Community Risk and Resiliency Act

New York State's legislature passed the Community Risk and Resiliency Act (CRRRA) in June 2014 and Governor Cuomo signed it into law on September 22, 2014. The bill was introduced with the purpose of ensuring "that state monies and permits include consideration of the effects of climate risk and extreme weather events." The statute amends the state's environmental conservation, agriculture and markets, and public health laws to consider future climate risk, including projections for sea level rise and other weather impacts. It also requires the creation of model local zoning laws regarding climate risk. The statute has five major components:

1. *Prepare official projections for sea level rise.*

CRRRA required the New York State Department of Environmental Conservation (DEC) to adopt regulations establishing science-based state sea level rise projections by the beginning of 2016.

The proposed sea-level rise rulemaking was made available for public comment in November and December 2015. Five public information sessions were held during summer 2015. On the basis of public comments received, DEC revised the proposed regulation. DEC will release the revised proposed regulation for public comment on November 30, 2016, and will accept public comment through December 30, 2016. DEC expects to adopt the regulation in early February 2017.

The regulation offers five sea level rise projections for each of three regions of the state in the 2020s, 2050s, 2080s, and the year 2100.⁴⁴ Those regions are:

- Mid-Hudson Region, including the main stem of the Hudson River from Troy to the mouth of Rondout Creek at Kingston;
- New York City/Lower Hudson Region, including the main stem of the Hudson River from south of the mouth of Rondout Creek at Kingston down the marine coast of the five boroughs, and into the Long Island Sound;
- Long Island Region, including the marine coast of Nassau and Suffolk counties.

The five projections, provided in inches of sea level rise, were:

- Low – Very likely to be exceeded by the specified time (10th percentile of ClimAID model output)
- Low-Medium – Likely to be exceeded by the specified time (25th percentile)

44 <http://www.dec.ny.gov/regulations/103877.html>

- Medium – About as likely as not to be exceeded by the specified time (mean of the 25th and 75th percentiles)
- High-Medium - Unlikely to be exceeded by the specified time (75th percentile)
- High – Very unlikely to be exceeded by the specified time (90th percentile)

2. *Consider sea level rise, storm surge and flooding in facility siting, permitting and funding.*
DEC is leading an interagency effort to develop State Flood Risk Management Guidance. This guidance will include recommended flood-risk reduction criteria to be incorporated into program-specific guidance for each of the programs affected by CRRA and, potentially, programs not covered by CRRA. It could also be incorporated into municipal floodplain management ordinances.

Applicants for permitting or funding in 16 state programs must demonstrate that they have considered physical climate risk due to sea level rise, storm surge and flooding. This requirement applies to applications received after January 1, 2017. Examples of DEC permitting programs affected include oil and natural gas wells as well as projects affecting wetlands and coastal erosion hazard areas. Facility siting programs impacted include hazardous waste and petroleum storage. Finally, numerous funding programs administered by DEC and other state agencies are also affected including landfill closure assistance, the Drinking Water Revolving Fund, and local waterfront revitalization.

As noted above, CRRA amends the application requirements for 16 permit and funding programs and adds requirements for state agencies in four other programs. Each of these 20 programs is based on a different authorizing statute and is governed by different operating regulations, creating the challenge of developing guidance for the consideration of sea-level rise, storm surge and flooding, as required by CRRA, that would be applicable across all programs. DEC's approach, as described above, is intended to provide general guidance that each permit, regulatory, and funding program can incorporate into its program according to its individual statutory authority.

3. *Modify the Smart Growth Public Infrastructure Policy Act Criteria.*
Mitigation of risk due to sea level rise, storm surge and flooding is added to the list of smart growth criteria. DEC is developing guidance for use by agencies in assessing public infrastructure projects they build, fund or approve. This guidance will be based on the Flood Risk Management Guidance described above. DEC and DOS expect to release this guidance for public review in January 2017.
4. *Model local laws to enhance resiliency.*
The statute requires the DOS to work with the DEC to develop model local laws related to climate risk, focusing on sea level rise, storm surge, and flooding based on available data predicting the likelihood of future events. These model laws must be made available to local jurisdictions for voluntary adoption.

The model local laws will recognize that New York is not “one-size-fits-all” with differences in local regulatory culture and capacities to administer laws. Individual communities also have differing typologies and environmental risk factors.

This effort will include a review of existing model local laws in the areas of coastal erosion control, flood damage, and stormwater management; development of a compendium of those laws applicable in New York, and associated commentary. These will be released for public review in early 2017.

Further, many communities have existing land use provisions that simply need to be strengthened. The final report will also include commentary on how and when local jurisdictions should utilize the model language as well as lists of additional resources.⁴⁵

5. *Provide guidance on use of natural resiliency measures to reduce risk.*

DEC, in consultation with DOS, must develop guidance on use of natural resources and natural processes to enhance resiliency.^{46,47}

DEC and DOS expect to release the Flood Risk Management Guidance, natural resiliency measures guidance and smart growth guidance documents for public review in January 2017. The model local laws to enhance resiliency and associated commentary will be released for public review in early 2017.

Although the deliverable required by CRRA are still under development, the interagency approach DEC and DOS have adopted has engaged at least 16 state agencies, raising awareness of flood risk among agency staff, drawing on relevant expertise from a large number of agencies, and providing for robust review of the content of guidance documents.

CRRA is only a first step in mainstreaming consideration of climate change into routine decision-making at DEC and other agencies. New York State has also developed tools and databases to support analysis of climate hazards and decision-making. Considerable work remains to train staff, applicants, consultants, etc., in the use of these tools and databases to ensure compliance with the intent of CRRA. Additional work is needed to support communities in local adaptation efforts, including technical assistance with planning and implementation of adaptation projects and funding.

Since the greatest opportunities for resiliency enhancements are likely to come in the wake of future disasters, development of guidance for communities to undertake pre-event, long-term recovery planning for vulnerable areas is a priority. DEC's Office of Climate Change is continuing to develop resources to support municipalities in resiliency and adaptation planning through its Climate Smart Communities program and to make funding available through Environmental Protection Fund Climate Smart Communities grants. Because New York is a home rule state and land use planning is primarily the jurisdiction of local governments, the CSC program and the model ordinance play a critical role in supporting municipalities.⁴⁸

45 http://www.dec.ny.gov/docs/administration_pdf/crrastkhldr1.pdf

46 <http://www.dec.ny.gov/energy/104113.html>

47 http://assembly.state.ny.us/leg/?default_fld=&leg_video=&bn=A06558&term=2013&Summary=Y&Memo=Y&Text=Y

48 <http://www.dec.ny.gov/energy/102559.html>

Post-disaster resilience planning

Case Study: Florida Post Disaster Redevelopment Planning

The State of Florida created the Post Disaster Redevelopment Planning Guidebook⁴⁹ to encourage localities to create a Post Disaster Redevelopment Plan (PDRP) prior to experiencing a disaster. The Florida Division of Emergency Management, the Florida Division of Community Development, and the Florida Department of Environmental Protection created the Guidebook with funding from NOAA and FEMA. The Guidebook is part of Florida's Post Disaster Redevelopment Planning Initiative, which began in 2007, and details the process for creating a PDRP. The Initiative also provides other tools and resources for Florida localities to create a PDRP including recordings of previous workshops.

As the Guidebook explains, a PRDP “identifies policies, operational strategies, and roles and responsibilities for implementation that will guide decisions that affect long-term recovery and redevelopment of the community after a disaster. The plan emphasizes seizing opportunities for hazard mitigation and community improvement consistent with the goals of the local comprehensive plan and with participation of the citizens.”⁵⁰

Creating a PDRP prior to experiencing a disaster offers Florida communities the following benefits:

- Faster and more efficient recovery through identification of appropriate planning mechanisms, financial assistance, as well as agency roles and responsibilities;
- The opportunity to rebuild better than before the disaster because communities create a guiding vision that prevents short-term decisions from restricting sustainable long-term redevelopment and overshadowing opportunities to exceed the status quo; and
- Local control over recovery through an opportunity to assess risk and create long-term redevelopment plans in advance.⁵¹

In order to be effective, a PDRP needs support from community leaders at all levels, particularly those who would potentially be involved in disaster recovery. Participation by stakeholders and the general public is also crucial during development and implementation of the PDRP. This plan must also be kept up-to-date with necessary funding and political support, so the jurisdiction must commit to the PDRP over the long term.

A PDRP can take any of the following forms, with the first option considered best practice:

1. Stand-alone PDRP integrated with other local plans
2. Adopt a post-disaster redevelopment ordinance
3. Integrate post-disaster redevelopment issues into the comprehensive plan
4. Integrate post-disaster redevelopment issues into the Local Mitigation Strategy

49 <http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/>

50 <http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/documents/Toolbox/Post-Disaster%20Redevelopment%20Planning%20Workshop.pdf>

51 <http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/documents/Toolbox/Post-Disaster%20Redevelopment%20Planning%20A%20Guide%20for%20Florida%20Communities.pdf>

5. Expand recovery annex of the Comprehensive Emergency Management Plan to address post-disaster redevelopment issues

When creating a PDRP, the local jurisdiction will need to appoint a staff member to lead the effort. They must also decide whether to prepare the PDRP in house or to hire a contractor. The timing of the planning process for the PDRP is also important. As noted above, it should occur prior to a disaster event. If another planning document needs to be amended or updated, the local jurisdiction may wish to incorporate PDRP issues at the same time. The jurisdiction should allow at least one year to complete the process, including stakeholder and public outreach efforts.

Once the jurisdiction is ready to move forward on their PDRP, the buy-in of local leaders is essential to give the effort legitimacy and to ensure they participate in the process. Getting local leaders on board will also serve to increase public awareness of what the PDRP is and how it will benefit the community.

The stakeholders selected to participate in the process should be individuals who can contribute to the PDRP's technical accuracy and/or its political acceptability. Existing committee structures within the jurisdiction's government could provide such a group of interested stakeholders for the purpose of preparing the PDRP.

Once the above are in place, a capacity assessment will allow the project team to collect necessary information and existing analysis. This includes a review of existing plans and programs as well as an assessment of resources in the community. The Guidebook provides a series of minimum, recommended additional, and best practices advanced tasks to perform as part of a vulnerability assessment of possible disaster scenario impacts affecting long-term redevelopment. Issue prioritization and public participation are also critical to the success of the PDRP.

The Guidebook suggests the following topics be included in a PDRP:

- Sustainable land use
- Housing repair and reconstruction
- Economic redevelopment, including business resumption
- Infrastructure and public facility restoration and mitigation
- Health and social services
- Environmental restoration
- Financial considerations
- Short-term recovery actions affecting long-term redevelopment
- Any other long-term recovery issues identified by the community

For each of these topics, the Guidebook recommends minimum, recommended, and advanced achievement levels.

The PDRP is implemented in a series of steps occurring both before and after a disaster. Pre-disaster actions occur following formal plan adoption but prior to a disaster. When a disaster strikes, the community activates the plan for periods of time required to complete short- and long-term recovery. Once the recovery is complete the PDRP is once again deactivated and updated as necessary based on lessons learned or changes made. It is critical that the plan is kept up to date.

Case Study: Panama City, FL's Post Disaster Redevelopment Plan

All coastal counties and municipalities in Florida are now required to have PDRPs in place. Panama City, on the panhandle's Gulf Coast, is one such locality. Like many communities in Florida, Panama City is vulnerable to hurricanes and other coastal disasters. Hurricane Opal in 1995 and Hurricane Ivan in 2004 both caused billions of dollars in damage to the surrounding area. Panama City was the first to create its PRDR under a pilot program funded by NOAA.

The mayor appointed the Panama City PDRP Executive Committee, which held five formal meetings. During these meetings, the committee discussed the roles and responsibilities of all agencies in a post-disaster environment. It also analyzed a report assessing the community vulnerability as well as the impact of current planning documents on post-disaster recovery. This enabled the community to identify post-disaster recovery issues.

The vulnerability assessment for the PDRP looked at Panama City's vulnerability to storm surge and flooding, including the downtown area, two hospitals, many employers and schools, as well as major retailers and residential zones. Parts of the city are also vulnerable to wind damage from tornadoes and tropical storms. Because much of the city's housing stock consists of single-family homes built prior to 2001, these homes may not withstand high winds.

This analysis also considered the local economy including the vulnerability of major employers to storm surges, flooding, and wind damage. To limit public expenditures in vulnerable areas, the assessment also determined which public facilities are most vulnerable to help decide whether mitigation actions were needed.

One challenge faced by the city in preparing this plan was a lack of staff time to dedicate towards it. The process requires a large amount of staff participation to be successful. The Panama City Board of Commissioners unanimously approved the completed PDRP in October 2008.

Single jurisdiction versus multiple jurisdiction PDRPs

A PDRP can encompass a single jurisdiction or multiple. The Panama City pilot found that there are advantages and disadvantages to preparing the PDRP on a municipal rather than county level (as other pilots have done). Local comprehensive planning occurs at the municipal level, and a municipal focus allowed city staff to learn more about their specific disaster recovery needs as well as how the city and county could coordinate resources.

However, other plans, such as Florida's Local Mitigation Strategy and the Comprehensive Emergency Management Plan, occur at the county level and services like emergency management and economic development planning are the responsibility of the county. County staff participated in the process, but they hesitated to show favoritism towards Panama City. Finally, other parts of the county were perceived as more vulnerable than Panama City itself.^{52,53}

52 Florida State Emergency Response Team. "Panama City PDRP Case Study." Available at <http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/documents/Toolbox/CaseStudyPanamaCity.pdf>.

53 Florida Department Of Community Affairs. (2010, October). "Post-Disaster Redevelopment Planning." Available at <http://www.floridadisaster.org/Recovery/documents/Post%20Disaster%20Redevelopment%20Planning%20Guidebook%20Lo.pdf>.

5. Develop strategies to address assets already in high-risk areas

A comprehensive risk assessment (which is required in all state Hazard Mitigation Plans) will reveal how a state's people, economy, infrastructure, and environment are already at risk. It is not enough, however, just to identify risk. States must determine how to address what is found to be in harm's way.

States can play an important role in buyout situations by helping communities develop plans, providing state funding, and assisting with the dispersal of federal funding. This example from North Carolina shows how the state worked with a local jurisdiction to manage parts of its community susceptible to repeated flooding.

Case Study: Innovative Floodplain Management in Kinston, NC

Following Hurricane Fran in 1996, North Carolina worked with the town of Kinston to develop an acquisition program for substantially damaged homes using FEMA Hazard Mitigation Grant Program funds. When Hurricane Floyd struck the same area three years later, a large portion of the Hurricane Fran recovery program was rolled over to begin including Floyd victims, eliminating the typically long time lapse between a disaster and completing deed transactions.

Between 1996 and 1999, hurricanes repeatedly struck the City of Kinston in Lenoir County, North Carolina. Hurricane Fran came ashore in 1996 and three years later, in September 1999, Hurricanes Dennis and Floyd impacted the area less than two weeks apart.

As a result of Dennis lingering off the coast for several days, the drainage basin in Kinston became saturated and unable to absorb the rainfall produced by Hurricane Floyd, a Category 2 hurricane with 110 mph winds at the time it made landfall. Floyd dumped 13 inches of rain on Kinston in 24 hours resulting in the Neuse River cresting at 10 feet above flood stage in Kinston.

The storms crippled the community. More than 75 percent of the homes located in the floodplain were substantially damaged or flooded repeatedly following these three storms.

Following these disasters, the city and county committed to reducing their risks by proactively incorporating floodplain management planning into their community. They utilized GIS as the foundation for this effort by developing databases and tracking functions. This enabled them to prepare maps to aid planning and implementation. It also provided a mechanism for tracking a comprehensive floodplain management program to relocate vulnerable families thoughtfully and restoring floodplain function along the Neuse River. The City of Kinston used GIS data on political and geographic boundaries, existing or proposed infrastructure, demographics, and property records to learn more about its vulnerabilities, including:

- Pre-Disaster Mitigation Planning: Creating maps showing the 100- and 500-year floodplains and susceptible structures. The city acquired many of these properties utilizing FEMA Hazard Mitigation Grant Program (HMGP) funds for 75 percent of the cost.
- Risk Reduction: Tracking the progress of floodplain property acquisitions.

- Disaster Response: Serving as a repository for critical information needed in the event of a disaster. Kinston's fire department utilizes GIS for critical data needed to respond to emergency calls.
- Disaster Recovery: Developing a demographic profile of the floodplain to identify how many homes (at what prices) are needed for residents looking to relocate outside the floodplain.

Residents were discouraged from leaving the community by structuring the acquisition program so that existing neighbors could move into the same new neighborhood together. The City has relocated 97 percent of the participating homeowners within the city limits. This reduced sprawl and the possibility of water quality issues. A total of 1600 homes have been purchased under this program and 73 percent of the city's floodplain remains as open space. The restoration of the floodplain has been passive and the land has reverted to a primarily forested state. And while the program is voluntary, GIS serves as an educational and marketing tool by graphically illustrating the plan and resulting benefits to the community.

The Office of the North Carolina Governor, Department of Corrections, and Division of Emergency Management partnered to build replacement houses for Hurricane Floyd victims. Using Governor's relief funds, the state manufactured wall panels using inmate labor within a prison. This program will contribute approximately 100 new homes in the City of Kinston. The city also converted an abandoned high school into senior housing units.

One requirement of FEMA's HMGP program is that the properties acquired must remain open space. In the mid-2000s, The City of Kinston partnered with the Conservation Fund and the University of North Carolina Department of City and Regional Planning to create the Kinston-Lenoir County Green Infrastructure Plan. The plan redevelops these areas to create community amenities and services. The plan focuses on heritage tourism (such as Civil War sites and historic buildings), passive recreation (a forest and nature trail) and active recreation opportunities to ensure the public is able to take advantage of the space. GIS allowed the city to assess land located in the floodplain for its suitability for the above purposes. They created hub areas for appropriate activities and linked them with connectors and greenways enabling varied modes of transportation.

The green infrastructure plan identified 14 potential greenway segments as well as additional canoe launches. The plan also developed a walking tour of historic Kinston and a driving tour of sites in Lenoir as connectors.⁵⁴

Kinston's story offers several lessons:

- Be proactive with pre-disaster preparation: The community learned from its experience following Hurricane Fran. Following that storm, it took more than a year to put together a FEMA and North Carolina funding application package. Prior to Hurricane Floyd, the community developed a pre-disaster project application package. This resulted in their FEMA and North Carolina applications being approved within a week following the storm.
- Use GIS for analysis and outreach: Kinston used GIS as both an analytical tool to help make decisions as well as an outreach tool to engage residents, understand the needs of vulnerable residents, and to build support.

54 https://www.fema.gov/media-library-data/20130726-1515-20490-7614/kinston_cs.pdf

- Weigh buyout and relocation pros and cons: Some residents miss their former neighborhoods. Also, some members of the community would like the now vacant property on the floodplain be used for something more that generates income. The city recommends that other communities continuing similar efforts to be aware of and communicate these restrictions consistently with residents.
- Pick solutions that avoid new problems: Because Kinston integrated smart growth, green infrastructure, and hazard mitigation into their approach, the community avoided consequences such as sprawl, loss of open space, and water quality impacts.⁵⁵

6. Help communities become more resilient

Local governments play an important role in building resilience. While it varies from state to state, towns and cities have a great deal of control over land use planning, local roads, building codes, zoning, parks, local government facilities, and building permits, but often do not have the expertise, resources, or capacity to take the steps needed to become more resilient.

Policy tools are an important element to building resilience. In addition to policies, the state should provide access to best practice resources, model ordinances, and resilience and recovery checklists for communities to emulate and implement. Non-profit organizations and local institutions can be valuable partners in producing these guides and toolkits. This section looks at one such example from Louisiana.

The state can also help communities establish similar, locally focused funds. While communities would control these funds, the state should incentivize their development, institute the necessary regulations that allow communities to levy additional fees and taxes for resilience, and provide assistance and guidance when needed. The Charlotte, North Carolina region offers one such case study of a local fund in practice.

Technical Assistance and Toolkits

Case Study: Center for Planning Excellence's Best Practices Manual for Development in Coastal Louisiana and Land Use Toolkits

The Center for Planning Excellence (CPEX)⁵⁶ is a non-profit organization that coordinates urban, rural, and regional planning in Louisiana. Founded in 2006, it has helped more than 30 cities, towns, and parishes with their planning efforts and its *Best Practices Manual for Development in Coastal Louisiana* emphasizes planning for resilience.⁵⁷ Invoking the destruction caused by Hurricane Katrina to the Lower 9th Ward in New Orleans, the Manual offers resilient design

55 <https://coast.noaa.gov/digitalcoast/training/kinston-flood-risk.html>

56 <http://www.cpex.org/>

57 Coastal Protection and Restoration Authority of Louisiana and the Center for Planning Excellence. "Best Practices Manual for Development in Coastal Louisiana." Available at https://static1.squarespace.com/static/536d55f1e4b07afeea8cef61/t/53c0485be4b0ec6e3ceb904a/1405110363834/BPM_Coastal_Louisiana.pdf

strategies to prevent such damage in the future. Funding for the Manual came from the Coastal Protection and Restoration Authority and the National Association of Realtors, with support from local Realtor Boards.

The Manual resulted from a recommendation in CPEX's *Louisiana Speaks Regional Plan*⁵⁸ and *Louisiana's Comprehensive Master Plan for a Sustainable Coast*⁵⁹. It is targeted at different types of users including local governments, state and federal agencies, tribal organizations, private real estate developers and builders, realtors, non-profit organizations, real estate professionals, insurance and financial services industries, as well as residents living in the region. The Manual identifies the following objectives:

- Create a new regional resource presenting best practices and shape current settlement and development trends in the region. People and communities play a role in creating sustainable and resilient long-term solutions.
- Understand the unique environmental, cultural, and economic conditions of Coastal Louisiana as a context for the manual's best practices and strategies.
- Compile the most current and relevant data through a list of agency and web-based resources.
- Provide relevant strategies based on international best practices that fit the coastal areas of Louisiana based on its unique culture and geography.
- Provide planning tools that create a framework guiding future development and the steps for community planning in coastal Louisiana.

The Manual begins by looking at delta and coastal regions abroad, including in Africa, Australia, Europe, and South America. Many of the solutions from those regions can be adapted to coastal Louisiana. For each one, it provides a profile and identifies a list of best practices from the case study. Specific examples profiled include the Rhine River Delta in the Netherlands; the Nile River Delta in Egypt; the Mekong River Delta in Vietnam; the Parana River Delta in Argentina; Venice, Italy; Kristianstad, Sweden; Bangladesh; Jakarta, Indonesia; Japan; and, Queensland, Australia.

It then considers the unique circumstances, both historical and contemporary, shaping coastal Louisiana. This includes land use and development, economic conditions, environmental conditions, and restoration efforts. The Best Practices Manual also examines the six geographic types ("geotypes") located in the region. Geotypes are distinct areas with defined natural, cultural, and economic characteristics. One example is the Coastal Delta geotype located along the coast where land and sea meet.

The manual provides strategies and best practices that will work in any or all of the geotypes. Besides identifying the geotypes that a particular strategy will work in, the manual rates its level of urgency for implementation (essential, encouraged, or optional). It provides strategies on the community scale as well as at the site/building scale.

The Manual ends by looking at how communities can develop plans that fit their individual circumstances while coordinating with other existing plans at the state and federal level. It also

58 <http://www.cpex.org/louisiana-speaks/>

59 <https://www.doi.gov/sites/doi.gov/files/migrated/deepwaterhorizon/adminrecord/upload/CPRA-Louisiana-s-Comprehensive-Master-Plan-for-a-Sustainable-Coast-2012.pdf>

helps localities make their plans a reality by describing how to create and adopt local regulatory ordinances. It refers to model ordinances in CPEX's toolkits, described below that support the strategies described in the Best Practices Manual.

Louisiana Land Use Toolkits

CPEX has also released two land use toolkits – a more general *Louisiana Land Use Toolkit*^{60,61} (Land Use Toolkit) as well as a more specific *Louisiana Coastal Land Use Toolkit*⁶² (Coastal Toolkit) that compliments the *Best Practices Manual*.

The Land Use Toolkit originated as an action item in the Louisiana Speaks Regional Plan in order to support sustainable development and a better future. It includes model development codes for zoning and subdivision regulations based on smart growth principles. This regulatory language helps communities guide their growth and development consistently with their comprehensive plan.

In April and May of 2009, CPEX held a number of workshops across the state including both discussion of development issues and needs as well as a hands-on mapping session. CPEX released the toolkit in 2009. The Louisiana Economic Development and the National Realtor Association funded this toolkit.

The Land Use Toolkit is written so that local governments in Louisiana can download it and customize it cafeteria style to meet their needs. The local government can choose to adopt the entire toolkit as a full development code or incrementally by adopting any individual components of it. The code is flexible to use in multiple locations throughout Louisiana with recommendations customized to each jurisdiction.

The Land Use Toolkit has been implemented in at least 13 communities across the state. Most of these jurisdictions would not have been able to create a land use model without the use of this resource.

The toolkit includes an implementation handbook to provide communities with a step-by-step guide to planning for and creating a complete development code. It walks them through four implementation steps:

1. Adopting a comprehensive plan
2. Mapping the toolkit
3. Customizing the toolkit
4. Adopting and administering the toolkit

The Coastal Toolkit, released in 2011 by CPEX, is similar to the Land Use Toolkit. However, the development needs of the coastal communities in Louisiana differ from those further inland.

After releasing the Land Use Toolkit, CPEX realized through focus groups and interviews that it did not include specific model regulations needed by coastal communities. For example, the Coastal

60 <http://www.cpex.org/louisiana-land-use-toolkit/>

61 <http://www.landusetoolkit.cpex.org/download>

62 <http://www.cpex.org/coastal-land-use-toolkit/>

Toolkit includes model ordinances on borrow pits and fill (to regulate the elevation of properties on fill), water management, heritage trees (for preserving native vegetation), and flood prevention model ordinances. It recognizes the unique building types and development patterns in the coastal regions of the state.

The Coastal Toolkit is intended to compliment the Best Practices Manual described above. While the Manual provides an overview of *what* the best practices are, the Coastal Toolkit provides the *how* of implementing them, including the model regulations that make that happen. The Coastal Toolkit was funded by the Coastal Protection and Restoration Authority and the National Association of Realtors, with support from local Realtor Boards.

In addition to the model zoning and subdivision codes, both toolkits include a number of additional ordinances. Examples of the additional ordinances include overlay districts for airports and historic areas as well as site development standards for parking, signage, and landscaping.

While focused on Louisiana, the Toolkits are both free resources available for download online from anywhere. As noted above, planners and consultants can tailor these toolkits to meet a community's specific needs. CPEX has worked with Tangipahoa Parish, Vernon Parish, the City of Gonzales, the City of Abbeville, Cameron Parish, Terrebonne Parish, and other Louisiana communities to implement parts of the toolkit. They are aware of the toolkit being used in at least 12 other Louisiana communities.

Unfortunately, CPEX cannot track specific locations where the toolkits are downloaded and utilized, beyond those which contact them directly. They can be applied in communities located in other states as well. In fact, several cities in other states have contacted CPEX requesting the regulations in an editable file format. This will allow these communities to modify them to comply with applicable state and local laws.

State and Local Resilience Funds

Case Study: Flood Risk Mitigation - Engineering and Mitigation Program, Charlotte-Mecklenburg, NC Storm Water Services Division

The Engineering and Mitigation Program within Charlotte-Mecklenburg, North Carolina's Storm Water Services Division (CMSWS) is the local authority in charge of analyzing flood hazard risk and for prioritizing properties for appropriate mitigation projects. These projects range from property buyouts to environmental restoration and are funded primarily throughout stormwater utility fees.

The agency is currently in the process of remapping its regulated floodplains. This effort is occurring in four phases, with the first phase going into effect in 2014 and the final phase continuing through 2018. In 2000, Charlotte-Mecklenburg became the first U.S. community to show on its official maps both the current floodplains (FEMA floodplains) where flooding is expected to occur now and its Community Floodplain where flooding is expected in the future.⁶³

The CMSWS flood risk mitigation program has two key elements:

⁶³ <http://charlottenc.gov/StormWater/Flooding/Pages/FloodplainsandMaps.aspx>

Under the **Floodplain Buyout (Acquisition) Program**, the agency purchases and removes buildings that are likely to flood repeatedly. This voluntary program has purchased 374 homes, apartment buildings, and businesses as of the end of 2016 located in the highest risk portions of local floodplains. Located in more than a dozen neighborhoods along various creeks, the program has relocated more than 600 families.

The buyout program has been in place since the late 1990s. The impetus for the program was several back-to-back floods that occurred at that time. The floods increased public and political support for an alternative to buying flood insurance and hoping for the best. The community recognized that floodplains are intended to flood and store water and it would be best to relocate buildings out of hazardous areas.

When considering a property, the program considers its flood risk and the cost effectiveness of buying it. The benefit to the public of buying the flood-prone property should exceed the public money cost of buying it. Example of public benefits include:

- Less tax money spent on emergency response, disaster relief, and to replenish the National Flood Insurance Program
- Restoration of the natural floodplain enhances water quality and the ecosystem
- Increased recreational opportunities
- Improved sewer line access for utility work crews

The program prioritizes each of the 5000 properties in the region's regulated floodplains by giving it a flood risk score. The agency considers the scores of individual properties, groups of properties, and the overall community benefits when making decisions. The CMSWS Risk Assessment, Risk Reduction Plan (RA/RR)⁶⁴, originally approved in 2012, is updated each year to identify and prioritize properties.

Local funds pay for buyouts identified in the RA/RR Plan. Other acquisitions also involve grant funding from federal or state sources. However, fewer properties meet the federal and state criteria than in the past.

The agency also has implemented a quick buyout program following major flood events. This is funded by local money through a rainy day fund. By doing pre-flood planning and identifying areas they would like to acquire properties, the acquisitions can be completed quickly after an event before homeowners make repairs or floodproof their homes from future events. This saves money and helps people move out of the floodplain at a time when their interest is likely to be highest. This program is also able to complete acquisitions quickly – in just 3-9 months – versus 3-4 years likely under FEMA programs (where homes are usually repaired before they are acquired). The program has been implemented three different times in the last 15 years.

After acquisition, the Engineering and Mitigation Program within CMSWS restores the floodplain to its natural state enabling it to store and filter excess rainfall and runoff. This may include parkland,

64 http://charlottenc.gov/StormWater/Flooding/Documents/Flood_RARR_Plan-Final.pdf

gardens, greenways, and other similar uses. The local police and fire departments may utilize acquired properties for training prior to demolition or relocation.⁶⁵

CMSWS hopes to expand the program during the next fiscal year by increasing the funding. They hope to convert it to a goal-driven mitigation program based more on flood risk reduction and less on utilizing the capital budget. The modified program would have targeted goals and results with performance metrics established.

The staff involved with the Floodplain Buyout (Acquisition) Program identified several lessons learned that have helped this program be successful:

- A long term plan and vision is essential. The advisory committee approves the annual plan and their elected board approves each purchase. These are opportunities to show program progress on location maps identifying proposed and completed activities.
- A system for justifying action and non-action for each parcel is also helpful. Some people will not be willing to sell properties deemed desirable to the program and others will want to sell their properties that the program does not want.
- Planning on a project or neighborhood level rather than at the individual parcel level may delay acquisition of some high risk sites but will help minimize negative impacts on adjoining parcels and entire neighborhoods
- Partnerships with other government agencies and utilities have proven fruitful when planning and funding projects. Potential partnerships may include storm and sanitary sewer, park and recreation departments, as well as police and fire departments (for training in empty structures)
- Plan for reuse, resale, or recycling of material from acquired properties. CMSWS has a formal arrangement with the local chapter of Habitat for Humanity to take material. This reduces asset disposal issues.

A second program offered by the Engineering and Mitigation Program within CMSWS is the **retroFIT Program**.⁶⁶ This effort offers financial and technical assistance to existing building owners not participating in other mitigation efforts. Started in October 2015 after Board of County Commissioners approval, the program has a goal of making dwellings more resilient.

The authorization for the program came from NCGS 153A-274.1, passed by the North Carolina legislature in 2014, which allows Mecklenburg County to use stormwater utility fees to implement flood damage reduction techniques in order to improve private property.⁶⁷ CMSWS worked with the legislature to pass this authorization to ensure North Carolina's storm water language would allow them to use their funds to make improvements on private property. The legislature received feedback from various stakeholders resulting in fairly detailed criteria for the program.

The agency realized that floods impacted many people who would not make it to the top of the Floodplain Acquisition Program buyout list due to the characteristics of their site or that the agency would be unable to service. This program also provided an opportunity to keep rising flood

65 <http://charlottenc.gov/StormWater/Flooding/Pages/FloodplainBuyoutProgram.aspx>

66 <http://charlottenc.gov/StormWater/Flooding/Pages/retroFIT.aspx>

67 http://www.ncga.state.nc.us/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_153A/Article_15.html

insurance rates down by doing some mitigation measures to properties. Recent National Flood Insurance Program restructuring contributed to higher premiums.

Residential and commercial property owners may check their eligibility for participating in the program online. Their habitable building must be located in the community-designated floodplain and be able to be modified to reduce or prevent future flood damage.

The program generally provides grants for 75 percent of qualified mitigation project costs. Depending on a property's tax value or the owners' enrollment in programs for low income or disabled individuals, certain owners may receive up to 95 percent of the project cost. Eligible projects that apply are selected and ranked based upon the expected risk reduction benefits. RetroFIT funds the following types of projects:

- Structure elevations: Raising the lowest finished floor to an elevation above flood level
- Structure relocation: Moving the structure to a location outside the floodplain
- Wet floodproofing: Modifying a structure so water can enter but not cause significant damage
- Dry floodproofing: Making a structure watertight so water cannot enter
- Equipment elevation: Elevating, relocating, or protecting service equipment such as HVAC units
- Abandoning the basement: Converting a finished basement to a crawlspace
- Demolition of the structure

The RetroFIT program application window occurs at least once a year if funding is available and consists of three phases. The first is the Application Phase during which property owners complete an Owner Interest Application and select the floodproofing improvement(s) they would like to make. If needed, CMSWS Engineering and Mitigation Program staff assists the property owner in determining which technique(s) would be effective for their situation.

During the Review and Assistance Phase, staff provides owners with technical assistance to make a formal determination whether a project is viable. This determination considers whether the improvements are feasible and cost effective as well as the minimum necessary to accomplish the goal. If approved, the owner then submits a formal grant application.

During the Approval and Implementation Phase, staff selects projects for funding as well as approval by the agency's volunteer Storm Water Advisory Committee. They execute a contract with the property owner so that the mitigation can proceed.

In its first year, the RetroFIT program has approved five grants, although one homeowner sold their house before implementation. For the current fiscal year, applications were due in October 2016 and approximately 40 were received. Grants are expected to be awarded during the 2017 calendar year.

Although the RetroFIT program is young, CMSWS staff identified the following lessons learned during the first year:

- The homeowner's portion of a project's cost, even 10 or 20 percent on a larger project, can be a challenge for some to afford.

- Owner interviews and contacts are a tool to promote awareness of available flood risk products as well as to capture personal flood history details. While only a few pilot project applications were funded, dozens of residents participated in one-on-one flood risk discussions with staff.
- Staff needs to have knowledge of flood insurance to answer questions, look for errors in current policies or declarations, and to estimate the effects of various mitigation techniques on premiums

The two elements of the flood risk mitigation program described above have an annual budget of approximately \$3.5 million in local money, of which about \$250,000 funds the RetroFIT program. The agency attempts to leverage FEMA grants on top of the local funding, but this has been challenging over the past four to five years.

7. Develop a process for monitoring, measuring, and reporting on progress

The state should require that any project—local or state level—applying for state resilience funding propose a set of performance metrics that will be used to determine success. These projects should also be required to submit monthly progress report back to the office or sub-cabinet and incorporate any data gathered into the state’s central resilience database.

Florida’s Local Mitigation Strategies (LMS) program offers a mechanism for localities in that state to plan for risk mitigation. Miami-Dade County has created a set of performance metrics to help them select projects for inclusion in their local mitigation strategy.

Case Study: Miami-Dade County, FL Mitigation Action Prioritization

This regional framework developed by state, local, and non-profit leaders evaluates proposed resilience projects based on cost, suitability, and risk reduction potential.

After Hurricane Opal in 1996, the State of Florida empowered local governments with the authority to plan and make decisions regarding the implementation of hazard mitigation projects. Beginning in 1997, the state promoted Local Mitigation Strategies (LMS) using a combination of FEMA Hazard Mitigation Grant Program (HMGP) and its own funds. The LMS has since evolved into a successful and unified program of local mitigation planning and implementation by serving as a bridge between various local planning and regulatory efforts.

Miami and Dade County lie in a geographic area that is particularly vulnerable to hurricanes and tropical storms. When the Miami-Dade County region was initially developed out of the Florida Everglades, the area was frequently inundated for extended periods of time. To help control this, the government and the private sector constructed a canal system that today is approximately 620 miles long. It also includes salinity control gates to control the flow of salt water into the Biscayne Aquifer.

Hurricane Andrew and Hurricane Irene impacted Miami-Dade County in 1992 and 1999 respectively. The region also experienced severe flooding in October 2000 resulting in \$100 million in infrastructure damage and more than \$200 million in agricultural losses. The local government's response following the 2000 flooding demonstrated the effectiveness of Miami-Dade's LMS program.

The region created the Miami-Dade County Flood Management Task Force in 1999 following Hurricane Irene to offer region-wide recommendations and, following the 2000 floods, the state's governor formed the South Florida Flood Management Working Group. The working group aimed to expand the table to include more state and local agencies as well as public and private interests in these conversations. These groups have pursued the LMS program to identify the region's risks and vulnerabilities. The LMS program also forms the basis of local planning initiatives and projects.

Creating a Local Mitigation Strategy

The State of Florida asked its counties, in conjunction with their municipalities, to establish Mitigation Strategy Working Groups. These working groups also brought other agencies and nongovernmental organizations into the process. The state also prepared an LMS Guidebook setting standards and procedures for this process.

The LMS program also helps to pre-identify and to prioritize local projects at the county and community levels that could help reduce the region's vulnerability to losses from future disasters. All 30 municipalities in the region participate in the LMS program, an important goal of the program, as municipalities are the most critical participants. The result of the LMS program has been a high level of cooperation among local, state, and federal agencies as well as other stakeholders.

In Miami-Dade County, the Office of Emergency Management coordinates the LMS program. The municipalities together created a quantitative prioritization tool for selecting projects for implementation. This methodology is intended to be systematic and unbiased. Referred to formally as the Benefit Cost Review (BCR), it analyzes the hazard mitigation projects' suitability, costs, and potential for risk reduction. This enables the projects to be compared to each other, ranked, and prioritized within each community, subject to two requirements:

- The measures employed by the methodology are based on needs identified and qualified by local officials and staff.
- The foundation of the methodology reflects the key parameters that participating municipalities agree to as well as their consensus view of relationships between the parameters, reflected in the weighting factors.⁶⁸

Local agency stakeholders propose mitigation projects that they wish to pursue. They are tracked utilizing a web-based LMS Project board tool within their incident tracking software known as WebEOC. Miami-Dade County OEM provides each of the 52 local agency stakeholders with a login for this system so that they can keep the information regarding their projects up-to-date. The system allows OEM staff to search and create reports. For example, projects could be sorted in a report based on the type of funding needed, project cost, or other factors. This assists the staff

68 <http://mitigation.eeri.org/files/resources-for-success/00056.pdf>

with annual reporting to FEMA and other entities. The WebEOC system tracks approximately 1300 proposed projects. This includes all projects proposed for Miami-Dade County, not only those receiving federal funding.

The projects are prioritized following completion of the vulnerability assessment and risk analysis. To calculate a prioritization score, the project sponsor answers questions within the WebEOC system regarding the parameters shown in the table below. For each factor, a project can receive up to a maximum of 5 points. In the January 2016 iteration of Miami-Dade County’s LMS, the prioritization criteria (and associated weighting factors) were as follows:⁶⁹

Parameter	Weighting Factor
Suitability	30% (overall)
Measure appropriateness	35%
Hazard vulnerability	15%
Mitigation measure lifespan and future risk consideration	15%
Environmental impact	10%
Consistency with existing legislation/policies	10%
Consistency with existing plans/priorities	15%
Risk Reduction	55% (overall)
Scope of benefits	15%
Potential to save/protect human lives	30%
Support protection of critical infrastructure/continuity of essential services	20%
Repetitive damages corrected	10%
Economic effect or loss during project lifespan	10%
Number of people to benefit	15%
Cost and Time	15% (overall)
Estimated costs (weighted factors for initial and maintenance/operating costs)	30%
<i>Initial costs</i>	75%
<i>Maintenance/operating costs</i>	25%
Affordability	30%
Implementation complexity	20%
Completion timeframe	20%

69 <http://www.miamidade.gov/fire/mitigation.asp>

Decisions are made by the LMS Steering Committee, facilitated by the region's LMS Coordinator, for those projects that have completed the BCR process outlined above. It is important to note that the LMS process considers other factors besides this project prioritization score. The Steering Committee also considers other factors such as the overall cost relative to the total funding available, the readiness of projects to be constructed, and the sponsor's ability to meet any matching fund obligations. Therefore, in certain situations, a "shelf-ready" project might be funded ahead of projects with a higher priority if a funding opportunity to pay for it is limited.

As noted above, project sponsors must complete the prioritization process by answering the questions to the best of their ability in order to be considered. Miami-Dade County OEM has found that getting some sponsors to perform this step to be challenging. Further, depending on the specific nature of the proposed project, project sponsors may find quantifying certain prioritization criteria to be challenging.

The project prioritization process helps streamline the mitigation efforts in Miami-Dade County. However, it is critical that the stakeholders do not view projects as simply a list. Doing so diverts attention of the strategies behind the local mitigation efforts. Goals and objectives need to be continuously updated as the priorities and needs of the region change.



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