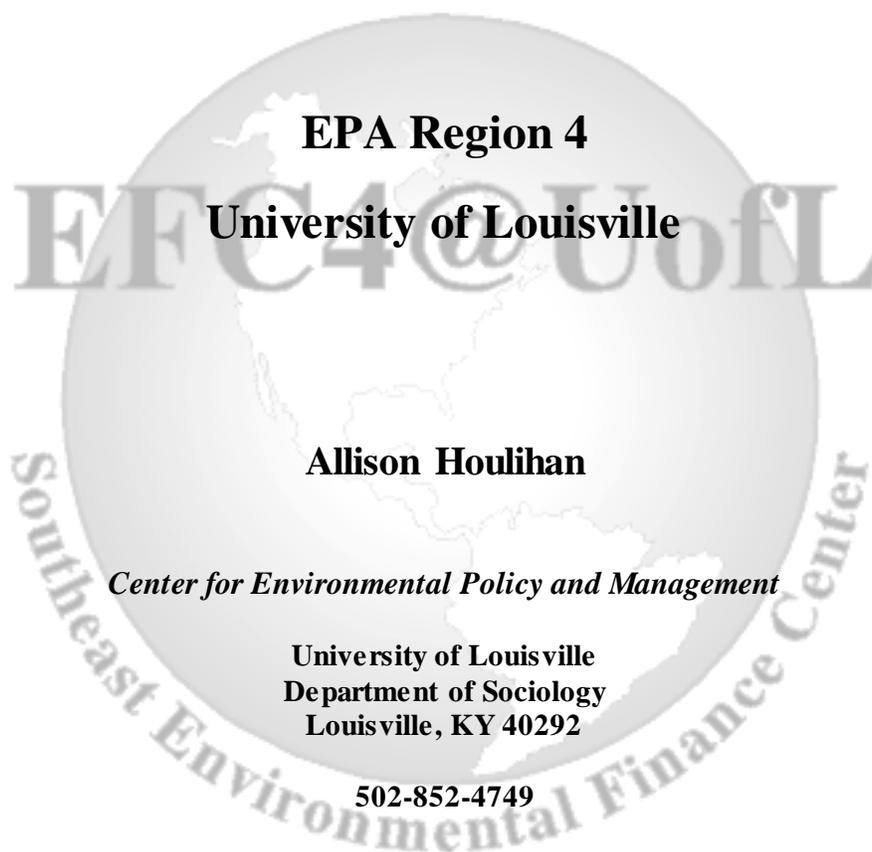


*Sustainable Hazards Mitigation*

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**Southeast Regional Environmental Finance Center**



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## **Introduction**

The cultivation of communities that are both livable and sustainable has increasingly become an objective of state and local officials. As urban growth and development increase in hazardous areas, it is necessary for planners and policy makers to make the critical link between hazards mitigation and sustainable development. Since the 1970s, the percentage of Americans migrating to hazard-prone areas has dramatically increased. Many of the fastest growing communities in the United States are located in the Gulf of Mexico and Atlantic coastal areas. For example, more than 80 percent of the population in Florida lives within 10 miles of the coast (Beach, 2002). Corresponding to these demographic and migration trends, there has been a dramatic increase in the costs associated with natural disasters. Now, more than ever, it is essential for planners and policy makers to appreciate the links between sustainability, livability and a healthy resiliency to natural and man-made disasters. Reducing vulnerability to natural disasters is an essential component of achieving sustainability.

The practices of hazard mitigation support general community objectives of economic vitality, social welfare, and environmental protection and conservation. Communities that actively pursue hazard mitigation planning by providing disaster-resistant housing, employment, transportation, and public services become more sustainable and robust. Reduction of the long-term risks associated with hazards can benefit communities and serve as a springboard for positive and creative change. Implementing a hazards mitigation planning process can be challenging; however, the long-term benefits are undeniable.

This practice guide is designed to help community planners and leaders enhance the livability of their communities by incorporating the principles of sustainable development into hazards mitigation. It begins with an introduction to the concepts of sustainability and the practices of hazards mitigation, followed by a discussion of how to link the two in application. The guide describes the planning process and most common techniques used by communities to implement sustainable hazards mitigation and reviews several federal programs that provide technical and financial assistance.

### **Concept Clarification: Sustainability**

In its most broad context, sustainable development “meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development Brundtland Commission, 1987). Three core principles express the underlying values of sustainability. The first principle promotes inter- and intra-generational equity; the second holds that access to adequate standards of living should be universal; and the third is grounded in the conviction that economics, ecology, and social equity are inseparable (Daly, 1990).

Essentially, the pursuit of sustainable development encompasses three domains: political, social, and economic. The expansion of each domain must develop, but not at the expense of either of the other two domains. A community seeking to improve its quality

of life through sustainable development will benefit from a political system that encourages citizen participation in all aspects of the planning and decision-making processes; an economic system that is self-reliant and has long-term productive capabilities; and a social system that facilitates cooperation and collaboration throughout the development process (Daly, 1990). To function harmoniously, each of these systems must respect the foundations of the others while encouraging innovation and flexibility.

Characteristics of sustainable communities include: efficient land use practices which emphasize open space planning by promoting greenways, parks, and landscaping; effective utilization of open space to prevent development from encroaching upon floodplains, active fault zones, and other hazard areas; redevelopment of underutilized urban areas to encourage infill and “brownfield” redevelopment; utilization of energy and resource conservation practices; prioritization of public transit and creation of mixed-use environments that reduce dependence on autos; and progressive action in support of an increased resilience to disasters (DESA, 2005).

### **Concept Clarification: Hazards Mitigation**

Mitigation is one of the four phases of the current emergency management approach in the United States. *Mitigation* is defined as, “any sustained action taken to reduce or eliminate long-term risk to life or property from a hazardous event” (Federal Emergency Management Association [FEMA], n.d). This cyclical process includes all preparedness, response, recovery, and prevention actions (Mileti, 1999).

*Preparedness* entails establishing a competent emergency response and management procedure prior to the hazard event so that, when disaster occurs, resources are accessible and distributed efficiently and effectively. This step involves vulnerability and risk analyses to identify potential hazards and the problems they might pose. Other aspects of preparedness include warning programs, shelters, training for response personnel, and maintenance of emergency supplies. The *response* stage refers to the activities directly before, during, and after the hazard event. These actions save lives, reduce property damage, and contribute to the general emergency response and management capabilities of the preparedness stage. Disaster *recovery* includes efforts to repair necessary communication and infrastructure systems and restore the status-quo. The first step in recovery is to conduct a damage assessment and prioritize immediate and long-term needs.

Hazard mitigation distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery. Although its stages are cyclical, mitigation is generally the final phase and includes any policies or activities intended to reduce future damages and losses (Mileti, 1999). It is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage—actions that produce successive benefits over time (FEMA, n.d.; Mileti, 1999). The best time to implement mitigation actions is before disasters occur. However, these actions are often made possible by postdisaster financial assistance and increased hazard awareness.

Mitigation activities vary depending on the community. Each hazard has a set of unique characteristics that can threaten the sustainability of an area. Measures to reduce flood damage include strengthening floodplain management regulations, identifying future opportunities for acquisition of flood prone properties, and prioritizing flood reduction mitigation measures. In earthquake prone areas, structural design standards that strengthen a building's ability to withstand ground shaking and soil liquefaction are utilized in conjunction with refined engineering standards to reduce landslide potential. Common measures to reduce the vulnerability of coastal areas to hurricanes discourage development in storm surge zones and enforce strict building code requirements to strengthen buildings against high wind damage.

### **A Sustainability Framework: Linking the Principles of Sustainability with Hazards Mitigation**

The first national and interdisciplinary endeavor to assess the nation's ability to withstand and respond to natural disasters was completed in 1975 at the Institute of Behavioral Sciences of the University of Colorado at Boulder. It introduced the use of mitigation and other preventive measures as a critical means of reducing the costs of natural hazards and encouraged the involvement of the social sciences in order to further understanding of the economic, social, and political effects of natural hazards. In the early 1990s, the hazards community began to call for a second assessment of the research on natural hazards, focusing on the increasing amount of dollar losses caused by natural disasters and sought to determine how best to establish disaster-resilient communities. The *Second National Assessment of Research on Natural Hazards* recommended a new research and policy agenda for the treatment of natural and related technological hazards in the United States. A complete list of references for the assessment can be found at [http://www.colorado.edu/hazards/publications/bibliography\\_disastersbydesign.html](http://www.colorado.edu/hazards/publications/bibliography_disastersbydesign.html) .

In *Disasters by Design*, Dennis Mileti, Senior Research Scientist of the Natural Hazards Research and Applications Information Center summarizes the findings of the 2<sup>nd</sup> assessment and finds that there is a clear need to merge the goals of sustainable communities and loss reduction activities. The risk of natural disaster is increased in areas with unsustainable development, and sustainable development is frustrated by the destructive environmental, economic, and social effects of disasters. Thus, efforts to help communities mitigate the effects of hazards in a sustainable manner should enhance overall sustainability and community resiliency (Mileti, 1999). This practice guide builds on the work of the *Second National Assessment of Research on Natural Hazards* as summarized by Mileti by providing case studies that illuminate his argument for linking sustainability and hazard mitigation.

As previously mentioned, the traditional indicators of a sustainable community are social, economic, and environmental health. A community's relative success in achieving sustainability reflects the extent to which the values underlying these indicators are satisfied. As an issue that contends with social, economic, and environmental factors,

disaster resistance should be considered one of the elements included in indicators of sustainability.

With regards to *social* viability in the face of hazard-related disasters, a community must balance the needs of its citizens for housing and access to basic public services and facilities. For instance, local leaders must weigh the competing needs of those who live in high-hazard areas and are less able to rebuild following a disaster against the needs of homeowners who have built in environmentally sensitive areas where rebuilding may not be in the public interest. Other significant social consequences of hazard-related disasters that contribute to the reduction of overall community sustainability including loss of security, severe stress and anxiety, diminished trust in government, and disruption of familiar environments and daily routines (DESA, 2005); FEMA, n.d.).

The *economic* vitality of a community is also directly affected by its level of disaster resistance. The three main objectives of community disaster recovery are to retain existing businesses, encourage new and continued economic development, and ensure that businesses are rebuilt in a sustainable fashion (Daly, 1990). Thus, a key element of a sustainable economy is reducing the vulnerability of local businesses and the economic infrastructure by keeping them out of high-risk areas or by disaster-proofing if there are no practicable alternatives for relocation.

*Environmental* sustainability preserves the integrity of biological and physical systems by limiting degradation of the environment and by preserving natural systems such as wetlands, floodplains, dunes, and active fault or landslide zones, all of which increase a community's resilience to natural hazards.

The Federal Emergency Management Agency (FEMA), whose role is to coordinate all national functions related to natural, technological, and civil hazards, has also noted the link between sustainability and hazard management (Drabek and Hoetmer, 1991). In *Planning for a Sustainable Future: The Link Between Hazard Mitigation and Livability*, FEMA claims that the increasing costs of natural disasters can be attributed to unsustainable development. It cites land development patterns over the past several decades, such as sprawling suburban communities; homes constructed with little protection against strong winds, flooding, wildfire, or other natural hazards; and development in high-hazard areas that satisfies an economic need or a locational preference with no consideration of long-term sustainability (FEMA, n.d.). FEMA describes sustainable development as actively linking policies for economic development, environmental health, resource protection, and social well-being. It encourages the incorporation of hazard mitigation strategies into other broad community goals, such as enhancing environmental, economic and social health. FEMA presents the objectives of sustainability and disaster-resistant, livable communities as inseparable (FEMA, n.d.).

Incorporating the principles of sustainability as well as those of hazards mitigation creates a sustainability framework to guide community planning and development. This framework consists of six basic components that establish six corresponding principles of sustainable hazards mitigation. These components include: environmental quality,

quality of life, disaster resiliency, economic vitality, inter- and intragenerational equity, and a participatory process (Mileti, 1999). With regards to environmental quality, the new paradigm seeks to preserve and maintain the environmental quality and to improve it whenever possible. Hazard mitigation efforts should simultaneously reduce a locality's vulnerability to future hazards damage while utilizing sound natural resource management and environmental preservation practices. Specific examples include restricting development in hazard-prone areas through land-use planning, and minimizing the exposure to hazards and environmental degradation due to urban sprawl by developing less vulnerable and less destructive transportation systems. An important principle of sustainable hazards mitigation is to preserve and maintain the general quality of life, improving it whenever possible. In regards to sustainability, this means that local communities need to determine the quality of life they deem desirable and take action to realize that goal for themselves and for future generations (Mileti, 1999).

Establishing a sense of community responsibility for and resiliency to natural hazards is another important principle of sustainable hazards mitigation. A certain degree of self-sufficiency is required if a locality is to endure a natural disaster with minimum loss and damage. This requires a conscious effort by all community members to be aware of environmental problems, common natural hazards, and environmental sustainability issues specific to their locale. By incorporating this awareness into development plans, sustainable hazards mitigation becomes a priority and resiliency becomes an attainable goal (Mileti, 1999). A viable local economy is another component of resiliency that demands a degree of self-sufficiency. A strong, diversified local economy is less likely to be thrown into upheaval by an extreme disaster than one dependent on a specialized industry whose productivity could be severely diminished by a natural hazard. Thus, fostering sustainable economies is a fundamental component of sustainable hazards mitigation (Mileti, 1999).

Confronting the multitude of political, social, and cultural barriers embedded in the capitalistic tradition is a daunting, but essential part of sustainable hazards mitigation. Local, regional, national, and international cooperation and coordination are necessary aspects of ensuring environmental quality and quality of life. While a certain degree of self-sufficiency and responsibility is important, the resiliency of local communities and their economies is also dependent on their relationships with other places. Therefore, a consensus building approach, initiated at a grass-roots level but ultimately bridging the global community, is an important principle of sustainable hazards mitigation. It should be noted that full consensus is not the objective; rather, it is a process where wide participation is sought among all stakeholders, generating ideas and information, and creating a sense of ownership and community are the goals (Mileti, 1999).

The principles of inter- and intragenerational equity are based on similar notions of continuity and community. *Intergenerational equity* refers to the responsibility of present generations not to exhaust natural resources and transfer unnecessary hazards to the extent that such actions compromise the ability of future generations to meet their own needs. With regards to the principle of consensus building, future generations are stakeholders in absentia and their welfare should be considered in any hazards

management decisions. *Intragenerational equity* refers to the fair distribution of environmental, technological, and economic resources across the world's present population. This means ensuring that these resources are used to make sure that certain groups are not placed at increased risk by living in areas or structures that are more vulnerable to or have higher exposure to natural hazards (Mileti, 1999).

### **Sustainable Hazards Mitigation Tools**

It should be noted that not all hazard mitigation techniques are sustainable. Some mitigation activities merely defer losses that will potentially be more devastating when they do occur, while others can result in short-term or cumulative environmental degradation (Mileti, 1999). The failed levee system in New Orleans is an example of postponed damage that resulted in enormous accrued losses. Environmental degradation from the destruction of coastal wetlands and the associated adverse environmental impacts of flood dams is also apparent in the wake of Hurricane Katrina. Not only do both instances negatively impact society, but they contribute to an increase in frequency and severity of hazard-related disasters (Mileti, 1999). There are, however, several sustainable mechanisms of hazard mitigation that can effectively reduce losses from hazards while minimizing social, economic, and environmental disruption. These techniques are derived from the traditional approach to hazards management; nonetheless, their potential contributions to the field of sustainable hazards management are significant (Mileti, 1999).

The primary mechanism for ensuring sustainable hazards mitigation is land-use planning and management. The broad application of this tool can incorporate the concepts of land-use planning, environmental protection, hazards mitigation, and sustainable development to reduce the vulnerability of communities to disasters, maintain the natural mitigative qualities of local ecosystems, and enhance the resiliency of the built environment (Mileti, 1999). Many land-use management measures exist that can be used to realize sustainable mitigation: building standards, development regulations, public policy, land acquisition, taxation, planning processes, and community outreach and information activities. Comprehensive local land-use plans are an effective means of linking together the various interests and providing guidelines for how each land-use management measure will be used to accomplish the community's sustainability goals.

There are eight components of a "long-range, comprehensive, sustainability-oriented plan" (Mileti, 1999, p.157): 1) hazard identification, 2) impact assessment, 3) estimation of potential loss, 4) carrying-capacity assessment for the local environment, 5) estimation of the maximum level for buildings and infrastructure for the locality, 6) estimation of local land and water needs, 7) assessment of local sustainability indicators, and 8) environmental impact statement (Mileti, 1999). The implementation of sustainable land-use management policies requires cooperation from many political, social, and economic interests. While the planning and execution of these programs occurs at the local level, they must be backed by mandates from the federal and state governments.

The use of building codes and standards is another tool of sustainable hazards mitigation that can greatly reduce the damages and losses from natural hazards. In the event of a disaster, the amount of human and financial loss sustained by a community is largely determined by the construction quality of its buildings and other structures. Thus, disaster-resistant construction is a critical element of resiliency (Mileti, 1999). The regulation and enforcement of such construction is achieved through building codes that dictate the structural requirements for buildings that help to ensure public safety and health. Standards are rules and conditions that apply to construction practices. Typically, they are classified as engineering, material and test standards. Building codes incorporate and specify the standards to which all construction projects must comply (Mileti, 1999).

In 1989, devastation from Hurricane Hugo created pressure in North Carolina for more stringent building codes to help buildings withstand high winds. As an example of mitigation, and to bolster itself against future disasters, Wilmington spent \$26 million on the Sweeney Water Plant. Funds were used to relocate the facility outside the floodplain, design the new facility to sustain 120 mph winds, and provide two 1,250 kW diesel generators to supply power for 2-3 days to ensure continued operation. The new system performed as expected following both Hurricane Fran in 1996 and Hurricane Floyd in 1999. According to local officials, if the old system had been in place and failed, the results would have been catastrophic, resulting in thousands of people without drinking water and sewage disposal for weeks (FEMA, n.d.).

Some localities retain the authority to design their own codes, but most states have enacted state-wide codes for reasons of uniformity and commerce. The administration and enforcement of building codes, however, is the responsibility of local governments. Most state codes can be found on the state's government website; specific information regarding the location of this information for states in EPA Region 4 can be found in the Appendix section.

The staffing and funding of building code professionals has been a challenge in the U.S. In a 1995 survey, many of these professionals reported that they lacked adequate resources to sufficiently manage the responsibilities of their local enforcement agency. Since that time, however, the Institute for Business and Home Safety has undertaken measures to improve national building code enforcement (Mileti, 1999).

While not technically regarded as a mitigation activity, insurance plays an important role in facilitating the adoption of mitigation measures. By quantifying risk and providing various financial incentives, the insurance industry has increased awareness about the threats of natural hazards and prompted individuals and communities to engage in loss reduction activities (Mileti, 1999). Additionally, there is a need for insurance companies to become involved in the building code development process. As an industry, insurance has the specialized knowledge and political clout to help create better, stricter codes and standards. The insurance industry also has the ability to limit the availability of certain kinds of insurance, which would induce property owners to consider mitigation more seriously (Mileti, 1999). For example, after Hurricane Andrew caused approximately \$16 billion in insured damage in 1992, the Tampa-based Institute for Business and Home

Safety was founded in Florida. The organization was created by the insurance industry to promote hazard resistant construction, maintenance and preparation practices (Sainz, 2007).

Prediction, forecast, and warning systems are additional mechanisms of sustainable hazards mitigation. While warning systems show great promise for loss reduction, the capacity of those in the U.S. is unevenly distributed and in need of much improvement. Warning systems in the U.S. are decentralized and spread throughout different levels of government and involve many organizations, both public and private. Furthermore, hazard-specific knowledge varies considerably with the type of hazard (Mileti, 1999). Integrating this complex web of knowledge and stakeholders is a difficult task. Nevertheless, prediction, forecast, and warning efforts have significantly reduced deaths and other losses in the U.S. With regards to sustainable hazards mitigation, long-term warnings and forecast have the most to contribute. Long-term systems could inform the local planning processes by identifying the risks faced by the community (Mileti, 1999).

### **The Sustainable Hazard Mitigation Planning Process**

The foundation of any disaster resistance effort is an effective and sustainable hazard mitigation planning process. The planning process identifies hazards that threaten a community, assesses vulnerability, and facilitates a consensus building approach to determine the most appropriate mitigation activities.

The classic planning approach (gathering information, setting goals, reviewing alternatives, and deciding which actions to take) anchors the following 10-step process, developed as part of FEMA's Project Impact (FEMA, n.d.), that identifies cost-effective, environmentally sound mitigation measures:

1. *Organize to prepare the plan.* Selecting the right person to lead the planning effort is important.
2. *Involve the public.* Emphasize participation of key stakeholders, including at-risk homeowners, business owners, managers of critical facilities, and technical staff.
3. *Coordinate with other agencies and organizations.* They can provide technical assistance and inform the community of relevant activities and programs that can support your efforts.
4. *Assess the hazard.* Identify the particular hazards affecting your community and the risks they pose to your community's critical infrastructure.
5. *Evaluate the problem.* Getting participants to agree on a problem statement is the first step in reaching consensus on solutions to the problem.
6. *Set goals.* Establish goals as positive and achievable statements that people can work towards.
7. *Review possible strategies and measures.* Include a range of hazard mitigation measures for consideration. While some measures may be quickly eliminated, others should be evaluated carefully to determine how they work as well as their costs and benefits.
8. *Draft an action plan.* Keep it brief. Include sections on how the plan was prepared, recommended mitigation actions, and a budget and schedule.

9. *Formally adopt the plan.* Gaining public acceptance is vital to reducing conflicts, building support for the recommendations, and getting the plan formally adopted. Keep the public informed and educated so they will readily accept the plan.
10. *Implement, evaluate, and revise the plan.* Develop procedures to measure progress, assess strengths and weaknesses, and decide on necessary changes.

The two main challenges to this process are: 1) public misunderstanding of risk, and 2) the common belief among citizens that their community will never experience a disaster or that the reoccurrence of a disaster is unlikely. Public awareness and public involvement are the most effective means of dealing with these issues. It is critical that community members are aware of their vulnerability to hazards. Involving all of the community's key interests builds a consensus regarding vulnerability, encourages a sense of ownership of the problem, and generates sustainable solutions (FEMA, n.d.).

There are several federal programs that can facilitate this 10 step process by providing technical and sometimes financial planning assistance to communities. These are:

*The Robert T. Stafford Disaster Relief and Emergency Assistance Act*

In the event of a disaster, local governments are responsible for undertaking immediate steps to warn and evacuate the public, alleviate suffering, and protect life and property. However, if they do not have adequate resources to respond to the situation and require additional help, communities may request emergency assistance from higher levels of government. State authorities would be notified first, but if the magnitude of the disaster is beyond state capabilities, the President may declare an "emergency" or a "major disaster" under the authority of The Stafford Act.

Such declarations result in the distribution of a wide range of federal aid to individuals and families, certain nonprofit organizations, and public agencies. The forms of assistance authorized by the Stafford Act include temporary housing, grants for personal uninsured needs of families and individuals, repair of public infrastructure, and emergency communications systems. Congress appropriates money for activities authorized by the Stafford Act to the Disaster Relief Fund (DRF), which is administered by the Federal Emergency Management Agency (FEMA) within the Department of Homeland Security (DHS) (Bea, 2006).

States, local governments, owners of certain private nonprofit facilities, individuals, and families are all eligible to receive the types of assistance authorized by the Stafford Act. However, not all persons or organizations affected by a catastrophe are eligible for Stafford Act assistance even if the President issues a declaration. Following a Presidential declaration, aid is provided according to need for assistance as it is determined by FEMA. For example, a family with adequate insurance and alternative housing options might not be considered eligible to receive financial aid. A local government that suffers damages to some facilities might not receive funds to rebuild infrastructure if the destruction does not necessitate assistance pursuant to FEMA regulations and guidelines. Certain nonprofit organizations (e.g., owners or operators of

educational or non-emergency health care facilities) may have to rely on Small Business Administration loans, not Stafford Act grants, to restore services (Bea, 2006).

The Stafford Act provides for a range of assistance programs. Two programs in particular are especially effective means of linking the objectives of hazards mitigation and sustainability.

1. Hazard Mitigation Planning: As a condition of receiving any federal disaster grant or loan funds under the Stafford Act, states are required to evaluate the impact of natural hazards within the area affected by the disaster and to take appropriate action to mitigate such hazards. FEMA requires states to prepare and implement a hazard mitigation plan.
2. Hazard Mitigation Grant Program (HMGP): HMGP combines the efforts of Federal, State, and local government – as well as the private sector – to end the cycle of repetitive disaster damage. These funds provide states and local governments with the incentive and capability to implement cost-effective, environmentally sound, and long-term mitigation measures that previously may not have been feasible. The primary goal of the program is to ensure that the opportunity to take critical mitigation measures to protect life and property from future disasters is not lost during the recovery and reconstruction following a disaster. Communities may apply for HMGP funding through their state, which assists in the preparation and prioritizing of the applications and the management of approved projects. FEMA can fund up to 75 percent of the eligible costs of approved projects.

#### National Flood Insurance Program (NFIP)

Communities participating in the NFIP agree to enforce floodplain management regulations in identified flood hazard areas. In return, citizens in these communities are eligible to purchase flood insurance that is not normally available through private insurance companies. Flood insurance may be purchased to cover structures (e.g., homes and businesses) as well as the contents of these buildings.

Due to a lack of awareness and/or misperceptions regarding the costs, only one in five U.S. homeowners living in flood hazard areas participates in the NFIP, so encouraging greater participation in the program is an excellent way for a community to facilitate recovery following floods. FEMA initiated a Community Rating System (CRS) to reward communities that exceed the NFIP's minimum floodplain management requirements. The CRS provides residents with an opportunity to qualify for lower flood insurance premiums.

Additionally, under the NFIP, Flood Mitigation Assistance Program (FMA) grants are provided to state and local governments for planning assistance and projects that reduce the risk of future flood damages, including elevating homes, conversion of property to open space, and minor drainage improvements. Funds are also available for

comprehensive watershed management planning projects which identify land use changes and prioritize recommendations to reduce impacts of future flooding.

To learn more about the NFIP, visit its official website at [www.floodsmart.gov](http://www.floodsmart.gov). This site provides basic facts about the program, directions on how to determine a community's flood risk, the role of the NFIP in the community, the first steps in estimating premiums, how to contact an NFIP agent, and other valuable NFIP-related resources.

#### *National Earthquake Hazards Reduction Program (NEHRP)*

In the United States, earthquakes have the greatest potential for casualties and damage from a natural hazard. The NEHRP is the federal government's approach to addressing these risks by coordinated efforts of four federal agencies: FEMA, the United States Geological Survey (USGS), the National Science Foundation (NSF), and the National Institute of Standards and Technology (NIST). For more information about the NEHRP, visit the official website at [www.nehrp.gov](http://www.nehrp.gov).

The NEHRP acknowledges that earthquakes are inevitable, but that earthquake-related damages are preventable. Program activities include basic and applied research; technology development and transfer; and training, education, and advocacy for seismic risk reduction measures. FEMA offers a range of grants and technical assistance programs to states to help increase awareness of earthquake hazards, foster plans, and implement mitigation actions to reduce seismic vulnerability.

#### *National Dam Safety Program (NDSP)*

There are more than 75,000 dams in the United States that serve as a critical part of the national infrastructure. Dams store water for crop irrigation and public water supplies, generate inexpensive and safe hydroelectric power, create recreational opportunities, and provide flood control. If they are not maintained properly, dams represent a significant risk and high costs to local communities. NDSP provides assistance through a grant program that helps states improve their dam safety. The NDSP is primarily administered through a partnership between the Association of State Dam Safety Officials (ASDSO) and FEMA. State-specific program information can be found at the ASDSO Web site, [www.damsafety.org](http://www.damsafety.org). Although state programs vary in the scope of their authority, program activities typically provide for the:

- evaluation of existing dams
- review of plans and specifications for dam construction and major repairs
- periodic inspections of construction on new and existing dams, and
- review and approval of Emergency Action Plans.

In addition, NDSP offers funds for research and training, monitors the state assistance program through its National Dam Safety Review Board, and funds the National Inventory of Dams that is conducted by United States Army Corps of Engineers. More information about the NDSP can be found at its official website, [www.fema.gov/plan/prevent/damfailure/ndsp.shtm](http://www.fema.gov/plan/prevent/damfailure/ndsp.shtm).

### *Project Impact: Building Disaster Resistant Communities Initiative*

While over 200 communities have been designated as Project Impact communities, it is not necessary to acquire a formal designation to adopt this approach. *The Project Impact Guidebook* and *The Community Tool Kit*, available through FEMA publications at no cost, provide directions on the initial steps to implement this initiative. *The Project Impact Guidebook* provides an overall description of the *Project Impact: Building Disaster Resistant Communities* initiative and directions on how to take the first steps toward building a disaster-resistant community, including forming partnerships, assessing risk, prioritizing needs, and communicating success to the community. *The Community Tool Kit* provides detailed information on how to achieve the four main steps described above and includes helpful implementation tips, checklists, and suggestions on how to achieve community goals (FEMA, n.d.). In addition, there is a Project Impact video that offers technical support and guidance on how to build community support and prevention and preparedness brochures.

Examples of hazard mitigation initiatives by Project Impact communities include: strengthening building codes to address natural hazards; enacting land use and zoning measures to discourage building in floodplains or other high risk areas; and retrofitting structures to better withstand hurricane-strength winds or seismic risk.

Project Impact funds have been used effectively in Shelby County, Tennessee, an area located within the New Madrid Seismic Zone. The water supply system that provides water to the area is owned by Memphis Light, Gas, and Water. The company has initiated a seismic retrofit project to protect its pumping station and enhance the survivability of the connections between the water distribution lines. Retrofit plans include reinforcement and anchorage of masonry walls; strengthening of steel frames; improved connection of concrete wall and roof, secured anchorage of pipes and valves, and bracing of pipelines; bracing of treatment and control equipment; and protection of an overhead crane. The estimated cost to replace the pumping station in the event of a large earthquake exceeds \$17 million. Each day the station is not in service costs an additional \$1.4 million. Total projected savings are expected to be \$112 million with a total project cost of \$968,800 (FEMA, n.d.).

### **Conclusion**

Complete prevention of natural disasters such as floods, tornadoes, earthquakes, and hurricanes is impossible; however, communities can reduce or even avoid the devastating impacts and rising costs associated with these events. This can be accomplished by planning for and implementing effective hazard mitigation measures before disasters strike and by ensuring that post-disaster recovery efforts incorporate suitable hazard mitigation measures. By adopting a sustainability framework which integrates the principles of sustainability with traditional hazards mitigation, communities can turn disaster prevention and recovery activities into community-wide planning endeavors that address long-term challenges.

Implementation of the programs discussed above will enhance communities' effort to include a sustainability framework in their hazard mitigation planning process. The Hazard Mitigation Planning objectives and the HMGP opportunities associated with the Stafford Act will enable communities already affected by disaster to end the cycle of repetitive disaster damage. Programs like NFIP, NEHRP, and NDSP provide incentives for communities to merge the goals of sustainable communities and loss reduction activities. These programs incorporate hazard mitigation strategies with other broad community goals, and in doing so, help to ensure communities' social viability, economic vitality, and environmental sustainability.

Two appendices are included with this practice guide. Appendix A includes brief summaries and information on how to access additional FEMA publications and other websites related to the field of sustainable hazards mitigation. Appendix B provides information on how to access state building code information for EPA Region Four states, as well as a website address with links to organizations, relevant industry topics, supplementary resources and guides related to the construction industry. Appendix B also provides contact information for EPA Region Four NFIP Regional offices.

## **Appendix A: Additional FEMA Publications & Related Websites**

The following publications, as well as many others, can be ordered from FEMA at 1-800-480-2520. In addition, some publications may be down-loaded directly from FEMA's website, [www.fema.gov/library](http://www.fema.gov/library).

**The Emergency Management Guide for Business and Industry**, FEMA, 1993, provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that companies can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a company's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions.

**HAZUS - FEMA's Standardized Risk Assessment Methodology**. FEMA has established a standardized risk assessment methodology, HAZUS, which is used to estimate potential losses from earthquakes. Flood and wind hazard modules are under development. FEMA will provide HAZUS software and additional resource documents at no cost. Minimum user requirements are MapInfo or ArcView GIS software.

**Seismic Considerations for Communities at Risk (FEMA Publication 83)**. This publication provides interested individuals and community decision makers with information for assessing seismic risk and making informed decisions about seismic safety in their communities and in determining what should be done to mitigate the risk. Also included are considerations when deciding whether and how to take action and suggestions for stimulating community action.

**Economic Impact Assessments**. As a result of Hurricane Floyd in September 1999, economic impact assessments were prepared for FEMA by the Economic Development Administration for the states of Virginia, North Carolina, and New Jersey. The objective of these economic impact assessments was to provide recommendations in the recovery process to aid in making decisions and contribute to long-range mitigation initiatives and strategic planning.

**Long-Term Recovery Action Plans**. Long-term recovery action plans were prepared due to flooding and the effects of past flood mitigation measures in Georgia, Alabama, and Florida. These plans emphasize mitigation opportunities as the core to recovery efforts.

**A Guide to Federal Aid in Disasters**, FEMA 262, June 1997. When disasters exceed the capabilities of State and local governments, the President's disaster assistance program (administered by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each of the various programs of assistance that may be available.

**Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments**, FEMA, DAP-12, September 1990. This handbook explains the basic

concepts of hazard mitigation, and shows State and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

#### Useful Websites

The following are useful websites that provide access to valuable planning resources for communities interested in sustainable initiatives:

<http://fema.gov>: website of the Federal Emergency Management Agency that includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures

<http://planning.org>: website of the American Planning Association, a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives

<http://ibhs.org>: website of the Institute for Business & Home Safety, an initiative of the insurance industry to reduce deaths, injuries and property damage, economic losses and human suffering caused by natural disaster; provides information on natural hazards, community land use and ways to protect property from damage

<http://livablecommunities.gov>: website of the Livable Communities Initiative and the White House Task Force on Livable Communities whose goal is to assist Federal agencies' efforts to help communities grow in ways that ensure a high quality of life and strong, sustainable economic growth

<http://sustainable.doe.gov/freshstart>: website for Operation Fresh Start; describes resources available to help individuals and communities incorporate sustainable redevelopment principles and environmental technologies into their recovery planning process

<http://usmayors.org/uscm/sustainable/>: website for the Joint Center for Sustainable Communities, a collaborative effort between the U.S. Conference of Mayors (USCM) and the National Association of Counties (NACo) whose mission is to provide a forum for cities and counties to work together to develop long-term policies and programs; provides local elected officials technical assistance, training, sustainable development literature and materials, and funding toward collaborative planning

#### **Appendix B: EPA Region Four State Building Code Information & NFIP Regional Office Information**

**Alabama:** Alabama Building Commission <http://www.bc.state.al.us/>

**Florida:** Department of Community Affairs, Building Code Information System  
[www.floridabuilding.org](http://www.floridabuilding.org)

**Georgia:** Department of Community Affairs [www.dca.state.ga.us](http://www.dca.state.ga.us)

**Kentucky:** Office of Housing, Building and Construction <http://www.ohbc.ky.gov/bce/>

**Mississippi:** There is no state-mandated building code for any building or occupancy classification in the state of Mississippi. It is up to local jurisdictions to adopt and enforce building codes. Government links to state agencies and city and county governments can be found at [www.ms.gov](http://www.ms.gov).

**North Carolina:** Department of Administration, State Construction Office  
[www.interscope2.doa.state.nc.us/](http://www.interscope2.doa.state.nc.us/)

**South Carolina:** Building Code Council [www.llr.state.sc.us/pol/bcc/](http://www.llr.state.sc.us/pol/bcc/)

**Tennessee:** There is no state-mandated building code for any building or occupancy classification in the state of Tennessee. It is up to local jurisdictions to adopt and enforce building codes. Government links to state agencies and city and county governments can be found at [www.state.tn.us](http://www.state.tn.us) and at the Office of the State Architect, the official site of the State Building Commission, which appoints the State Architect as its chief staff officer and oversees all building construction for the state government, <http://tennessee.gov/finance/rpa/archit.htm>.

An additional resource that provides a wealth of information regarding organizations, relevant industry topics, supplementary resources and guides related to the construction industry can be found at <http://www.constructionweblinks.com/index.html>. This website is sponsored by Thelen Reid Brown Raysman & Steiner LLP and offers state-specific information.

#### EPA Region IV NFIP Regional Offices

Atlanta Office:

P.O. Box 2706

Suwanee, GA 30024-0984

(770) 887-6865

Fax: (770) 887-6878

Tampa Office:

P.O. Box 1046

Zephyrhills, FL 33539-1046

(813) 779-9642

Fax: (813) 779-3085

North Carolina Office:

P.O. Box 670

Belmont, NC 28012-0670

(704) 922-6925

Fax: (704) 922-6967

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