Including Building Codes in the National Flood Insurance Program

Fiscal Year 2013 Report to Congress

Impact Study for Biggert-Waters Flood Insurance Reform Act of 2012

Homeland Security

Department of Homeland Security
500 C Street, SW
Washington, DC 20472

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Foreword from the FEMA Administrator

October 21, 2013

I am pleased to present the following report, "Including Building Codes in the National Flood Insurance Program."

The Federal Emergency Management Agency prepared this document in response to Section 100235, *Biggert-Waters Flood Insurance Reform Act of 2012* (HR 4348) Report on Inclusion of Building Codes in National Flood Insurance Program. The report describes the impact, effectiveness, and feasibility of including widely used and nationally recognized building codes as part of the Federal Emergency Management Agency National Flood Insurance Program floodplain management criteria.

Pursuant to congressional requirements, the report is being provided to the following Members of Congress:

The Honorable Tim Johnson
Chairman, Senate Committee on Banking, Housing, and Urban Affairs

The Honorable Michael D. Crapo
Ranking Member, Senate Committee on Banking, Housing, and Urban Affairs

The Honorable Robert Menendez
Chairman, Senate Subcommittee on Housing, Transportation and Community

The Honorable Jeb Hensarling
Chairman, House Committee on Financial Services

The Honorable Maxine Waters
Ranking Member, House Committee on Financial Services

The Honorable Randy Neugebauer
Chairman, House Subcommittee on Housing and Insurance Committee on Financial Services

The Honorable Michael E. Capuano
Ranking Member, House Subcommittee on Housing and Insurance Committee on Financial Services

Inquiries related to this report may be directed to me at (202) 646-3900 or to the Department's Deputy Chief Financial Officer, Peggy Sherry, at (202) 447-5751.

Sincerely,

Craig W. Fugate
Administrator
Federal Emergency Management Agency

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Executive Summary

The purpose of this report is to present findings of the impact, effectiveness, and feasibility of including widely used and nationally recognized building codes as part of the Department of Homeland Security Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) floodplain management criteria in response to Section 100235, Report on Inclusion of Building Codes in Floodplain Management Criteria, of the *Biggert-Waters Flood Insurance Reform Act of 2012* (BW12) (P.L. 112-123). This report provides findings of the regulatory, financial, and economic impacts that would likely occur to homeowners and government entities if it were adopted and the feasibility and effectiveness in reducing flood damage in the future.

For the purposes of this evaluation, the widely used and nationally recognized building codes are collectively referred to as the I-codes. FEMA applied the following four research methods to examine the impacts of Section 100235 of BW12:

1. Analysis of existing program data, such as the NFIP, building code, and building inventory databases to identify those states and communities that do not mandate the adoption of building codes. This analysis was conducted because it was determined that these entities would likely be the most impacted by this legislative change.

2. Empirical analysis or reviews of prior studies conducted by researchers, non-profit organizations, research institutes, and government agencies to evaluate their relevance and validity in relationship to current knowledge. There have been a number of prior studies that touch on aspects of this impact assessment, but no prior studies were identified that directly address the scope of this impact assessment.

3. Development and evaluation of various scenarios to illustrate costs and approaches of providing building code services, and other cost impacts.

4. Outcomes of a working group convened with subject matter expert to obtain opinions, with follow-up queries with participants to clarify findings supporting preparation of this assessment.

There are eight evaluation areas set by Section 100235 of BW12. Each area is described in this report and includes findings for each section along with supporting information and discussions. There are a total of 31 findings (*see* also attached Appendix G, Table G-1: Summary of Findings). The major findings, based on estimated scale of impact, are presented here:

1. The overall impacts of including building code as part of the NFIP would be positive in helping to reduce physical flood losses and other hazard losses, which would in turn positively affect the land use planning and regulatory climate. Current model building codes, such as the I-codes, have flood provisions that are consistent with NFIP requirements for buildings and structures, and are effective in reducing flood-related damage because of the specific mitigation provisions required for compliance.

2. Most NFIP communities already administer building codes based on the I-codes. For communities that have already adopted building codes, the impact of including codes into the NFIP would be negligible. Twenty-two states mandate local enforcement of statewide codes and 28 states have partial or complete code adoption and enforcement between the state and local levels.

3. NFIP communities that currently do not have building codes would be more affected by inclusion of codes into the NFIP. These communities may incur minor increased initial costs as property owners invest in building code-compliant structures, and as communities establish building departments to perform permitting and inspection. Benefits of these actions and investments are abundant, and include: generally increased property values, reduced losses during flood and other hazard events which reduce insurance rates over a 5- to 10-year period, and a more actuarially sound NFIP and insurance industry.

4. The most significant benefits would likely arise from the required added elevation above flood levels (freeboard) for dwellings in certain locations (such as Coastal A Zones). Enhanced code compliance by builders, and improved enforcement of NFIP flood provisions would occur because of the statutory enforcement authority of building officials.

5. Insurance losses would be reduced for the properties required to comply with building codes because those properties would sustain less damage. The reduction of losses would lower actuarially rated insurance premiums for those structures, which in turn would make insurance more affordable and attract a broader participant pool, further enhancing soundness and reducing subsidy needs of the NFIP.

6. Enforcing building codes as part of the NFIP would only affect new structures and substantially damaged or substantially improved structures required to be brought into compliance with the requirements for new structures.

7. The financial and regulatory impacts on rural communities and Indian reservations that do not already enforce building codes or have adopted codes that are substantially out of date may require additional resources for enforcement, such as communities where significant growth occurs. As with large communities, the impact on rural communities and the Indian reservations that already administer current building codes would be negligible.

Including Building Codes in the National Flood Insurance Program

January 2013

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I. Legislative Language

As a requirement of Section 100235 of the *Biggert-Waters Flood Insurance Reform Act of 2012* (BW12) (P.L 112-123), which was signed by the President on July 6, 2012, the Department of Homeland Security Federal Emergency Management Agency (FEMA) is tasked to conduct a study and submit a report to Congress by January 6, 2013. The report is to assess the impact, effectiveness, and feasibility of amending Section 1361 of the *National Flood Insurance Act of 1968* (NFIA) (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria. Prior to joint passage of H.R. 4348, the House passed H.R. 1309, which contained Section 30 (formerly Section 25), a provision nearly identical to Section 100235. On June 9, 2011, the House Committee on Financial Services submitted House Committee Report 112-102 to the Whole House, including report language on Section 25. The final version of H.R. 1309 was passed on July 12, 2011 and post-dates the June 9, 2011 Committee Report.

As stated in Section 100235 of the BW12, Report on Inclusion of Building Codes in Floodplain Management Criteria:

> Not later than 6 months after the date of enactment of this Act, the Administrator of the Federal Emergency Management Agency shall conduct a study and submit a report to the Committee on Banking, Housing, and Urban Affairs of the Senate and the Committee on Financial Services of the House of Representatives regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C.4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine—
>
> (1) the regulatory, financial, and economic impacts of such a building code requirement on homeowners, States and local communities, local land use policies, and the Federal Emergency Management Agency;
>
> (2) the resources required of State and local communities to administer and enforce such a building code requirement;
>
> (3) the effectiveness of such a building code requirement in reducing flood-related damage to buildings and contents;
>
> (4) the impact of such a building code requirement on the actuarial soundness of the National Flood Insurance Program;
>
> (5) the effectiveness of nationally recognized codes in allowing innovative materials and systems for flood-resistant construction;
>
> (6) the feasibility and effectiveness of providing an incentive in lower premium rates for flood insurance coverage under such Act for structures meeting whichever of such widely used and nationally recognized building codes or any applicable local building codes provides greater protection from flood damage;

(7) the impact of such a building code requirement on rural communities with different building code challenges than urban communities; and

(8) the impact of such a building code requirement on Indian reservations.

As stated in House Committee Report 112-102, Section 25, at 43:

> This Section directs FEMA to study the impact, effectiveness and feasibility of including widely used and nationally recognized building codes as part of its floodplain management criteria and report its findings to Congress within 18 months. It is the intent of this provision that FEMA would examine only the use of the International Building code and/or International Residential Code, which contain relevant provisions covering flood plain management and are consistent with the current NFIP. Such "impact" studies, including those designed to examine building code requirements in rural communities and on Indian reservations, must address cost impacts, including upfront costs to consumers for buildings covered by such codes, and include in the "feasibility and effectiveness" assessment of the use of "innovative materials and systems for flood resistant construction."
>
> The report must include language specifying that FEMA is required to abide by the standard regulatory process in considering the including and application of building codes in these criteria. This section does not authorize FEMA to establish regulatory guidance that may be used in any enforcement action brought by the Agency.

II. Background

A. National Flood Insurance Program and Building Codes

The National Flood Insurance Program (NFIP) reduces building damage and other community losses during flood events through community adoption and enforcement of its requirements. FEMA has long known that building codes also improve building performance during flood events. FEMA is currently evaluating the losses that have been avoided in communities that adopt building codes and have experienced a flood event. Appendix A-1 contains a brief summary of the purposes and an overview of the NFIP and the NFIP requirements for buildings in special flood hazard areas (SFHAs). It also contains an introduction to the International Code Series (I-Codes) and briefly describes the relationship between the NFIP and the I-Codes.

B. Key Terms and Assumptions

For the purpose of this report, the following terms are used:

***Community*:** Community as defined in NFIP regulations at 44 CFR 59.1: "Community means any State or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or Alaska Native village or authorized native organization, which has authority to adopt and enforce flood plain management regulations for the areas within its jurisdiction." Communities may be counties, parishes, boroughs, cities, towns, townships, villages, and other terms used to describe political subdivisions of states.

Participating in the NFIP: Communities that elect to adopt and enforce NFIP-consistent regulations and Flood Insurance Rate Maps (FIRMs) are referred to as "participating in the NFIP." FEMA produces FIRMs to show special flood hazard areas that are designated as flood zones (*see* text box).

Actuarial Soundness: When insurance premium rates offset all the expected value of all future costs associated with the sale of each insurance policy.

***NFIP Criteria*:** NFIP criteria include both statutes and regulations. The BW12 requirement for the inclusion of building codes into the NFIP criteria is referred to as "including building codes in the NFIP."

***Substantial Improvement*:** Substantial improvement is any reconstruction, rehabilitation, addition, or other improvement of a building, the cost of which equals or exceeds 50 percent of the building's pre-improvement market value. When repairs and improvements are made simultaneously, all costs are totaled and used in the determination. (FEMA, 2010). *See* 44 CFR 59.1.

Substantial damage: Substantial damage is damage of any origin where the cost to restore a damaged building to its pre-damage condition equals or exceeds 50 percent of the building's market value before the damage occurred. *See* 44 CFR 59.1.

***Freeboard*:** Freeboard is a factor of safety that refers to additional height above the minimum NFIP-required level of protection for buildings in flood hazard areas.

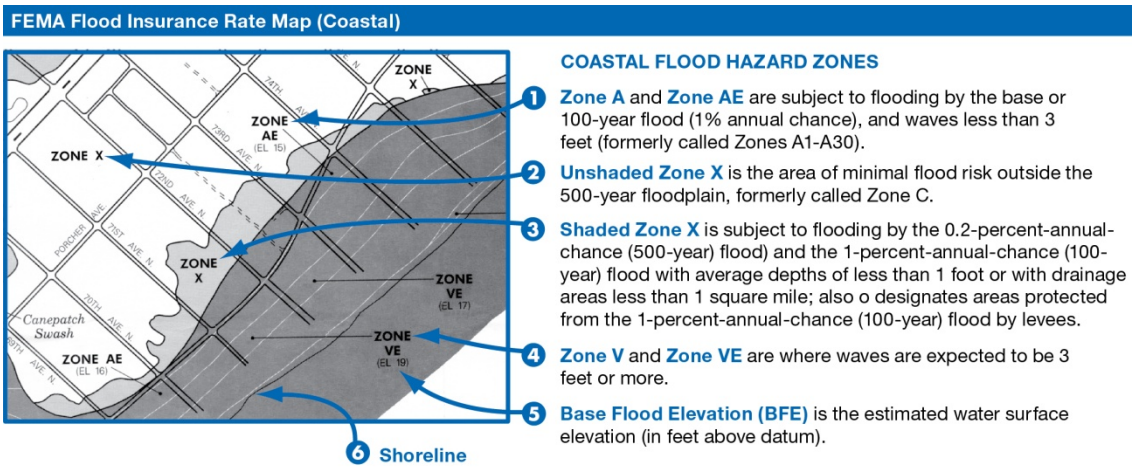
Flood Zones

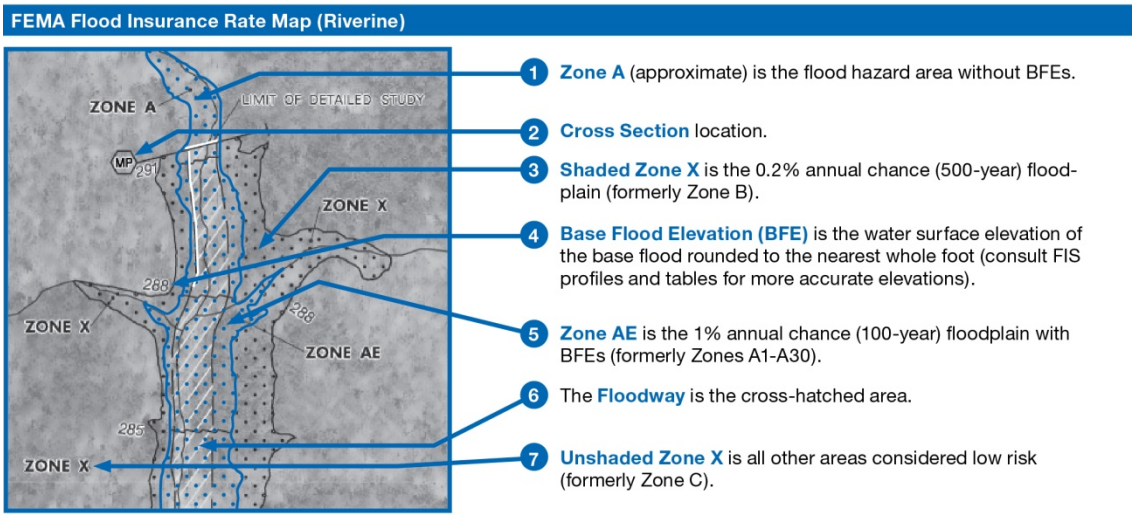
Zone A identifies areas of special flood hazard subject to flooding associated with the 1- percent-annual-chance flood event in riverine areas and in coastal areas not subject to high velocity wave action.

Zone V identifies those portions of special flood hazard areas along open coasts that are subject to high velocity wave action from storms or seismic sources. Also called "coastal high hazard areas," Zone V areas are subject to additional hazards associated with storm wave heights that are predicted to be 3 feet or greater during 1-percent-annual-chance flood conditions.

Shaded Zone X identifies areas subject to flooding by the 0.2-percent-annual-chance (500-year) flood); areas subject to flooding by the 1-percent-annual-chance (100-year) flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected from the 1-percent-annual-chance (100-year) flood by levees.

Unshaded Zone X identifies areas of minimal flood risk that are outside the 0.2-percent annual chance floodplain (500 year floodplain).





***Coastal A Zone*:** Coastal A Zone is the area within a special flood hazard area, landward of a coastal high hazard area or landward of an open coast without mapped coastal high hazard areas.

In a Coastal A Zone, the principal source of flooding is from coastal sources including storm surges, seiches, or tsunamis. During the base flood conditions (defined as the 1-percent-annual-chance flood event, also known as the 100-year flood event), the potential for breaking wave heights is at least 1.5 feet.

Widely Used and Nationally Recognized Codes: This study assumes widely used and nationally recognized codes to be the International Building Code (IBC), International Residential Code (IRC), and International Existing Building Code (IEBC), collectively referred to as the I-Codes. The I-Codes are developed and maintained by the International Code Council, Inc. (ICC).

- **International Building Code.** The provisions of the IBC apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures. The IBC does not apply to dwellings within the scope of the IRC.

- **International Residential Code for One- and Two-Family Dwellings**. The provisions of the IRC apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one– and two–family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures.

- **International Existing Building Code.** The provisions of the IEBC apply to the repair, alteration, change of occupancy, addition, and relocation of existing buildings.

Homeowners, Property Owners, and Properties: "Homeowners" refers to owners of residential properties. In its broadest sense, it is interpreted to mean property owners to encompass the owners of all properties, regardless of use (residential, governmental, commercial, and industrial). The term "properties" means those parcels of land that are vacant with the potential to be developed, and those parcels of land that are developed with existing buildings.

C. Report Preparation

This report represents the culmination of a study designed to be highly collaborative and result in a comprehensive look at the impacts, effectiveness, and feasibility of amending Section 1361. This report is not intended as a consensus document and does not provide recommendations. Rather, it provides an assessment of potential impacts based on existing studies, expert opinions, and limited supporting data and analysis. To the extent possible, the report identifies the impacts and the effectiveness and feasibility of the eight determination areas defined in BW12, Section 100235.

FEMA applied the following four research methods to examine the impacts:

1. Analysis of existing program data, such as the NFIP, building code, and building inventory databases to identify those states and communities that do not mandate the adoption of building codes. This analysis was conducted because it was determined that these entities would likely be the most impacted by this legislative change.

2. Empirical analysis or reviews of prior studies conducted by researchers, non-profit organizations, research institutes, and government agencies to evaluate their relevance and validity in relationship to current knowledge. There have been a number of prior studies that touch on aspects of this impact assessment, but no prior studies were identified that directly address the scope of this impact assessment.

3. Presentation of scenarios to illustrate costs and approaches of providing building code services, and other cost impacts.

4. Outcomes of a working group convened with subject matter expert to obtain opinions. Follow-up queries were performed to support the preparation of this impact assessment.

An important element of report preparation was an intensive one-day working group, held on September 28, 2012, which brought together subject matter experts (*see* Appendix A for a list) from:

- FEMA Building Science Branch, Grants Data Analysis and Tools Branch, Grants Implementation Branch, Floodplain Management Branch, Office of Chief Council, and the NFIP;

- Industry associations; and

- Subject matter experts through the FEMA Technical Assistance Research Contract.

Because the working group involved participation by outside, non-federal agency individuals and industry representatives, and FEMA contractor staff, it was performed in compliance with the *Federal Advisory Committee Act of 1972*, as amended (5 U.S.C. Appendix 2). Special care was given to ensure all participants clearly understood the exceptions to the *Federal Advisory Committee Act of 1972* upon which FEMA carried out the working group. For example, no collective advice or consensus voting was performed. The working group focused on sharing individual viewpoints and opinions, with a concerted effort to facilitate meaningful, relevant exchange of technical and procedural information. A list of working group attendees, along with questions posed in a facilitated process to elicit responses, are included as Appendix A.2.

D. Report Organization

This report is organized by the eight determination areas described in BW12, Section 100235. For each determination area (identified as topics), the purpose, context and findings are provided at the beginning of the report section followed by discussion, including supporting data, analysis references and examples. Future needs, which address data gaps required to better understand the impacts associated with each determination area, are provided separately in Section XI of the report. A summary of key findings (*see* Section XII of this report) and reference and resource list (*see* Section XIII) conclude the report.

Additional details are provided in the appendices, which provide contextual information used by the working group participants during their meeting and in preparing this report.

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III. Topic 1: Regulatory, Financial, and Economic Impacts of Including Building Codes in Floodplain Management Criteria

A. Purpose and Context

Purpose: This section describes the regulatory, financial, and economic impacts of including building codes in the NFIP, to homeowners, states, local communities, land use polices, and FEMA. Topic 1 is broad in scope and reflects elements also addressed in Topics 2 through 8.

Context: Regulatory impacts are usually addressed at the federal, state, and local levels, while economic and financial impacts may be felt by all the stakeholders identified in the purpose statement. For this report, financial impacts refer to personal, corporate, local, state, and federal financial needs of the entity. Economic impacts refer to supply and demand market interactions on a larger scale.

BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria

… Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…

1) the regulatory, financial, and economic impacts of such a building code requirement on homeowners, States and local communities, local land use policies, and the Federal Emergency Management Agency;…

Some of the impacts are associated with the technical provisions of the codes, while others are influenced by administrative enforcement of the codes or by social and cultural responses to use using the codes. More specific impacts associated with Topics 2 through 8 appear in those sections.

B. Findings

The following presents regulatory findings followed by financial and economic findings.

i. Regulatory Findings

Finding #1. Current model building codes have flood provisions that are consistent with NFIP requirements for buildings and structures. Appendix B.3 includes a checklist comparing the flood provisions of the codes with NFIP provisions. Including widely used building codes in the NFIP would have an overall positive effect in reducing losses and creating improved regulatory and use practices:

- The parts of State model floodplain management ordinances that address building and structures would be harmonized with codes, reducing duplication.
- The level of protection for critical facilities would be improved by compliance with code-adopted risk categories.

- State-owned buildings would be subject to the code, obviating the need for alternative mechanisms to ensure compliance with the NFIP.

- Communities that do not participate in the NFIP would still be required to enforce code provisions where those jurisdictions are required by state or self-imposed adoption provisions.

- Local enforcement and land use decisions would improve through administration of building codes.

- Model codes would become a national standard of practice for architects and engineers.

- The required adoption of the codes would include provisions beyond flooding. Buildings would be designed and built to resist many effects of prevalent hazards, increasing resistance to each individual hazard.

Finding #2. Any potential rulemaking involving the inclusion of a nationally recognized building code standard into the NFIP criteria would require compliance with all appropriate and relevant requirements. At the federal level, rulemaking involves satisfying numerous statutory and Executive Order requirements. Eight important considerations are identified here, but it is noted that there are other statutory, Executive Order, and other requirements that come into play during the rulemaking and implementation processes. At a minimum, requirements would include:

- Executive Order 11988, Floodplain Management, 42 *Fed. Reg.* 26951 (May 24, 1977)

- Executive Order 12866, Regulatory Planning and Review, 58 *Fed. Reg.* 51735 (September 30, 1993)

- *Regulatory Flexibility Act of 1980*, as amended (5 U.S.C. §§ 601–612)

- *Unfunded Mandates Reform Act of 1995,* as amended (2 U.S.C. §§ 1501 et seq.)

- *National Environmental Policy Act of 1969,* as amended (42 U.S.C. §§ 4321–4327)

- Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 65 *Fed. Reg.* 67249 (November 6, 2000)

- Executive Order 13132, Federalism, 64 *Fed. Reg.* 43255 (August 10, 1999)

- Office of Management and Budget (OMB) Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities (February 10, 1998)

ii. Financial and Economic Findings

Finding #3. The majority (approximately 70 percent) of NFIP communities currently enforce building codes with flood provisions based on the model I-Codes, so the net financial and

economic impact of including building codes in the NFIP would likely be relatively small in those communities. The statutory enforcement authority of the building official, however, would improve the level of enforcement attained compared to when floodplain management ordinances are administered by an office or agency other than the building department.

Finding #4. Communities that participate in the NFIP and have not adopted current I-Codes would be affected by the inclusion of the codes in the NFIP. The primary impact on communities that have not adopted I-Codes is that they would be required to adopt the codes and create a system to enforce them. Some costs associated with administering building codes may be reimbursable with federal dollars (such as environmental review costs) and other costs may be covered by permit fees or absorbed within the current local government budgets. It is expected that provisions would be established so that some small communities with limited development can be addressed on an individual basis.

Finding #5. Over the long-term, the relatively small additional upfront investment in code-compliant hazard-resistant building construction would result in both direct and indirect economic benefits (American Institutes for Research, 2006). Benefits observed to offset these upfront costs include avoided damage from flood and other hazards, as well as overall improved building performance and value. Additional benefits may include reduced cost of insurance and other indirect economic benefits such as uniformity of code requirements from jurisdiction to jurisdiction. This uniformity creates savings because designers, developers, builders, material manufacturers, and building officials are able to develop more efficient means and methods, ultimately resulting in cost savings.

Finding #6. There is a small risk that enforcing building codes may have a short-term negative economic impact on land values and increased costs to homeowners in some locations. It is anticipated that over an extended time frame, this impact would be negligible. Additional studies would be required to determine when certain effects are positive or negative.

Finding #7. Implementation could result in significant financial impacts for FEMA and other federal agencies. Communities that do not currently maintain modern building codes can expect to incur greater disaster damage than in other jurisdictions that do maintain modern codes. With this increased level of disaster damage, a greater strain is placed on federal disaster assistance programs and FEMA's Disaster Relief Fund (DRF). By including a code requirement as part of the NFIP, it is possible that more communities will adopt these codes which could reduce future disaster damages. In turn, this would reduce the demand for federal disaster assistance programs and reduce the strain on the Disaster Relief Fund. These impacts will grow over time as more communities adopt modern build codes and the building stock is modernized. By contrast, the communities who already have codes (a significant portion nationwide as identified in Appendix B) will produce a minimal incremental benefit to the DRF because the reduced demand for assistance has already being realized. It should also be noted that the inclusion of building codes in the NFIP would give FEMA a new mission that requires specific capabilities and resources for a national oversight role.

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C. Discussion

The regulatory, financial, and regulatory impacts and requirements of including the building codes in the NFIP are described in this section, including benefits, required regulatory reviews, construction costs, community land use impacts, and financial impacts to FEMA.

i. Regulatory Impacts

(a) Benefits of Including Building Codes in the NFIP

State model floodplain management ordinances would be harmonized with codes

Existing variability of state model floodplain management ordinances that meet NFIP minimum requirements would need to be harmonized with I-Codes. The existing NFIP requirements will continue to address some community issues outside the scope of the I-Codes (ICC, 2008). Implementation would be facilitated by completion of the current draft FEMA model floodplain management ordinance which is explicitly coordinated with the I-Codes.

FEMA and state review of local requirements would be simplified

The level of effort necessary for the 700 to 800 annual reviews of local ordinances would be reduced because the building code provisions are deemed consistent with the NFIP requirements for buildings and structures. The FEMA and State reviews could then focus on companion ordinances or Appendix G of the IBC (*see* Appendix B.1) to ensure that all other requirements of the NFIP are satisfied. This would simplify the responsibility of State and FEMA staff to review local regulations each time a Community Assistance Visit is conducted or a flood study or map is revised.

Level of protection for critical facilities would be improved by compliance with code-adopted risk categories

Buildings that serve essential public purposes would be better protected because of the more explicit and specific provisions, by building types, in the codes. The NFIP requirements are not as specific as the building codes in defining critical facilities,[1] such as hospitals, that are vital to a community's disaster resilience. Only if Federal funding is provided for planning, design, and construction of new critical facilities, or for repair of existing critical facilities, is the decision-making process set forth in Executive Order 11988 required; this requirement may result in decisions to either avoid locating such facilities in flood hazard areas, or to require such facilities to be protected to the 0.2-percent-annual-chance (or 500-year) flood level (*see* Appendix A.3).

The IBC requires each building and structure to be assigned a Structure or Risk Category from I to IV based upon occupancy and importance of use, with Category III and Category IV for

[1] Critical and essential facilities are buildings that are occupied by uses and services necessary for emergency response and recovery, and those that pose a substantial risk to the community at large in the event of failure, disruption of function, or damage by flooding, including hospitals, fire and police stations, emergency shelters, emergency operations centers, power plants, water and sewer facilities, communication towers, electrical substations, fuel and water tanks, and buildings that contain toxic or explosive substances.

essential critical facilities requiring higher levels of protection.[2] Federal agencies would continue to apply the process required by Executive Order 11988 to projects supported with federal funds that involve critical actions. Any buildings included in such projects would comply with the code requirements as a function of the building's importance or category assigned under the IBC.

State-owned buildings would be subject to the code, obviating the need for alternative mechanisms to ensure compliance with the NFIP

States that currently have mechanisms other than building codes to ensure that state-owned buildings comply with NFIP requirements would rely on the flood provisions of the codes to satisfy the state's commitment as an NFIP community (*see* 44 CFR § 60.25(9)).

Communities that do not participate in the NFIP might still enforce flood provisions of the code

Nearly 24,000 communities have been identified by FEMA as having some degree of flood risk, of which 91 percent (21,834) participate in the NFIP.[3] Of the total that participate, more than half (12,929) are in states that mandate enforcement of building codes by all communities and the remainder (9,654) are in states that do not mandate code enforcement by all communities (*see* Appendix B.2, Table B.2-1 and Table B.2-2).

Of the nearly 24,000 flood-prone communities, nine percent (2,153) elect to not participate in the NFIP.[4] Based on data from several sources described in Appendix B.2, the majority of non-participating communities are in states that do not require all communities to enforce building codes. Of the remaining non-participating communities, just 746 are in states that require all communities to enforce building codes; these communities may still be required to enforce the flood provisions of the state-mandated building codes. An unknown number of non-participating communities in states that do not require all communities to enforce codes may elect to adopt and enforce codes. All of these communities may still be required to enforce the flood provisions of the code, although this has not been subject to a legal test.

Local enforcement and land use decisions would improve through building code administration

Anecdotal reports by FEMA, some states, and subject matter expert opinion expressed in the working group affirmed that compliance by builders and enforcement by communities of the NFIP building standards can improve when the building codes contain flood provisions because of the more dominant statutory nature and culture of enforcement in building departments. Guiding development to less hazard-prone areas is one of the objectives established by Congress for the NFIP. Local planning, land use, and zoning requirements are satisfied apart from building codes, but would be strengthened by linkage with the codes.

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[2] See "Highlights of ASCE 24-05" for the Structure Category table found in the 2006 and 2009 editions of the IBC.

[3] NFIP Community Status Book (Nation), accessed November 14, 2012, http://www.fema.gov/cis/nation.pdf.

[4] Includes communities that elect to participate, but that are temporarily suspended for missing adoption of new Flood Insurance Studies and flood maps.

Model codes would become the national standard of practice for architects and engineers

Even in states and communities that do not adopt and enforce building codes, most architects and engineers charged with designing many types of buildings elect to base designs on the I-Codes. The codes are becoming the accepted standard of practice and provide the minimum standard of care for professional liability protection. Having a national standard of practice may encourage more uniform adoption with fewer local variations.

Buildings would be designed and built to resist the effects of all prevalent hazards, increasing resistance to each individual hazard

I-Codes include provisions for resistance to seismic, wind, flood, snow and fire hazards and provide a basis for multi-hazard design producing the widely accepted benefit of generally stronger buildings that are better able resist all the loads and environmental conditions they are likely to experience. This provides a degree of protection for many other hazards not explicitly accounted for in building designs. The manner in which the proposed NFIP criteria would be written could affect the ability for states and local communities to modify non-flood provisions.

(b) Regulatory Requirements that FEMA Would Need to Investigate if Building Codes are Included in the NFIP

Regulatory impacts would become more evident if concrete proposals are eventually put forward in the form of rulemaking activities. Federal agencies perform required regulatory analyses associated with rulemaking proposals. This would include any rulemaking associated with incorporating a widely used building code into the NFIP floodplain management criteria. A regulatory impact assessment for any future rulemaking would include an analysis of the following (Appendix A.3 provides more in-depth descriptions regarding these analyses):

Executive Order 11988, Floodplain Management, 42 Fed. Reg. 26951 (May 24, 1977): FEMA must apply an eight-step decision-making process to evaluate FEMA-funded actions to avoid, to the extent possible, long- and short-term adverse impacts associated with occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Executive Order 12866, Regulatory Planning and Review, 58 Fed. Reg. 51735 (September 30, 1993): Pursuant to Executive Order 12866, FEMA must determine whether a rule is a significant regulatory action using the criteria listed in the Executive Order.

Regulatory Flexibility Act (RFA) of 1980, *5 U.S.C. 601-612:* Under the RFA, FEMA would evaluate and consider whether any rulemaking would have a significant economic impact on a substantial number of small entities, including small government entities.

Unfunded Mandates Reform Act (UMRA) of 1995, 2 U.S.C. 1501 et seq.: Under the UMRA, an agency must prepare a written statement which addresses an assessment of the anticipated costs and benefits of the federal mandate, including the costs and benefits to State, local, and Tribal governments or the private sector.

National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. 4321 et seq.: Under NEPA, for a rulemaking, i.e., a major federal action, that would "significantly affect the quality of the human environment," FEMA would need to prepare a detailed statement addressing the environmental impact of the regulation.

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 65 Fed. Reg. 67249 (November 9, 2000): To the extent practicable and permitted by law, no agency shall promulgate any regulation that has tribal implications, that imposes substantial direct compliance costs on Indian tribal governments, and that is not required by statute, unless funds necessary to pay the direct costs incurred by the Indian tribal government or the tribe complying with the regulation are provided by the Federal Government, or the agency, prior to the formal promulgation of the regulation, consults with tribal officials early in the process of developing the proposed regulation.

Executive Order 13132, Federalism, 64 Fed. Reg. 43255 (August 4, 1999): Executive Order 13132 provides guidelines for federal agencies issuing "policies that have federalism implications." If a regulation has federalism implications, an agency must adhere to the fundamental federalism principles listed in section 2 of the Executive Order. For example, the national government has specific enumerated powers as defined by the Constitution; all other sovereign powers are reserved to the States or to the people. Acts of the national government that exceed the enumerated powers violate the principle of federalism established by the Framers of the Constitution.

Office of Management and Budget (OMB) Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, (February 10, 1998): "Voluntary consensus standards" are standards developed or adopted by voluntary consensus standards bodies, both domestic and international. These standards include provisions requiring that owners of relevant intellectual property have agreed to make that intellectual property available on a non-discriminatory, royalty-free or reasonable royalty basis to all interested parties. OMB Circular A-119 (February 10, 1998) directs agencies to use voluntary consensus standards in their regulatory actions in lieu of government-unique standards except where inconsistent with law or otherwise impractical.

(c) Other Considerations Related to State and Local Regulatory Activities

States already participating in the NFIP and their communities that already adopt and enforce building codes with flood provisions based on the model I-Codes, and the property owners in those communities, would be anticipated to experience no new requirements from including building codes in the NFIP. This represents the majority of NFIP communities and sets an overarching premise that the net impact is relatively small for those communities that are already implementing both sets of requirements. Primary differences between building codes and the NFIP criteria are described in Topic 3. Appendix B.3 includes a checklist comparing notable flood provisions of the codes with NFIP provisions. Figure III-1 shows the location of counties that have not adopted building codes. At this scale, a map of the Nation cannot reasonably represent the distribution of all communities (including cities and towns) that enforce building codes or participate in the NFIP. Primary data sources used to create this map include the

Insurance Services Organization's (ISO) Building Code Effectiveness Grading Schedule (BCEGS), ICC, and Association of State Floodplain Managers, Inc.

There is an unanswered question as to whether some of the communities that participate in the NFIP but do not currently enforce building codes might withdraw from the NFIP if codes were required. Also, if communities do not enforce the NFIP requirements, FEMA could suspend them from the NFIP.

ii. Financial and Economic Impacts

Over the long-term, the relatively small additional up-front investment in code-compliant hazard-resistant building construction would yield greater savings for property owners through lower insurance costs and avoided damage resulting from multiple natural hazards such as flood, wind, and seismic events. Less property damage after a natural disaster speeds up the recovery process with lower business and social disruption costs, in turn reducing pressure on the national, state, regional, and local economies and reducing the need for government expenditures, thus reducing tax demands. The homeowner and property owner investments drive this chain of efficiency and market competitiveness, which causes a benefit of uniformity among jurisdictions. Residential losses constitute, by a significant majority, the largest single portion of disaster losses, whether insured or uninsured.

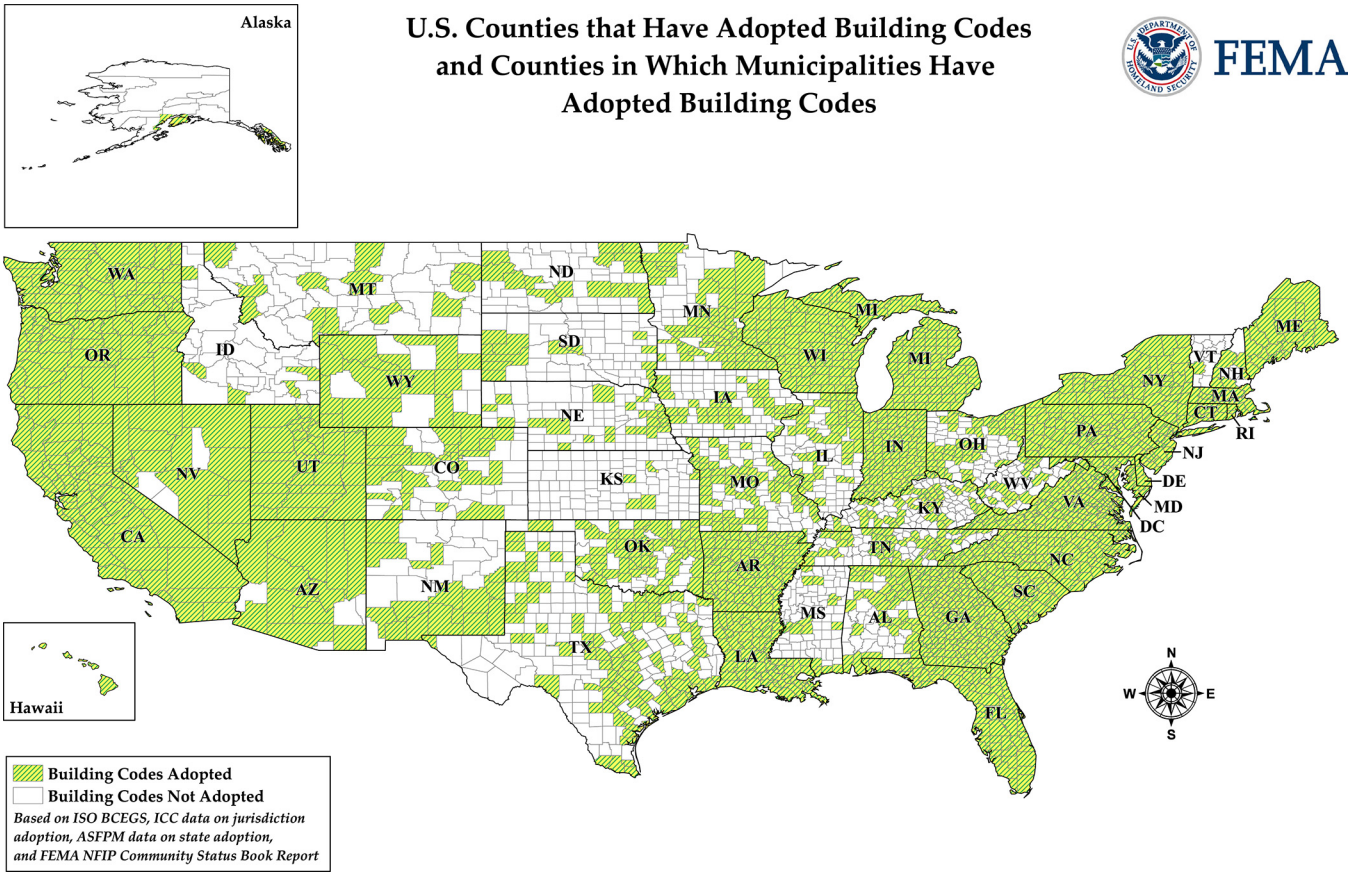

Figure III-1: Counties in the United States that have adopted flood-resistant building codes

Lower insurance costs resulting from incorporating building codes in the NFIP largely benefit those relatively few communities where:

- Building codes are not currently enforced;
- The building code's requirements are higher than the community's floodplain management requirements; and
- New building owners purchase insurance, increasing the insured pool (*see* Topics 4 and 6).

State and local code adoption and enforcement would increase consistency with NFIP and require coordination between building departments and floodplain managers (*see* Topic 2 discussion on resource coordination and Appendix B.4).

(a) Financial and Economic Impacts of Including Building Codes in the NFIP

The ICC, which provides tools and support to states going through the adoption process, has identified the following general benefits associated with building code enforcement, which FEMA has evaluated and promotes. These short- and long-term compounding benefits are widely accepted among subject matter experts:

- Building codes promote public health, safety, and welfare. Communities that do not currently administer and enforce building codes would realize diverse benefits of code-compliant construction, with better performance under a range of natural hazards including flood, wind, seismic, and general deterioration. Code compliance also increases building value leading to other short- and long-term benefits (Dehring, 2006). Some state land use laws that permit the adoption of building code would aid the process for these communities (*see* also Topic 3).
- Building codes provide consistent minimum standards for construction, creating an economy of scale that can reduce costs. The design and construction industries benefit from uniformity in design, permitting, engineering, construction methods, and manufacturing of materials on a wider scale. Cost savings from uniformity in requirements are passed on to consumers.
- Inspection during construction provides independent verification that code compliance has been achieved. The I-Codes specify several inspections, including two successive inspections that are specific to construction in flood hazard areas, each requiring submission of surveyed elevation data: (1) when the lowest floor is placed and prior to further vertical construction, and (2) prior to the final inspection and issuance of the certificate of occupancy.
- Building codes contribute to the well-being of communities. The preservation of life and safety, as well as maintenance of property values over time, and a culture of quality are direct results of the application and enforcement of building codes.

(b) Financial Costs of Including Building Codes in the NFIP

- Those communities that do not currently administer and enforce building codes would bear costs of establishing local building departments. As an example, the Institute for Building Technology and Safety has experience in Louisiana and Pennsylvania and provided documentation that the costs of administration and enforcement have been shown to be manageable, and can generally be covered by revenues collected as permit fees (Hattis, 2007) (*see* also Topic 2 and Appendix C.2).

- Those states that do not currently have commissions or agencies to adopt and administer building codes would bear costs to establish those entities. The costs can vary widely, depending on the nature of functions performed. Some states undertake a full range of functions, including state-specific modifications, providing interpretations, certifying materials, licensing building professionals, and establishing mechanisms to provide for credential training as qualifying for continuing education requirements. Some states rely on the ICC to provide some or all of those functions.

(c) Long-term Benefits and Impacts of Including the Building Codes into the NFIP

- Mitigation technologies and lessons learned from building code-related post-disaster investigations work their way into the codes through the consensus process, keeping communities up to date, better protected, and reducing losses and financial impacts over time (*see* also Topic 3).

- Reduced losses to new buildings and substantially improved existing buildings include reduced damage associated with additional elevation (freeboard) required in building codes (non-residential only) (*see* also Topic 3).

- Insurance premiums for new buildings and substantially improved existing buildings can be anticipated to be lower, or at least not rise, as a result of reduced losses (specifically NFIP premiums based on freeboard that is required in building codes) (*see* also Topic 6).

- Actuarial soundness would improve as a result of reduced losses by new buildings and substantially improved existing buildings (*see* also Topics 4 and 6).

- Post-disaster government expenditures would be reduced due to improved hazard-resistance of code-compliant buildings.

- Communities that participate in the NFIP's Community Rating System (CRS) program would be eligible to advance to CRS Class 6 (related to multi-hazard benefits of building codes) by fulfilling requirements for improved BCEGS scores as a measure of building code performance (*see* also Section 6). The CRS provides discounts on flood insurance premiums in communities that elect to undertake activities that support three goals: reduce flood damage to insurable property; strengthen and support the insurance aspects of the NFIP; and encourage a comprehensive approach to floodplain management.[5]

[5] http://www.fema.gov/national-flood-insurance-program/community-rating-system

- Additional marginal costs to build code-compliant structures would be borne by homeowners and property owners in communities that do not currently enforce codes (*see* Appendix B.5). As codes are updated every 3 years, there is generally a small increase in requirements and related costs, while in some cases or locations hazard mapping updates may reduce design hazard levels and related compliance costs (*see* also Topic 3).

(d) Financial Impacts Related to Construction Costs for Building Code Compliance

Financial impacts on states and communities can be broken into four cost categories if building codes are included in the NFIP. These include initial costs associated with adoption of codes, costs associated with triennial changes in the codes, costs to comply with requirements that exceed the NFIP minimums (e.g., freeboard), and permit fees. A more detailed description of each is provided in Appendix B.5.

(e) Interaction of State and Local Community Land Use Impacts and Building Codes

The following two studies described in Appendix B.6 provide contrasting views of the cost and benefits associated with the interaction of building codes and land use:

1. *Natural Hazard Mitigation Saves: an Independent Study to Assess the Future Savings from Mitigation Activities* (National Institute of Building Science [NIBS], 2005)

2. *The Value of Building Codes* (Dehring, 2006)

FEMA is completing a pilot study specifically modeling the loss reduction effects of building code adoption on damage from flood, wind, and seismic hazards at a community level (Charleston, South Carolina and Salt Lake City, Utah). The results indicate the potential for significant reduced losses accrued over time consistent with benefits described in this report. This loss reduction study is being performed using FEMA's Hazus-MH loss modeling software. It compares current code-compliant building construction with previous construction. The study models code-specific provisions. The results confirm the potential for significant variability among communities based upon their particular hazard profiles, building inventory profiles, and growth projections (*see* also Appendix D).

Reduced damage and losses would in turn affect local, state, and federal agencies. Primary economic impacts would be benefits to others, primarily to property owners. These would be monitored in terms of impact to federal agencies savings via disaster recovery costs, debris removal, and social factors, such as lost work efficiency from duress (FEMA, 2009) and other broad government efficiency studies (Institute for Market Transformation, 2011).

(f) Financial Impacts to FEMA and Other Agencies

Financial impact to FEMA and other federal agencies would be minimal because they are already performing support functions for adoption and enforcement of building codes. FEMA and other federal agencies provide technical expertise and formulate national policies on building codes. Notably, as the lead agency for the NFIP, FEMA funds efforts to incorporate flood provisions in the codes, coordinates with the ICC, publishes technical guidance, evaluates

building code performance, tests materials and structural systems, develops training tools, and promotes public awareness.

This change would create a new mission for FEMA requiring additional monitoring to provide guidance and oversight of state code adoption and to facilitate coordination between NFIP state coordinating agencies and State building agencies and commissions. At the regional level, FEMA already performs some of this type of coordination with States and communities. Some additional resources would likely be needed, focusing on building codes and individual community ordinances.

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IV. Topic 2: Resources Required of State and Local Communities to Administer and Enforce Building Codes

A. Purpose and Context

Purpose: This section describes the resources that would be required of states and communities to administer and enforce building codes, should building codes be included in the NFIP. This discussion is more specific than the general resource considerations described in Topic 1.

Context: The administration and enforcement of building codes frequently involves shared resources between state and local governments. The majority of the population of the United States lives within jurisdictions that already have administrative infrastructure in place to enforce building codes, and are assumed to have existing funding mechanisms and resource-sharing agreements.

> **BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria**
>
> …Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…
>
> 2) the resources required of State and local communities to administer and enforce such a building code requirement;

B. Findings

Finding #1. Twenty-two states have already adopted building codes at the state level and mandate enforcement at the local level (refer to Appendix B.2) which means separate action by communities is not required. Including building codes in the NFIP would have minimal effect on the resources of those states.

Finding #2. Twenty-eight states either have some level of adoption of building codes at the state level, but may not mandate enforcement at the local level, or may permit adoption at the local level (*see* Appendix B.2). Most of those states have some form of commission or council that already serves some degree of administrative function. The impact on States would depend in part on the level of administrative function each state elects to implement, but could include update of the codes every three years, amending the I-Codes to include state-specific requirements (such as higher standards or for consistency with floodplain management requirements established in separate state authority), overseeing local amendments to the codes (if such amendments are permitted), rendering interpretations of the codes, and providing training and certification of building department personnel (building officials, plans examiners, and inspectors). Some states might also conduct plan reviews and building product evaluations.

Finding #3. Since many communities in the United States already administer and enforce building codes, both with and without being mandated, , the effect on resources of including building codes in NFIP would be minimal for those communities (*see* Appendix B2 and C2).

Finding #4. For those communities that do not currently administer and enforce building codes additional resources would be required. The inclusion of the building codes in the NFIP would create a requirement for NFIP communities to establish an administrative infrastructure for building code enforcement, or to expand existing capabilities that are already in place to enforce floodplain management requirements. Communities would most likely require additional personnel with different training and skills to enforce building codes as a condition of continued participation in the NFIP.

Finding #5. The inclusion of building codes in the NFIP would require increased resources to provide coordination between NFIP State Coordinating Agencies and state building agencies and commissions, and increased coordination between local floodplain management agencies and local building departments.

C. Discussion

i. Impacts to State Resources

States that adopt building codes at the state level typically establish a building code council or commission, with appointed membership and varying regulatory approaches. In some states the authority and responsibilities of the council or commission are established by state law; in others, they are established by regulation. Some states manage their building code functions as part of a state agency, without an appointed commission or council. Although the effect of including building codes in the NFIP would vary from state to state, many state building code programs already perform the following needed functions:

- *Updating the building codes periodically***.** Many states are required to update or adopt each new edition of the I-Codes every three years, while some states are required to do so within specific periods of time, such as within 1 year or 18 months[6] of publication by the ICC. Figure IV-1 shows code editions currently adopted by states.[7] Lag in this process is due to varying adoption schedule requirements. Having the I-Codes as a national standard would encourage more uniform timely adoption.

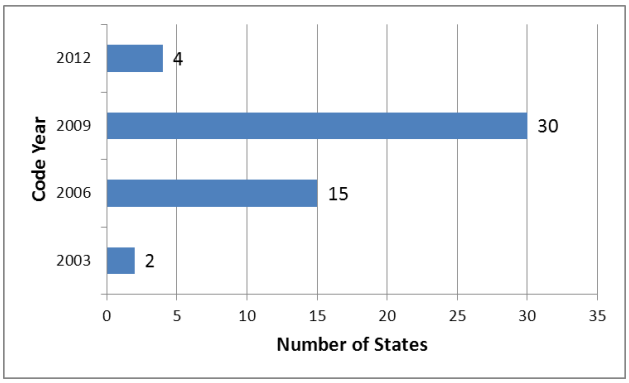

Figure IV-1: Code editions currently adopted by states and Washington D.C.

[6] http://www.iccsafe.org/gr/Documents/AdoptionToolkit/CodeAdoptionProcessState.pdf

[7] http://www.iccsafe.org/gr/Documents/stateadoptions.pdf (accessed November 2012)

- *Amending the I-Codes to produce state-specific building codes***.** Fewer states are now amending the model I-Codes.[8] Those that do process state-specific amendments require proposed amendments to be justified based on a state-specific need.

- *Oversee local amendments to the building codes***.** Many states do not permit any local amendments to the building codes and those that do restrict such amendments to modifications that are more restrictive. Some states are silent regarding whether local amendments are permitted. The state's role can vary widely, ranging from authority to approve or reject local amendments, to simply making available to the public documentation of local amendments (typically online), to no involvement at all.

- *Provide training*. This includes educational opportunities and professional certification of local building officials, plans examiners, and inspectors. The ICC manages an extensive inventory of publications and classroom courses, and a growing number of on-line educational opportunities that are generally accepted by states that have their own continuing education requirements. ICC reports that it has issued or renewed more than 180,000 active certifications (worldwide) and plans to administer more than 34,000 exams in 2012 (ICC, 2012a). Twenty states recognize and require ICC certifications as a condition of service.

- *Render interpretations of the building codes***.** The I-Codes clearly establish the power of the building official to render interpretations of the code (*see* IBC Section 104.1, IRC R104.1, and IEBC 104.1). Such interpretations are required to be "in compliance with the intent and purpose" of the codes, and "shall not have the effect of waiving requirements specifically provided for" in the codes. Some state bodies establish a formal process to accept requests for interpretation from any person, and to hear and decide on appeals of interpretations made by local building officials. The ICC provides technical support to code officials, design professionals and builders. The ICC answers informal questions and provides staff opinions by telephone and email (approximately 69,000 per year) and processes requests for formal interpretations through a committee composed primarily of code officials (548 requests since August 2002) (ICC, 2012a).

- *Plan reviews***.** Some states perform plan reviews for special occupancies (e.g., hospitals and schools) and some offer plan reviews at the request of applicants. Some states perform plan reviews for development in communities that do not perform plan reviews. The ICC offers plan review service to aid members in the timely examination of construction documents and fee-based technical consulting for the evaluation of codes as applied to specific projects or circumstances.

- *Building product evaluations***.** Some states and communities provide building product evaluation (*see* Topic 5).

[8] http://www.isomitigation.com/bcegs/0000/bcegs0001.html

ii. Impacts to Local Community Resources

Communities in states that require local enforcement of the building codes, and communities in other states that elect to adopt codes locally, already have in place the resources to administer and enforce codes. Similarly, communities that participate in the NFIP already have offices and resources in place to administer and enforce floodplain management requirements, whether those requirements are found in the codes or in stand-alone floodplain management ordinances.

In states and communities that participate in the NFIP but do not currently have building codes, there would be some changes required due to the addition of building code enforcement responsibilities. Additional qualified personnel would be required, permit processing procedures would change, and additional processing time would be required for plan review, permit issuance, and inspection related to requirements for hazards other than flood. A number of factors influence the size of building departments and the number and mix of plan examiners and inspectors. The factors include community population, building start activity, mix of building types and complexities, general economic outlook (which affects not only new building starts but owner interest in renovation of existing buildings), and the timeliness and level of service the communities are required to provide or may desire to provide (*see* Topic 5.C.ii). Some communities establish relationships with other jurisdictions or private third-party providers to assist in fulfilling their enforcement responsibilities.

Most states provide the authority for communities to share resources (typically with written cooperative agreements) and many authorize the use of "third-party" providers. Third-party providers are private sector companies or individuals that provide building department services under contract. Typically, third-party providers that perform building official duties, examine plans, or conduct inspections are required to be certified to perform these specific services.

Resources, including the number of staff and skill levels, required to administer and enforce building codes are value-driven in large part by the level of service community leaders desire to provide. A range of approaches to resources and enforcement priorities is reflected in ongoing questionnaires administered to communities for the BCEGS. This activity is administered by the ISO[9] (*see* Appendix C.2 for additional information).

iii. Resources for Required Funding

Required resources are well within customary State and local regulatory and public funding mechanisms.

Building department funding models indicate that resources required for establishing building departments are obtained in a variety of ways. Building permit fees alone are typically not able to adequately fund these resources. The acknowledged public benefits of code implementation justify the contribution of other public funds.

The most common funding model appears to rely, at least in part, on building permit fee income. Some building departments are managed as "enterprises" in which the entire budget is generated

[9] ISO, formerly the Insurance Services Office, Inc., is now a subsidiary of Verisk Analytic; it has maintained its identity of ISO in its business related to mitigation and the CRS.

from permit fees alone. Anecdotal reports during the housing downturn in recent years indicate widespread downsizing of building departments because the pace of construction did not require large staffs to provide service, and because permit fee income was insufficient to maintain budget levels. Building departments that have inter-local agreements with other communities, or that use third-party providers must have sufficient funding in their budgets to cover those costs. One approach used by many communities to establish permit fees is based on Building Valuation Data updated by the ICC every 6 months (ICC, 2012b). The Building Valuation Data table provides "average" construction cost per square foot and includes foundation work, structural and nonstructural components, electrical, plumbing, mechanical and interior finish materials (*see* Appendix C.2 for additional information).

*Required resources are scalable to community population, demographics, and geography***.**

Building department staffing can be augmented with cooperative agreements and market-driven solutions for third-party inspections, based on building size, complexity, and aggregate building volume of a jurisdiction. Basic approaches for funding building department activities include:

- Funds from city or state general revenue, and
- Fees from permits and other local government revenue allocations designated to building departments, which they accumulate separately and manage.

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V. Topic 3: The Effectiveness of Building Code Requirements in Reducing Flood-Related Damage to Buildings and Contents

A. Purpose and Context

Purpose: The purpose of this section is to determine the effectiveness of including building codes into the NFIP requirement in reducing flood-related damage to buildings and content.

Context: Building code effectiveness is assessed based on the reduction of flood damage (physical damage) resulting from the pertinent requirements of the code, i.e., reduced flood losses, both at the individual level and at the community level. A full accounting of flood losses would include both direct physical damage and indirect economic losses such as loss of employment and housing.

> **BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria**
>
> …Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…
>
> 3) the effectiveness of such a building code requirement in reducing flood-related damage to buildings and content…

The three parameters that most directly lead to reductions in flood damage are building floor elevation, building foundation type, and use of flood-damage resistant material. The first two parameters are central to resisting flood damage during flood conditions up to the required design flood elevation. The third parameter is necessary for long-term integrity of structures subject to flooding, even if exposed to water levels that rise to only minor to moderate levels.

The effectiveness of building code requirements related to flood hazards depends on several things, among them: the specific provisions of the code; whether and how States or communities modify the flood provisions of the model codes; the degree to which the flood provisions of the code are enforced; and the degree to which the regulated community complies with the provisions.

B. Findings

Finding #1. The model building codes are effective in reducing flood-related building damage because of specific design requirements, primarily the minimum elevation requirements and, in some cases, the inclusion of additional elevation (freeboard) and foundation improvements.

Finding 2. The effectiveness of NFIP ordinances separately enforced by communities is very similar to that of building code flood provisions except the codes have more specific requirements than the NFIP. In addition, the codes include certain provisions that exceed the NFIP minimum requirements (also called "higher standards"). However, identifying the extent to which the benefits of these requirements are realized and quantifying how they improve effectiveness is difficult and beyond the conceptual level. For example, the codes have freeboard requirements in Zone V (specified by IBC and IRC) and in Coastal A Zones (specified by IRC). The result is the code requires most buildings to be elevated higher than required by the NFIP

minimum requirements. Uncertainty in estimating the effectiveness of code requirements is due to widely varying quality of flood hazard mapping and growth patterns in flood zones.

Finding #3. State and local amendments to model building codes can alter, strengthen, or reduce the flood provisions. By including building codes into the NFIP, it may be more difficult to pass such amendments to weaken flood provisions. Most States that adopt codes at the state level do not permit any local amendment or permit only local amendments that make the codes more stringent, which would serve as a precedent for other states.

Finding #4. Including building codes in the NFIP would increase the effectiveness of enforcing compliance because States that mandate local enforcement provide clear statutory authority for enforcement by building officials. FEMA's observations after many disasters and those of other researchers reinforce the merits of effective enforcement which reinforces improved compliance by property owners and builders, resulting in reduced flood losses.

C. Discussion

i. Building Code Effectiveness

Numerous studies have examined the effectiveness and economic impacts of building code adoption and enforcement (e.g., ICC, 2008; McAneney, 2007; FEMA, unpublished). Many studies examined wind provisions and some looked at flood provisions. Building codes generally address *how* to build as opposed to *where* to build. Many flood losses are likely associated with poor siting, and the adoption and enforcement of building codes are unlikely to address this issue. The strong links between code adoption, enforcement, and effectiveness in reducing flood losses are validated by the related insurance rate adjustments captured by the BCEGS and insurance loss models. The primary flood-related code provisions that exceed minimum NFIP requirements (*see* Appendix A.1) include:

Administrative:

1. Clear authority to require applicant to use data from other sources or to determine the base flood elevation (BFE) and/or floodway

2. Submission of elevation documentation at two specific times during construction (foundation inspection and prior to final inspection)

Technical:

1. Freeboard: based on structural category (IBC)

2. Freeboard: +1 foot if Coastal A Zone is delineated (IRC)

3. Designer required to determine whether Coastal A Zone conditions are present and account for wave loads (IBC)

4. Performance of fill to support buildings (IBC)

5. Extensive and detailed specifications for pile foundations (IBC)

6. Breakaway walls: no service equipment or components mounted on or penetrating (IBC, IRC)

7. Dwellings in floodways required to be designed per American Society of Civil Engineers (ASCE) Standard 24 (IRC)

8. Minimum floodproofing protection level is BFE + 1 foot (IBC) and limitations on use of floodproofing is a function of velocity of flood flows and warning time

ii. Effect of Adding Freeboard

The code requirement for freeboard has the greatest impact in reducing flood damage. The amount of freeboard required by the code depends primarily on the flood hazard zone (Zone V, Zone A, and Coastal A Zone) and the building occupancy or risk category that is assigned in the building code. Critical and essential buildings are required to be elevated higher above the BFE than other buildings (*see* Topic 1, Finding 1).

An evaluation of NFIP building standards (Jones, et al., 2006) quantified the costs and benefits of freeboard, and found that freeboard is cost effective for new homes in a variety of flood scenarios: Zone V, Coastal A Zone, and Zone A over a wide range of flood depths, and flood velocities and wave heights.

There is a large inventory of buildings that were built in areas prone to flooding before the Federal Government produced flood hazard maps and before communities adopted floodplain management requirements. In addition, in the decades since communities began to participate in the NFIP, hundreds of thousands of buildings have been built in compliance with the NFIP minimum requirements. Compared to the combined total of those buildings, the freeboard requirement in the building code has been applied to a relatively small number of new buildings and substantially improved buildings that were required to comply with the codes. Those buildings, and all future buildings required to comply with the codes, would realize significant benefits in terms of reduced damage. In addition, because most NFIP communities already enforce building codes, new and substantially improved buildings in those communities have already realized those benefits.

iii. Local Amendments

Some States amend the model codes and some States permit local governments to amend the codes to suit their particular needs and constituencies. Communities in states that do not control building codes also amend the model codes. Amendments generally are limited to more restrictive provisions, but some jurisdictions do delete or weaken code provisions, including flood provisions. These changes can alter the effectiveness of the model code.

iv. Code Enforcement

The greatest flood damage reduction benefit from inclusion of the codes in the NFIP would likely be achieved in communities currently without building codes and that do not participate in the NFIP, followed by NFIP communities without adopted building codes. There is anecdotal evidence that enforcement of flood requirements is improved when building codes are in place,

because of the building official's statutory authority and culture of enforcement, rather than relying solely on enforcement of NFIP-based floodplain regulations.

Communities that participate in the NFIP must not only adopt regulations, they must have clearly defined enforcement procedures. However, many communities have traditionally assigned floodplain management responsibilities to planning, engineering, public works, or environmental offices where issuance of permits is likely not a primary responsibility. Inclusion of flood provisions in the model codes has resulted in joint responsibility for flood requirements between those offices and building departments.

The building official's statutory enforcement authority improves the level of enforcement. Building departments are more likely to have formalized administrative infrastructure and personnel to perform examination of plans and supporting design documentation, inspections, enforcement, and issuance of certificates of occupancy. Effective enforcement by States and communities also fosters improved compliance by designers and contractors who understand and follow the code provisions.

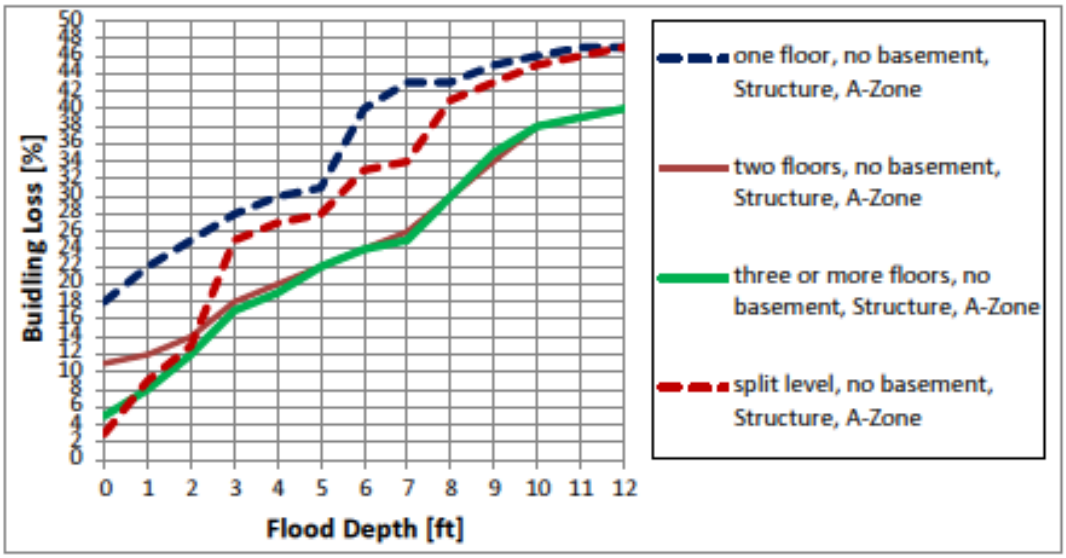
v. Measuring Reduced Flood Losses Resulting from Adopting Building Codes

FEMA is performing a flood loss reduction study of building code adoption for several cities and towns in the Charleston, South Carolina area (FEMA, [unpublished]). The evaluation is being performed as part of a FEMA-sponsored pilot study modeling reduced losses or "losses avoided" (*see* Topic 1.C.ii). The FEMA Hazards-United States Multi-Hazard (Hazus-MH) loss modeling software[10] was used with parcel-specific data to evaluate specific flood provisions, in particular the effects of freeboard and foundation types required by building codes. A parametric (i.e. sensitivity) study was used by calculating a range of potential loss reductions for various assumptions of the building characteristics using damage functions based upon flood depth, derived from past flood events.

The Hazus building code pilot study results indicated a range of $87-163 million reduced direct and indirect losses for a modeled building inventory of 21,671 structures, or about $4,000-7,500 per structure for the 1-percent-annual-chance (100 year) building code flood event scenario. The range of variability of the calculated reduced losses resulting from the adoption of building codes for structure types modeled relative to first floor elevation for single family dwellings with no basement is shown for direct building losses in Figures V-1. This figure illustrates the variability of the relationship driving the calculation of flood losses. The objective of the building code flood provisions is to lower the loss relationships.

The preliminary study results appear reasonable with respect to the Multi-Hazard Mitigation Council study (NIBS, 2005) that determined, on average, that $1 spent on mitigation in general for grant projects which are required to be compliant with building code provisions and other mitigation requirements, returns approximately $4 in future reduced losses.

[10] Hazards-United States (Hazus) is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes.



Source: FEMA, 2012

Figure V-1: Building direct loss by flood depth for the modeled building types

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VI. Topic 4: The Impacts of Building Code Requirements on the Actuarial Soundness of the NFIP

A. Purpose and Context

Purpose: This section describes the impact of including nationally recognized building codes in the NFIP on its actuarial soundness.

Context: The NFIP has been in place since 1968 and provides flood insurance policies to homeowners and businesses in nearly 22,000 communities that have agreed to adopt flood hazard maps and enforce minimum floodplain management requirements. As of October 31, 2012, there are 5.54 million policies in force, insuring an estimated $1.27 trillion in property value with a total annual paid premium of $3.54 billion.[11] Premium income is used to pay claims, repay Treasury borrowing and interest, and to pay for other program-related expenses.

> **BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria**
>
> …Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…
>
> 4) the impact of such a building code requirement on the actuarial soundness of the National Flood Insurance Program;…

Currently, the NFIP is not actuarially sound because it was authorized by Congress with a deliberate subsidy for premiums on properties built before the flood insurance maps identified those areas as being flood-prone (referred to as "pre-FIRM") and certain other properties. Because of the subsidy, approximately 20 percent of policies do not pay sufficient premiums to cover expected future losses.

NFIP has a two-tiered rating scheme: one for properties that are actuarially rated, which comprise about 80 percent of all policies, and one for properties that receive a subsidy, which comprise the remaining 20 percent. Actuarial rates are determined using hydrologic analyses, depth-damage functions, and historical information from claims. Actuarial rates are intended to cover all potential future losses and expenses. In accordance with the intent of the NFIP to make flood insurance affordable, some rates have been subsidized (Binghamton et, al. 2006). Subsidy reduction provisions in the BW12 will transform the NFIP into a program that is more actuarially sound. Many of those details need to be determined and are beyond the scope of this study.

B. Findings

Finding #1. The short-term impact of including building codes in the NFIP on the actuarial soundness of the NFIP would be small to negligible for two reasons:

1. Prior to full implementation of the rate increases required by BW12, the National Flood Insurance Fund was managed at a relatively constant rate between insurance premium revenue fluctuations and NFIP subsidy levels outside of major catastrophic events.

[11] NFIP Policy Information by State, http://bsa.nfipstat.fema.gov/reports/1011.htm.

Insurance losses would be reduced for properties that are built in compliance with building codes because those buildings would sustain lower damage levels. However, reduced lower losses paid by the NFIP would be, to some extent, offset by the reduced income because of lower, actuarially rated insurance premiums.

2. Including building codes in the NFIP would only affect new buildings and structures and those that are substantially improved or repaired after sustaining substantial damage. Of all these building types, only some are insured—or are likely to be insured—by the NFIP. They would represent a relatively small percentage of properties insured under the NFIP and therefore have only minor impact on actuarial soundness in the immediate near term.

Finding # 2. The long-term impact of including building codes in the NFIP is expected to be beneficial. When the rate adjustments in BW12 fully take effect over the next 5 to 10 years and the effects of most subsidies are phased out, significant rate reductions for those structures where these requirements apply should be expected. In addition, while actuarial rates pay for all future losses and take into account how buildings are built, certain strength features in building codes are not incorporated. Reduced future losses from these unincorporated provisions not factored into flood insurance rate setting process, would also accrue increased actuarial soundness.

Finding #3. The current NFIP insurance program has built-in elements that inhibit achieving true actuarial soundness: requiring enforcement of stringent construction standards such as those found in model codes would not address all of these issues. The lack of actuarial soundness is almost entirely due to the cost of government-subsidized policies (*see* Section C).

Finding #4. Including building codes in the NFIP would have a positive long-term impact on the program soundness because the insured structures impacted by this action would, over the long-term, be better able to withstand the effects of future flooding, including flooding that may increase as a result of changes such as coastal erosion, loss of wetlands, upland development that increases runoff, climate change, and sea level rise.

Finding #5. The actuarial benefits of including building codes in the NFIP would be impaired without improved FIRMs that delineate flood hazards with reasonable accuracy. Many factors affect mapping accuracy (*see* Section C, Discussion). The effectiveness of the model codes, the NFIP building requirements, and insurance rates depends on up-to-date flood hazard data on which to base FIRMs. If maps are not updated in a timely manner with more precise data, the actuarial soundness of the NFIP could be adversely affected (Congressional Budget Office [CBO], 2009).

Finding #6. The soundness of the pool would also improve because the size of the insured pool would increase due to lower rates and updated maps attracting more participants.

C. Discussion

i. Definition of Actuarial Soundness

The term "actuarial soundness" within the insurance industry does not have a single definition, but is dependent on the context of the specific practice area; however, "the concept of actuarial soundness is becoming more visible in public discourse, particularly in the context of existing

federally funded programs like the NFIP" (American Academy of Actuaries, 2012). At its most fundamental level, an insurance program is considered actuarially sound when its premium rates offset the expected value of all future costs (claims and administrative) associated with the sale of each insurance policy. The private insurance industry predicates its ability to set actuarially sound premiums on the availability and continuous updates of the information necessary to fully understand the risks involved in insuring, either for individual units or each class of unit (Binghamton et al., 2006).

ii. Actuarial Soundness of the NFIP

In 1981, FEMA established a goal of making the NFIP self-supporting for the historical average loss year.[12] Since actuarially rated policies cover all future expected losses and expenses, subsidized policies would then have to generate sufficient revenue, in combination with the actuarially rated policies, to meet the targeted amount of the historical average loss year. Even though the average premiums for subsidized policies are about two times the premium for actuarially rated policies, subsidized rates are 40 to 45 percent of the full actuarial risk borne by the program (FEMA, 2012).

In 2001, according to the General Accounting Office (GAO),[13] the NFIP was not actuarially sound because the program does not collect sufficient revenue to cover expected losses and expenses over the long term, including losses for catastrophic flood events. It was inevitable that losses from claims would exceed available funds from policy premiums in some years and cumulatively over time (GAO, 2001).

Many factors contribute to this situation. Some of the current and projected losses result from the basic objectives of the NFIP, which extend beyond just the operation of a fiscally sound insurance program. These other basic goals of the program include:

- Decrease the risk of flood losses;
- Reduce the costs and adverse consequences of flooding;
- Reduce the demands for and expectations of federal flood disaster assistance; and
- Protect and enhance the natural and beneficial functions of floodplains (CBO, 2009).

iii. Subsidized NFIP Premiums

The flood insurance part of the NFIP was created to be one element of a larger enterprise and was designed to support the overall NFIP objectives (*see* Appendix A.1). There are several classes of subsidized premiums that affect the actuarial soundness of the NFIP.

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[12] "According to FEMA, the average historical loss year is computed to determine the minimum (target) amount of premium that needs to be collected to cover at least the average annual loss as determined by historical data. The risk-premium, or "actuarial" rates, are then set according to a rate model for high-risk zones, and remaining actuarial rates are set based on judgment and the high-risk rates." (GAO, 2008, pg. 19).

[13] At the time the GAO report was prepared in 2001, the agency was called the General Accounting Office. In 2004 the name changed to Government Accountability Office to better reflect the mission of the office.

(a) Subsidized Premiums for Pre-FIRM Structures

Established in 1968, Congress designed the NFIP to subsidize premiums for older structures built before the availability of flood hazard data to encourage community participation in the NFIP. There was concern that expensive flood insurance premiums would discourage communities from participating in the NFIP. An integral part of the NFIP includes requirements to adopt and enforce minimum floodplain management regulations to reduce flood losses.[14] In addition, the purchase of flood insurance by property owners is intended to transfer the fiduciary risk from the Federal Government to the insurance policy holders and thereby decrease federal disaster assistance costs.

As of late 2012, 20 percent of the NFIP's 5.6 million policies are written on pre-FIRM structures; these polices pay an average of only 40 to 45 percent of their actuarial cost (FEMA, 2012). There are no additional funds being collected to offset this deficit and no other parties are paying more than their actuarially fair share to make up the premium shortfall. The end result is that the NFIP is not able to collect enough premiums in total to match the amount that would be required for the application of actuarial rates. To provide the subsidy covering premium shortfall, the NFIP is borrowing funds, and the interest on the borrowed portion has a negative effect on soundness that varies with interest rates. Given current low interest rates, this negative effect on soundness is expected to increase since interest rates may increase in the future, possibly before the subsidy reductions and soundness improvements from Findings #4, #5, and #6 are realized to a significant level.

The NFIP's goals with respect to actuarial soundness are to support sound floodplain management to reduce losses over the long-term and to assess the actuarial premiums of all post-FIRM structures and other structures that qualify for actuarial rating. Thus, there should be no subsidies for these post-FIRM and other actuarially rated policies. With regard to the subsidized policies, NFIP's goal has been to charge sufficient premium on these policies to keep the program self-sufficient except in exceptionally catastrophic loss years. Built-in actuarial deficits did not show up for many years until 2005 when there was an unprecedented number of claims from Hurricanes Katrina, Rita, and Wilma. Starting in 2007, FEMA began including the 2005 losses in calculations to establish premium rates, but only assigned it a weight of roughly one-third to reflect the rarity of such a high-loss year and to keep subsidized policies affordable.

(b) Premiums for Buildings in Areas Protected by Flood Control Structures

Another class of policies subsidized by the NFIP is for structures in areas where a flood control structure, usually a levee, is being constructed or upgraded to meet certain criteria (shown on FIRMs as Zone A99 and Zone AR). This additional financial risk is due to the fact that during a part of the construction period the insurance rates are lower assuming that the levee is already providing some level of risk reduction. As of November 2012, this class of policies represented only 0.5 percent of the policy base, but is expected to increase as FEMA implements its new Levee Analysis and Mapping Program.[15]

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[14] It is estimated that $1.2 billion in potential annual flood losses have been avoided due to the actions of state and local officials in enforcing NFIP floodplain management requirements (FEMA, 2012).

[15] FEMA's Levee Analysis and Mapping Program was developed in response to concerns that the current study methodology did not consider the beneficial effects of levees that fell short of fully complying with levee

(c) Properties with Lower Rates Due to Grandfathering

Properties with Lower Rates Due to Grandfathering: When FEMA updates a flood insurance study and FIRM, some properties originally mapped as low risk (shown as Zone X on the FIRM) may be remapped to reflect a higher risk (shown as Zone AE on the FIRM). For these remapped properties shown to be at higher risk than originally mapped, the NFIP has a grandfather provision that allows those property owners to keep the Zone X rates, and in some cases Preferred Risk Policy (PRP) rates.

To offset the cost of these higher risk Zone X and PRP-rated policies, FEMA considers these properties as a unique class and sets rates based on historical losses of that class as a whole. In effect, the true Zone X policies are paying more than what their actuarial rate would otherwise indicate to make up for the higher risk grandfathered policies. Because of this cross-subsidy, the impact of grandfathering for Zone X polices on the actuarial soundness of the program is believed to be negligible.

An example of this is when an area protected by a levee is remapped. Based on updated information and improved modeling, some levees originally modeled as providing protection from the 1-percent-annual-chance (or 100-year) flood event have now been shown as not providing an adequate level of protection; for such levees, structures within the levee-protected area would now be mapped as flood-prone. CBO estimates that 20 to 25 percent of the NFIP policies rated at the standard Zone X, and PRP, rates are actually located in a higher risk zone such as Zone AE or VE (CBO, 2009).

Properties with Preferred Risk Policies: In an attempt to expand the NFIP policy base, FEMA introduced the PRP, a low-cost policy for properties in Zone X that have not had two claims or disaster relief payments for flood of $1,000 or more, or three losses of any amount. The PRP offers a number of different fixed options that combine structure and contents coverage with effective rates that are much lower than the standard Zone X rate.

In response to concerns about insurance affordability, FEMA announced a decision in 2011 to apply a grandfathering provision similar to that previously described for properties that are remapped into a higher risk zone.[16] However, this provision is limited to an additional 1 year, after which the rate for those properties is changed to the standard Zone X rate. Subsequent to the enactment of BW12, the PRP Extension was extended beyond two years and is being phased out by 20 percent annual premium increases.

iv. Projected Effect of the BW12 on Subsidized NFIP Premiums

With passage of BW12, most of the NFIP premium subsidies will be phased out over the next 5 to 10 years. Once that process is complete, nearly all policies will be actuarially rated at their full risk. The exception will be policies on pre-FIRM primary residences which are specifically identified to maintain their subsidies, unless such residences are also in one of a number of

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accreditation regulations. The new approach will be more precise in analyzing flood impacts on non-accredited levees. For more information, go to: http://www.fema.gov/living-levees-its-shared-responsibility/fema-revising-its-levee-analysis-and-mapping-approach.

[16] http://www.floodsmart.gov/floodsmart/pdfs/prp/prp_community_faqs_102510.txt

circumstances that the statute identifies for elimination of the subsidy, such as "Severe Repetitive Loss Properties" as that term is defined in the NFIA.

v. Other Factors that Affect Actuarial Soundness

The CBO examined the issue of whether FEMA's actuarial application will result in fiscal soundness for the NFIP (CBO, 2009). The CBO identified some factors of the actuarial rating process that tend to result in surplus and others that tend to result in a deficit. The most significant feature is the increased building strength and building elevation for Zone A policies and Zone V policies intended to account for uncertainties in flood impacts. Another possible source of surplus is the way FEMA deals with short historical hydrologic records (GAO, 2001). FEMA includes in its rating a factor that accounts for the possibility that some areas have not experienced rare events resulting in higher rates than what the short record would indicate. On the other hand, CBO notes that FEMA's full-risk rates may be too low because of out-of-date or incomplete information about areas at risk from flooding. The FIRMs can become obsolete because of coastal erosion, loss of wetlands, upland development that increases runoff, climate change, and sea level rise. There is insufficient specific data to determine if the deficit related factors offset the surplus related factors (CBO, 2009). However, it is recognized that if the frequency or severity of flooding increases over time, the resulting losses will also increase, making the benefits of code compliant building more pronounced.

Another area of concern expressed by the CBO is the way FEMA treats levees (CBO, 2009). Areas protected by levees that meet FEMA's 1-percent-annual-chance (or 100-year) flood event accreditation regulations are not subject to building standard requirements for properties in SFHAs; only minimal building standards are required. Also, insurance premiums in these areas (generally those for shallow flooding or Zone X areas) are very low compared with areas protected by non-accredited levees. FEMA's rate schedule does not fully reflect the residual or unknown risk associated with levees. For example, residual risk can be higher behind a levee than if there were no levee because of the violent and sudden flood flows if the levee fails. The National Research Council is studying this issue and released a report of findings in early 2013.

vi. Effects of Substantially Damaged and Substantially Improved Properties

NFIP requirements apply to buildings and structures that have been substantially damaged or are being substantially improved. Such buildings are required to be brought into compliance with the same standards that apply to new buildings in the SFHA. Currently, damaged buildings for which the cost to restore the buildings to their pre-damage condition equals or exceeds 50 percent or more of their market value are considered substantially damaged. Structures that undergo improvements where the cost of the improvements equals or exceeds 50 percent of the structure's market value are substantially improved. The new substantial improvement provisions of BW12 are anticipated to have an overall positive impact on the actuarial soundness of the NFIP.

vii. Changes in Flood Risk that Affect Flood Hazards Shown on FIRMs

Flood hazards change over time, and the associated flood risk needs to be reasonably reflected in FEMA's FIRMs. Scientific and technical approaches to modeling and mapping also change over time, which allows production of more refined risk evaluations and more precise depictions of flood risk. Changes that may result in more refined flood risks shown on a FIRM include:

- Increased development within a watershed that changes land use and increases impervious surfaces, which can result in loss of wetlands, increased runoff, and higher levels of flooding;

- Topographic changes, such as erosion, that affect flood flow pathways and shorelines;

- Improved hydrologic data resulting from the availability of longer periods of climatic or stream flow records (shorter records of stream flow data are less reliable than longer periods of record);

- Acquisition of more reliable topographic data for delineating high-risk zones with improvements in models that calculate flood depths; and

- Effects of climate and sea level changes.

If the factors that change flood risk over time are not incorporated into revised FIRMs, then the application of building codes will be based on data that does not reasonably reflect risk. Not only would this mean that code-compliant buildings would not be built to account for those changes, the insurance rating would also be affected leading to a downward bias or trend of the actuarial soundness of the NFIP. The CBO states that, "topographic information that is not up to date lends a downward bias to estimates of flood risk and thus contributes to the likelihood of an actuarial shortfall."

viii. Community Rating System and Premium Discounts

The CRS provides discounts on flood insurance premiums in communities that elect to undertake activities that support three goals: reduce flood damage to insurable property; strengthen and support the insurance aspects of the NFIP; and encourage a comprehensive approach to floodplain management. Premium discounts range between 5 and 45 percent, depending on the activities undertaken in the community. Approximately 1,200 communities participate in the CRS, representing 66 percent of the NFIP policies in force nationwide. Property owners in CRS communities receive an average discount of 15 percent on their premiums (FEMA, 2011a).

In an attempt to keep neutral the effect of the CRS program costs on the NFIP revenue neutral, FEMA raised the base (undiscounted) rate by about 9.5 percent. Thus, even if the CRS discounts overstate the benefits of some of specific creditable (eligible) activities, the CRS program has a whole probably has little effect on the overall actuarial soundness of the NFIP. However, CBO states that if CRS communities are induced to reduce their flood risks beyond what is factored into FEMA's rate setting model, then claims would decline without any corresponding decrease in premium, so the overall impact on the actuarial soundness of the NFIP would be positive (CBO, 2009).

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VII. Topic 5: Effectiveness of Nationally Recognized Codes in Allowing Innovative Materials and Systems for Flood-Resistant Construction

A. Purpose and Context

Purpose: This section describes effectiveness of nationally recognized codes in allowing innovative materials and systems for flood-resistant construction.

Context: For the purpose of this report, innovative materials and systems for flood-resistant construction are those materials and practices that are not already required to be used in the construction of building elements that extend below the flood level. Referred to as alternate materials and methods (AMMs), these materials and systems include the application of flood-resistant coatings, waterproof foundation materials, and flood barriers.

> **BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria**
>
> …Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…
>
> 5) the effectiveness of nationally recognized codes in allowing innovative materials and systems for flood-resistant construction;…

Many provisions contained in building codes are prescriptive and explicitly list practices and materials that satisfy the current code requirements. Other provisions pertinent to materials establish the expected performance, and do not list explicit practices and materials. The building codes authorize building officials to approve alternative materials (IBC 104.11 and IRC 104.11). These sections state that the provisions of the codes are not intended to prevent the installation of any material or prevent any design or method of construction not explicitly prescribed by the code. Alternatives may be approved where the building official finds the alternatives comply with the intent of the code and the materials are at least equivalent to the code in terms of quality, strength, effectiveness, fire resistance, durability, and safety. One way that new and technologically advanced materials not prescribed by codes can be accepted by building officials is for the manufacturers to have them approved through a product approval consensus process. Many manufacturers also submit code proposals to include new materials and systems in the building codes. The ICC considers such proposals during its update process every 3 years.

B. Findings

Finding #1. Including building codes in the NFIP would not alter authority of building officials to approve alternative materials nor would it alter the process used by ICC to accept AMMs in the codes. Obtaining approval to add a new material into the I-Code typically takes a number of years (*see* also Section C). The length of time for the adoption process reduces the effectiveness of the codes in specifying requirements for a particular material. However, the broad definitions of material types and applications in the code (i.e., FEMA Technical Bulletin 2, *Flood Damage-Resistant Materials Requirements* [2008], which is referenced by the IBC) allow for incorporating innovative materials within those types.

Finding #2. The process that the ICC uses to accept AMMs in the codes is usually effective in ensuring that new AMMs meet appropriate safety and performance standards. However, the process is lengthy and can be cost prohibitive to smaller manufacturers, thereby eliminating potential beneficial technological advances. Using third-party evaluation services may be a timelier alternative, although it also can be costly. In addition, third-party evaluations provide the evidence necessary to allow building officials to accept AMMs under their authority to approve alternative materials.

C. Discussion

i. Code Development Process

Subject matter expert opinions related to innovative practices and systems have focused on the need to improve and expedite the process of accepting innovations in the building code. Since any person, business, or manufacturer can submit a code change and introduce a new material to the building codes, more than a thousand code change proposals are typically received during every code cycle. Revised versions of the I-Codes published every three years are preceded by an approximately three- to five-year code development process. Code development is by formal consensus, involving several steps including public hearings. Final approval of a proposal is by majority vote of ICC members.

Code change proposals related to AMMs typically come from larger manufacturers and relate to practices that are widely used regionally or nationally. Generally, building product manufacturing, distribution, design, and construction are national or large regional endeavors. There are economic benefits to uniform national standards because having different standards would introduce inefficiencies related to structure development, design, and construction.

ii. Third-Party Evaluation Services

There are a number of organizations that provide third-party evaluation services. The ICC Evaluation Service,[17] a subsidiary of the ICC, performs technical evaluations for code compliance. Evaluations are performed for building products, components, methods, and materials. Manufacturers are required to submit technical evidence documenting calculations and tests that demonstrate compliance with the intent of codes and standards. Upon completion of evaluations, which includes the opportunity for public comment, the ICC Evaluation Service issues evaluation reports that are made available to the public.

Manufacturers use evaluation reports as evidence that their products meet code requirements and warrant acceptance by construction professionals and building officials. In general, buildings officials would exercise their authority to approve alternative materials, including new and innovative materials and systems (*see* Appendix E.1 for additional discussion of this topic). For AMMs not explicitly included in the buildings code, some local jurisdictions choose to develop a methodology to guide their review and acceptance of such materials. Communities may provide specific criteria that must be followed to get an AMM locally approved. Some manufacturers, especially larger enterprises, develop reports and tests as a part of their product development to

[17] The ICC Evaluation Service Web site (http://www.icc-es.org/) includes documentation on both standards for evaluations and specific products that have been evaluated.

document their performance when those products are not addressed in the prescriptive requirements of the code.

iii. Government Role in Supporting Innovative AMMs for Flood-resistant Construction

(a) Federal Emergency Management Agency

FEMA plays a prominent federal role in addressing the use of innovative materials and systems in the code. The FEMA Building Science Branch works to strengthen the provisions in the codes related to flood damage resistant construction, including provisions specific to flood damage-resistant materials. The Building Science Branch provides strong support for code development when FEMA has determined materials and construction practices are of high value and high priority in reducing losses.[18]

(b) Other Federal Agencies

Other federal agencies also have interest in the building code development, particularly the Department of Housing and Urban Development (HUD). Other federal agencies tend to have different objectives. For example: HUD also works with the Department of Energy to develop practices that focus on alternative energy and sustainability in materials and systems. The Department of Commerce National Institute for Standards and Technology focuses on standards and innovations. The U.S Army Corps of Engineers develops specifications and guidance for coastal and riverine infrastructure projects or programs that often include buildings.

iv. Current Lists of Flood Damage-resistant Materials

A critical element of flood-resistant construction is the use of flood damage-resistant materials. The requirement to use damage-resistant materials is found in the NFIP regulations and also in the building codes. The IBC references a standard for flood resistant construction (which includes the explicit requirement to use flood damage-resistant materials) and the IRC cites FEMA's Technical Bulletin No. 2, *Flood Damage-Resistant Materials Requirements* (FEMA, 2008). This technical bulletin provides current guidance on materials, including lists of materials by generic names and uses and whether the materials are acceptable or unacceptable.

The standard referenced by the IBC is developed by ASCE (ASCE, 2005). ASCE develops numerous standards that are cited by the building code, including ASCE 24, *Flood Resistant Design and Construction.* Standards are developed through a formal process that is independent of the ICC. Although the term "flood damage-resistant materials" is defined in ASCE 24, the standard does not include a list of materials that are deemed to meet the performance expectation for flood damage-resistant materials. Another standards development organization, ASTM International, is in the process of developing standards for flood damage-resistant materials.

A limitation on the use AMMs is related to having different sources and lists of flood damage-resistant materials which may be too narrowly described to cover many AMMs. Designers, builders, and property owners may be reluctant to specify unlisted AMMs.

[18] FEMA Building Science publications are available at http://www.fema.gov/building-science#3.

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VIII. Topic 6: The Feasibility and Effectiveness of Providing an Incentive in Lowering Premium Rates for Flood Insurance Coverage under Such Act

A. Purpose and Context

Purpose: This section describes the feasibility and effectiveness of providing an incentive in lowering premium rates for flood insurance coverage for structures meeting a widely used and nationally recognized building code or any applicable local building code that provides greater protection from flood damage.

Certain structures in states and communities that have adopted current building codes are able to obtain lower NFIP insurance rates, primarily because the codes require some buildings to be elevated above the BFE. FEMA establishes insurances rates based on hydrologic models, depth-damage functions, and historical loss information from previous claims and trends (*see* Topic 3). For buildings constructed after FEMA issues FIRMs, individual property rates are based on the flood hazard that the property could experience according to the mapped flood zone and elevation of the structure with respect to the BFE. Under the current rating structure, flood insurance premiums can be reduced using the following mechanisms:

> **BW12, Section 100235: Report on Inclusion of Building Codes in Floodplain Management Criteria**
>
> …Federal Emergency Management Agency shall conduct a study and submit a report … regarding the impact, effectiveness, and feasibility of amending section 1361 of the National Flood Insurance Act of 1968 (42 U.S.C. 4102) to include widely used and nationally recognized building codes as part of the floodplain management criteria developed under such section, and shall determine…
>
> 6) the feasibility and effectiveness of providing an incentive in lower premium rates for flood insurance coverage under such Act for structures meeting whichever of such widely used and nationally recognized building code or any applicable local building code provides greater protection from flood damage;…

1. Property owners can elect to elevate or floodproof their structure above the minimum required elevation.

2. Communities can participate in FEMA's CRS (*see* Topic 4); rates in CRS communities are discounted based on each community's floodplain management activities.

B. Findings

Finding #1. The inclusion of building codes in the NFIP would be somewhat effective in lowering premiums because the codes require structures in certain situations to be built or protected to higher elevations than the minimum elevations required under the NFIP. There is a direct established relationship between building structures to a higher elevation, reduced damage, and lower insurances rates.

Finding #2. It is feasible for adopting building codes into the NFIP to provide this incentive of lower insurance rates to property owners nationally because it requires all NFIP communities to adhere to building codes.

Finding #3. Including building codes in the NFIP would reinforce the existing CRS incentives, which already provide credits for adoption of building codes.

C. Discussion

i. NFIP Rate Setting Process

The NFIP uses four basic types of information to set rates for buildings in the SFHA (*see* also Topic 3):

- Local frequency of floods of different sizes;
- Historic flood losses;
- Representative topographic data to convert flood flows to water height; and
- Depth-damage functions for various zones based on a combination of U.S. Army Corps of Engineers and claims experience.

ii. Rating Based on Building Characteristics

Under the NFIP insurance and rating criteria, building characteristics and measures designed to affect future flood losses are taken into account for buildings that are actuarially rated (most buildings that are built after FEMA issues a community's first FIRM). These characteristics include the elevation of the building's lowest floor, the number of stories, type of foundation, and occupancy (*see* Appendix F.1).

While the NFIP minimum building standard requires only that the lowest floor, or lowest horizontal structural member of the lowest floor in Zone V, be at or above the BFE, lower rates are charged for buildings that are elevated higher than the minimum requirement. For every foot a structure is elevated above the BFE, flood insurance premiums are lowered (*see* also Appendix F.2). Buildings that have their lowest floor two feet or more below BFE are rated individually by FEMA underwriters, and can have annual premiums exceeding $10,000 (*see* Topic 4 for discussion of the anticipated impact of BW12 on actuarial rating of many buildings that current have subsidized rates).

iii. Discounts and Contingencies

All SFHA policies include a contingency factor of 10 percent in Zone A and 20 percent in Zone V to account for uncertainties, such as flood depth and velocity. All communities participating in the CRS also receive discounts based on their level of participation (*see* Topic 4).

iv. Increased Cost of Compliance

The NFIP charges a separate premium for Increased Cost of Compliance coverage that varies from $4 to $70 per policy, depending on the building type and age, and the flood zone where the building is located. Payments under a claim for Increased Cost of Compliance coverage are used to bring eligible flood-damage buildings into compliance with the requirements for new buildings.

v. Administrative Costs

The NFIP is required to collect income to cover administrative costs, staffing costs, certain floodplain management and flood hazard mapping activities, and compensation to insurance companies under the "Write Your Own" flood insurance program, loss adjustment expenses, and other operational expenses. A portion of those costs are included in the rate structure, while other costs are covered by income associated with the Federal Policy Fee. The Federal Policy Fee is set at $40 per policy ($20 on PRPs). In addition, FEMA sets a minimum rate of 0.24/0.08[19] in Zone A and Zone AE to cover expected fixed administrative cost on each policy.

vi. Unnumbered Zone A

Flood hazard areas where FEMA has not developed detailed BFE data are referred to as "unnumbered Zone A" areas. Rates in these areas are generally higher than those properties with flood elevation properties because of the uncertainties about the full flood risk. In these areas, the NFIP uses three rating methods:

- Building certified as compliant;
- Buildings where the adjacent grade is known; and
- Buildings with no elevation information available.

vii. Annual Rate Increase

Prior to the enactment of BW12, annual rate increases were limited by statute to 10 percent, which may have resulted in an artificially lower annual increase than what actual data may have indicated for certain classes of risks. With the passage of BW12, the limit on annual increases has been raised to 20 percent.

FEMA reviews its rate structures annually to achieve the goal of having sufficient income from premiums to cover claims and expenses associated with the historical average loss year. Following the unusually large losses from Hurricane Katrina in 2005, FEMA assigned a weight of 1 percent to that year, approximately one-third the weight applied to all the other years in calculating the historical average loss year. Otherwise, premium revenue would have required a significant increase in the subsidized pre-FIRM policy premiums to meet the historical average loss year target (CBO, 2009).

viii. Insurance Premium Discounts for Participation in the Community Rating System

FEMA's CRS provides premium discounts to communities that agree to adopt code standards beyond the minimum required for NFIP participation and engage in other activities that promote flood risk awareness. Premium discounts range between 5 and 45 percent, depending on the activities undertaken in the community. Approximately 1,200 communities participate in the CRS, representing 66 percent of the NFIP policies in force nationwide; these 1,200 communities receive an average discount of 15 percent on their premiums (FEMA, 2011a).

[19] The rates are per $100 of coverage. The first number (0.24) is for the first $50,000 of building coverage, and the second number (0.08) is for the remaining coverage up to the maximum of $250,000 for a single-family residential building.

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IX. Topic 7: The Impact of Building Code Requirements on Rural Communities Differs from Building Code Challenges in Urban Communities

A. Purpose and Context

Purpose: This section describes whether the effect of including nationally recognized codes in the NFIP would affect rural communities differently than urban communities.

Context: Urban communities tend to have more financial and technical resources to carry out code requirements and enforcement, while rural communities tend to be more geographically disparate, distant from technical resources, and smaller in population and infrastructure.

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>
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>
> 7) the impact of such a building code requirement on rural communities with different building code challenges than more urban environments; and…

B. Findings

Finding #1. The financial and regulatory impacts on rural NFIP communities that do not currently administer and enforce building codes would be from additional resources required if the building code is included in the NFIP. As stated in Topic 2, the inclusion of the building codes in the NFIP would create a requirement for NFIP communities to establish an administrative infrastructure or expand existing capabilities that are already in place to enforce floodplain management requirements. Communities would most likely require additional personnel with different training and skills to enforce building codes as a condition of continued participation in the NFIP. Rural communities are more likely to take advantage of options for third-party providers and cooperative agreements to fulfill their administrative responsibilities for code enforcement.

Finding #2. The potential benefits of including the I-Codes into the NFIP would be realized by rural communities, just as they would be by more urban communities. As stated in the Topic 3 findings, the building codes are effective in reducing flood-related damage because of specific mitigation provisions required for compliance, including primarily the inclusion of freeboard, foundation improvements, and mandatory verification of compliance.

C. Discussion

i. Defining "Rural"

Rural communities can be defined in many ways, and definitions can be based on administrative, land use, or economic concepts. Researchers and policymakers can choose appropriately from among nearly two dozen definitions currently used by federal agencies. Depending on the boundary choice and the population threshold, the portion of the U.S. population defined as rural

and its socioeconomic characteristics can vary substantially. The share of the U.S. population considered rural ranges from 17 to 49 percent depending on the definition used. In 2000, 21 percent of the U.S. population was designated rural using the Census Bureau's land-use definition (outside urban areas of 2,500 or more people), compared with 17 percent for economically based non-metro areas (outside metro areas of 50,000 or more). The Census Bureau land-use concept, developed by the U.S. Department of Agriculture, identifies urban areas based on population density in a given area. The economic concept, used by the Internal Revenue Service and used in most rural research applications, recognizes the influence of cities on labor, trade, and media markets that extend well beyond densely settled cores to include broader commuting areas (Cromartie and Bucholtz, 2008). This study was informed by both the Census Bureau land-use and Internal Revenue Service economic concepts.

ii. Rural Communities, the NFIP, and Code Enforcement

The NFIP does not distinguish rural communities from all other communities. Any community, whether rural or urban, may participate in the NFIP upon adoption of FIRMs and upon adoption and enforcement of codes and ordinances that meet the NFIP requirements.

Many rural communities may lack the resources to provide the same level of government services provided in urban areas. Rural counties tend to be large in area, making it more difficult to provide government services throughout their service areas. Despite these challenges, many small, rural communities that have been identified by FEMA as having special flood hazard areas elect to adopt floodplain management regulations in order to participate in the NFIP.

The responsibility for managing and financing land use planning, zoning, and regulation of building codes rests with local jurisdiction officials. Some rural communities may choose to not manage hazards because they lack sufficient personnel and capacity to finance activities necessary for enforcement, as well as for other political and social reasons. Managing risks to life, property, and the environment requires resources and expertise.

Maintaining a department to administer and enforce codes requires the steady collection of building permit fees or tax revenues which in turn depends on a stable environment for building construction activity. While rural communities tend to have a smaller economic base than urban areas, many states provide alternatives for communities that cannot support full-time staff or staff with the right skill sets necessary for effective code enforcement.

iii. Alternatives for Code Enforcement

One option that is widely used by small rural communities is a cooperative agreement with another government entity. The smaller community enters into an agreement with a larger county, regional planning agency, or a state agency. Some states have statutory requirements that provide explicitly for inter-local agreements, calling for such agreements to be in writing so that it is clear which entity is responsible for which functions.[20] These arrangements are frequently used for administration of building departments and to fulfill the requirements for participating in the NFIP, and have been identified by NFIP State Coordinating Agencies and

[20] For example, see *Florida Interlocal Cooperation Act of 1969*, Section 163.01, F.S., http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0100-0199/0163/Sections/0163.01.html (accessed November 19, 2012).

FEMA Regional Office staff during Community Assistance Visits and Community Assistance Contacts.

Another option that is permitted in many states is use of "third-party providers," which are qualified private sector service providers. Communities typically contract for "on demand" services, which means costs are incurred only when necessary. Appendix C.2 provides examples of how communities use third-party providers to address their needs. The advantages of using third-party providers include minimal program office setup costs and access to highly experienced personnel.

iv. Characterization of Rural and Urban Code Adoption

Many jurisdictions that enforce building codes participate in ISO's Building Code Effectiveness Grading Schedule (BCEGS). This program evaluates building codes in effect in a community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. The BCEGS program scores each municipality, assigning a BCEGS grade of 1 to 10 where 1 is highest score for exemplary building code enforcement.

ISO develops BCEGS scores based on an evaluation questionnaire (*see* Appendix C.1 for an abbreviated version of the questionnaire). Of the jurisdictions that meet the ISO's BCEGS minimum standards and participate in ISO's BCEGS,[21] 52 percent report populations of less than 2,500, 45 percent report populations between 2,500 and 50,000, and 3 percent report populations larger than 50,000.

When BCEGS jurisdictions are sorted by population and sorted scores are averaged, they are similar to that shown in Table IX-1. The implication is that small jurisdictions that enforce building codes are able to administer codes with reasonably similar effectiveness as larger jurisdictions. It is important to note, however, that the BCEGS data do not distinguish between small urban jurisdictions. An assumption made for this Topic is that small communities are a proxy for rural communities with respect to code enforcement.

Table IX-1: BCEGS-IRC Classification by Community Size

BCEGS Jurisdiction Population[21]	*<2,500*	*>2,500 and <50,000*	*>50,000*
BCEGS-IRC Classification for* Majority Jurisdictions	4 to 5	3 to 4	3 to 4
Total Number of Participating Jurisdictions	9,410	22,418	6,604
Jurisdictions Meeting Minimum Requirements	5,388	4,595	312
Percent Jurisdictions Declining to Participate BCEGS-IRC	9%	7%	6%

*Classifications listed are from the most recent BCEGS survey.

[21] ISO BCEGS jurisdictions include entities other than local governments that meet census definitions or the NFIP definition of "community". An example of these other entities is fire districts.

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X. Topic 8: The Impact of a Building Code Requirement on Indian Reservations

A. Purpose and Context

Purpose: This section describes the impact of requiring building code compliance as part of the NFIP on Indian reservations.

Context: Many federally recognized tribal governments and Indian reservations do not have codified, legally enforceable building codes, but some codes influence reservation development indirectly.

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>
> 8) the impact of such a building code requirement on Indian reservations.

B. Findings

Finding #1. Indian reservations and tribes that participate in the NFIP and have not adopted current I-Codes would be affected by the inclusion of the codes in the NFIP. The primary impact on tribes that have not adopted I-Codes is that they would be required to adopt the codes and create a system to enforce them. Some Indian reservations have not adopted any building codes, some use legacy building codes (pre-I-Codes), and some have adopted the I-Codes. Some costs associated with administering building codes may be reimbursable with federal dollars (such as environmental review costs) and other costs may be covered by permit fees or absorbed within the current tribal structure.[22]

Finding #2. The potential benefits of including the I-Codes in the NFIP would be realized by Indian reservations, just as they would be by other jurisdictions. As stated in the Topic 3 findings, the building codes are effective in reducing flood-related damage because of specific mitigation provisions required for compliance, including primarily the inclusion of freeboard, foundation improvements, and mandatory verification of compliance.

C. Discussion

i. History

The U.S. Department of the Interior Bureau of Indian Affairs conditions funds provided to tribal governments on compliance with building codes, although the Bureau references the National Fire Protection Association's (NFPA) Building Construction and Safety Code (known as NFPA 5000 (NFPA, 2012) and some of its documents continue to refer to the "Uniform Building Code" (a legacy code that pre-dates the current model I-Codes).

When the HUD Office of Native American Programs published Tribal Housing Code under "Our Home: Providing the Legal Infrastructure Necessary for Private Financing" in 1996 (revised in

[22] http://www.tribal-institute.org/codes/part_six.htm

1999), most tribal governments had not formally adopted any form of building code (Rosser, 2006). Prior to the enactment of the *Native American Housing Assistance and Self-Determination Act of 1996*, as amended (25 U.S.C. §§ 4101 et seq), tribal housing ordinances had to receive the approval the Bureau of Indian Affairs before they could take effect. Today, however, the Tribal Law and Policy Institute encourage tribes to set overall policies to guide development, including the adoption of building codes. Funds provided under the *Native American Housing Assistance and Self-Determination Act of 1996* do not require any minimum building standards.[23]

For the purpose of participating in the NFIP, FEMA considers tribal governments to be communities and encourages those that have identified flood hazards to participate (FEMA, 2012). The NFIP Community Status Book[24] indicates that only 41 tribal governments participate in the NFIP which means they have adopted regulations that meet the minimum requirements of the NFIP. One hundred and four tribal governments do not participate despite being identified by FEMA as having special flood hazard areas. This source is not a definitive statement as to whether lands of other tribal governments and reservations are or are not subject to flooding. In the early years of the NFIP, many lands owned by tribal governments were likely not evaluated when the federal government prepared its initial identification of areas that are prone to flooding. In addition, although tribal governments are separate and distinct governments, it appears that many tribal lands are delineated on FIRMs prepared for counties.

The ICC reports that at least 40 federally-recognized tribes enforce building codes.[25] Some of those tribes enforce state building codes, some have adopted one or more of the I-Codes, several continue to use codes that pre-date the availability of the I-Codes, and a small number enforce "home-written" codes. Of the tribes that ICC identifies as enforcing codes, 11 also participate in the NFIP.

ii. Definitions and Background

According to the U.S. Department of the Interior, Bureau of Indian Affairs, the federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal treaty rights, lands, assets, and resources, as well as a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes and villages. The recently issued EO 13175 directs federal agencies to consult with tribal officials early in any federal regulation development.[26]

There are 566 federally recognized tribes and 34 state-recognized tribes as of August, 2012.[27] According to the Bureau of Indian Affairs, a federally recognized tribe is "an American Indian or Alaska Native tribal entity that is recognized as having a government-to-government relationship

[23] http://www.hud.gov/offices/pih/ih/regs/tribal_consultation_issues.cfm

[24] NFIP Community Information System (Tribal Nation Report), accessed December 16, 2012

[25] Personal communication, David Karmol, ICCSafe.org (October 5, 2012)

[26] See http://www.whitehouse.gov/the-press-office/memorandum-tribal-consultation-signed-president

[27] http://www.loc.gov/catdir/cpso/biaind.pdf

with the United States, with the responsibilities, powers, limitations, and obligations attached to that designation, and is eligible for funding and services from the Bureau of Indian Affairs." [28]

State Indian reservations are lands held in trust by a state for an Indian tribe. With state trust lands, the title is held by the state on behalf of the tribe. The lands are not subject to state property tax, but are subject to state law. State trust lands stem from treaties or other agreements between a tribal group and the state or colonial government(s) that preceded it.[29]

Within Indian reservations, there are a variety of ownership patterns based on treaties and tribal laws. Some of the parcels are unrestricted fee simple, whereas others may be restricted tribal trust or allotted trust land. In the case of the latter, the responsibility for compliance with any changes to the NFIP building code requirement would likely resort to the tribe or its designated housing entity. [30] Some tribes choose not to participate in the NFIP; instead they are self-insured and manage risk on their own outside the NFIP.

American Indian and Alaska Native tribes, businesses, and individuals may also own land as private property. In such cases, they are subject to state and local laws, regulations, codes, and taxation. Casinos are usually the most visible structures of a tribe and sometimes are located away from the actual reservation lands. If the state merely regulates a type of gaming, then the tribe can engage in it free of state control (National Congress of American Indians, undated).

Any casinos or gaming halls built by tribes must be on federally-recognized Indian lands that may be U.S. Trust lands close to, or within, an established city. In these cases, while tribes are not required to adhere to local land use laws, they may choose to do so in order to maintain good relations with the jurisdiction. Sometimes the sovereign land may be a parcel within an established city. In these cases, Indian tribes are required to enter into a compact with states and the gaming operations must conform to that compact (Dunstan, 1998). Local governments can only regulate activities on Indian lands, including U.S. Trust parcels within their jurisdiction, if there is a Memorandum of Understanding signed between the tribe and the local government.

iii. Adherence of Tribes to Building Codes

State-recognized Indian tribes adhere to the local building codes, while federally recognized tribes may or may not. Whether tribes have adopted their own codes or enforce local or state building codes, they would be affected by the inclusion of codes in the NFIP under some federal rules. The Tribal Law and The Tribal Law and Policy Institute advises the following:[31]

- The federal rules governing implementation of the *Native American Housing Assistance and Self-Determination Act of 1996* may contain requirements that could be addressed in building codes. Tribes must comply with NFIP requirements under the *Flood Disaster Protection Act of 1973* as amended (42 U.S.C. §§ 4001 et. seq); they must not acquire, construct, or rehabilitate structures in a flood hazard area unless the community is part of the NFIP or it has been less than a year since FEMA notification.

[28] http://www.bia.gov/FAQs/index.htm.

[29] http://www.bia.gov/FAQs/index.htm

[30] From http://www.hud.gov/offices/adm/hudclips/handbooks/hsgh/4150.2/41502appcHSGH.pdf

[31] http://www.tribal-institute.org/codes/part_six.htm

- HUD's review for compliance with performance measures may include on-site evaluation of the quality of work performed and building codes may be a mechanism to have builders, owners, and inspectors gather the necessary information.

- Section 184 of the *Indian Housing Loan Guarantee Program of the Housing and Community and Development Act of 1992,* as amended (12 U.S.C. § 1515z-13a) administered by HUD requires that flood insurance be obtained if a property is in an area mapped by FEMA as an SFHA.[32]

[32] http://www.hud.gov/offices/pih/ih/homeownership/184/processing/chap4.htm#4_12

XI. Future Needs

The range of topics covered in this study are a diverse mix of policy and technical considerations, some of which have little or no precedent research but which are affirmed by subject matter expert opinion. This section describes data needs that would help refine the evaluation of the impacts, effectiveness, and feasibility of including the building codes in the NFIP. The level of effort to pursue many of these identified future needs may not be justified solely for the purposes of this study, but may be useful for other purposes. The activities and studies identified in this report section are not currently funded.

Topic 1: Regulatory, Financial, and Economic Impacts of Including Building Codes in Floodplain Management Criteria

Enforcement Impacts on Building Performance: Given that an identified primary benefit of incorporating building codes into the NFIP is improved enforcement, a significant need is to develop a means to measure and link degrees of enforcement to changes in building performance. The BCEGS enforcement data provides a relative view on a range of enforcement effort and may be useful in a study to develop the needed enforcement performance metric. Results could be followed with a national trends analysis and monitoring.

Building code and land used combined impacts study: In addition, a comprehensive study for evaluating building code impacts with land use planning, zoning, and growth management in a community would be beneficial.

Topic 2: Resources Required of State and Local Communities to Administer and Enforce Building Codes

Costs for Administering and Enforcing Building Codes: The costs for administrative infrastructure, including personnel, have not been studied in a comprehensive manner. It appears that providing for public health, safety, and welfare through enforcement of building codes is a widely-accepted premise that detailed analyses of those costs are not generally performed. A study of the approaches used nationwide would allow sharing of best practices. The examples of costs used in this report are based upon a just few locations where data was available. Some data about the anticipated costs associated with managing a state-level building agency or commission may be available from states that have enacted legislation establishing those entities within the last few years. Those states that have long-standing agencies or commissions could be queried as to the resources necessary to provide various levels of service.

Topic 3: The Effectiveness of Building Code Requirements in Reducing Flood-Related Damage to Buildings and Contents

Benefit-Cost Analysis of Code Adoption: The revision of the building codes by the ICC every three years follows a deliberative process to gain consensus (*see* Topic 5). These deliberations involve documentation of each code change proposal, including statements regarding costs and benefits. More studies of communities implementing code provisions would help identify approaches to meet a range of differing community risks and needs. The ongoing FEMA

building code loss reduction Hazus pilot study which focuses on benefits could be expanded beyond loss reduction to include an evaluation of code costs.

Topic 4: The Impacts of Building Code Requirements on the Actuarial Soundness of the NFIP

Effects of Reduced Losses on Actuarial Soundness: Aside from the findings of this report, there have been no studies of the effect of code changes on the actuarial soundness of the NFIP. FEMA's on-going studies of the reduced losses when communities adopt building codes could include an extrapolation to assess the effects of such code adoption on the actuarial soundness of the NFIP**.** Also, FEMA is undertaking a study with Texas A&M University to compare the reduced losses of CRS versus non-CRS communities, expected to be completed late 2014. An element of this study may assess the effectiveness of above-code requirements that exceed the minimum NFIP requirements.

Topic 5: Innovative Materials and Systems for Flood-Resistant Construction

Studies on Use of Flood-Resistant Materials and Systems: There is only limited supporting data about the successful use of innovative materials and systems for flood resistant construction. Most of the available information on alternate materials and methods is prepared as part of the evaluation process for newly developed materials and systems. This information, however, does not explicitly address whether such materials and systems meet the NFIP and building code expectation for flood-damage resistant materials. These reports typically do not provide a comparison between different products or practices and how those materials will perform in the built environment. Post-disaster evaluations of how alternate materials and methods are used would allow analysis of the benefits of their use.

Topic 6: The Feasibility and Effectiveness of Providing an Incentive by Lowering Premium Rates for Flood Insurance Coverage under Such Act

Feasibility and Effectiveness of Lowering Insurance Rates: Studies are needed to specifically address the impact of lowering premium rates. Future studies regarding actuarial soundness identified for Topic 4 can also be extrapolated to determine effects on insurance rates.

Topic 7: The Impact of Building Code Requirements on Rural Communities Differs from Building Code Challenges in Urban Communities

Impacts to Rural Communities: As an extension of the future needs identified for Topic 2, additional research on rural versus urban impacts, local practices, and variations in requirements across a variety of regions with different characteristics of flooding could help identify efficient best practices for sharing nationwide.

Topic 8: The Impact of a Building Code Requirement on Indian Reservations

Impacts to Indian Reservations: A FEMA study in progress will addresses overall FEMA program impacts on Indian reservations. The study is not yet available, and will supersede impacts identified herein, if conflicting.

Appendix A: Background

A.1 Purposes and Overview of the National Flood Insurance Program

A.2 Working Group Participants and Questions

A.3 Significant Federal Regulations (from FEMA Office of Chief Counsel)

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the findings, which are in the main report.

A.1 Purposes and Overview of the National Flood Insurance Program

The following section provides background and context for the NFIP and its relationship with the building codes. The original authorizing legislation for the NFIP was passed in 1968. Congress expressly found that "a program of flood insurance can promote the public interest by encouraging sound land use by minimizing exposure of property to flood losses..." (FEMA, 2004).

The NFIP is administered by FEMA, which is part of the Department of Homeland Security. The NFIP is intended to encourage States and local governments to recognize and incorporate flood hazards in their land use and development decisions. In some communities, this is achieved by guiding development to areas with lower risk. When a proposal is made to develop within a flood hazard area, application of the criteria set forth in Federal regulation (Title 44 Code of Federal Regulations [CFR] Section [§] 60.3) is intended to minimize exposure and flood-related damage. The NFIP regulations broadly define the term "development" at 44 CFR 59.1: "Development means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials."

More than 21,800 local governments currently participate in the NFIP and many of them have enforced floodplain management regulations for decades. Participating jurisdictions must incorporate at least the minimum NFIP requirements in their floodplain management regulations.

The NFIP has three main elements:

Hazard identification and mapping, in which engineering studies are conducted and flood maps are prepared to delineate areas predicted to be subject to flooding under certain common set of conditions;

Floodplain management criteria, which establish the minimum requirements for communities to adopt and apply to development within mapped flood hazard areas; and

Flood insurance, which provides financial protection for property owners to cover flood related damage to buildings and contents.

Federal flood insurance is designed to provide an alternative to disaster assistance and disaster loans for home and business owners. Disaster assistance usually covers only a portion of the costs to repair and clean up. Although available to qualified victims, disaster loans do not significantly ease the financial burden because of repayment terms. Disaster assistance, including temporary housing, is available only after floods have been declared major disasters by the President of the United States. In contrast, flood insurance claims will be paid any time damage from a qualifying flood event occurs.

An important objective of the NFIP is to break the cycle of flood damage. Many buildings have been flooded, repaired or rebuilt, and flooded again. In some parts of the country, this cycle occurs every few years. Before communities adopted floodplain management regulations, people tended to rebuild in the same flood-prone areas using the same construction techniques that did not adequately protect the structure when the first event occurred. To obtain NFIP funding, structures must be rebuilt to NFIP floodplain management requirements, which experience, on average, 80 percent less damage through reduced frequency of inundation and severity of losses.

By encouraging communities to guide development to lower risk areas, and by requiring the elevation of new buildings and existing buildings when owners propose significant improvement or when such buildings have sustained substantial damage, the long-term NFIP objective of reducing flood damage and losses is being realized. Older buildings that are required to comply with NFIP requirements may be removed, replaced, upgraded, or modified with techniques that lead to little or no flood damage.

The NFIP establishes distinct responsibilities for the Federal, state, and local levels of government:

Communities are responsible for regulating all development in mapped flood hazard areas, issuing permits, and enforcing the requirements, including requirements for improvements and repairs of existing buildings.

States generally are responsible for providing technical assistance to communities, monitoring community programs, and coordinating efforts between communities and the NFIP. Some states also administer regulatory programs and many are engaged in flood hazard mapping initiatives.

FEMA, through administration of the NFIP, promulgates the minimum regulatory requirements, supports state programs, provides technical assistance, monitors community programs, and produces flood hazard maps.

i. The National Flood Insurance Requirements for Buildings

The NFIP performance statement for flood-resistant construction at 44 CFR § 60.3(a)(3) requires communities to:

> Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall
>
> (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy,
>
> (ii) be constructed with materials resistant to flood damage,
>
> (iii) be constructed by methods and practices that minimize flood damages, and

(iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Further, the regulations identify specific requirements for buildings based on the nature of Special Flood Hazard Areas (SFHAs).[33] SFHAs are identified on Flood Insurance Rate Maps (FIRMs) as those areas subject to high-velocity wave action where wave heights of 3 feet and higher are predicted (these areas are labeled "Zone V" on FIRMs) and those areas not subject to such waves (labeled "Zone A" on FIRMs). In general, all buildings are required to be elevated and otherwise protected to resist damage associated with the base flood (commonly called the 100-year flood). In addition to requirements set forth in the performance statement at 44 CFR § 60.3(a)(3), communities are required to ensure that buildings meet the specific requirements based on flood zone:

60.3(c) – In Zone A, buildings shall have lowest floors elevated to or above the base flood elevation (BFE) (nonresidential buildings may be dry floodproofed in lieu of elevation). Enclosures below buildings in Zone A are required to have flood openings to permit the automatic entry and exit of flood waters to minimize unequal pressure that could cause structural damage to walls and foundations.

60.3(e) – In Zone V, buildings shall be elevated on columns or pilings such that the bottom of the lowest horizontal structural member of the lowest floor is elevated to or above the BFE. Enclosures with walls below buildings in Zone V are required to have walls that are designed to break away under specific flood loads to minimize the potential for damage to foundations.

ii. Introduction to the International Code Series

The International Code Series (I-Codes) is developed and maintained by the International Code Council, Inc. (ICC). The series, referred to as the I-Codes, is a family of coordinated codes that are designed to work together. The dominant codes, in use by the majority of government entities that enforce codes, are the International Building Code (IBC) and the International Residential Code (IRC). Other codes in the family are the International Existing Building Code (IEBC), International Mechanical Code, International Plumbing Code, International Fuel Gas Code, ICC International Performance Code, International Green Construction Code, International Swimming Pool and Spa Code, and others.[34]

The fundamental purpose of a building code is to protect public health, safety, and welfare. The IBC and IRC have the same purpose statement: ". . . to establish minimum requirements to safeguard the public safety, health and general welfare, through structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation and safety to life and property from fire and other hazards attributed to the built environment . . ."

[33] SFHAs are subject to flooding by the base flood, which is the flood having a 1-percent chance of being equaled or exceeded in any given year (commonly called the "100-year" flood).

[34] www.iccsafe.org

Taken together, the IBC and IRC can govern the design and construction of all buildings and structures.[35] Many jurisdictions also adopt the IEBC, which applies to existing buildings. The following scopes define the application of each code:

> **IBC 101.2 Scope.** The provisions of the *International Building Code* shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures. The IBC does not apply to dwelling within the scope of the IRC.
>
> **IRC R101.2 Scope.** The provisions of the *International Residential Code for One- and Two-family Dwellings* shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures.
>
> **IEBC 101.2 Scope.** The provisions of the *International Existing Building Code* shall apply to the repair, alteration, change of occupancy, addition, and relocation of existing buildings.

iii. Relationship between NFIP and the I-Codes

Beginning in the early 1990s, three major model building code development organizations agreed to work together to establish the ICC and to develop the I-Codes. FEMA participated from the outset to incorporate flood provisions for buildings and structures.

The I-Codes that currently have flood provisions are the IBC, IRC, IEBC, International Mechanical Code, International Plumbing Code, International Fuel Gas Code, International Fire Code, and ICC Performance Code. Most states and local jurisdictions that adopt and enforce building codes base their codes on the I-Codes.

According to FEMA, the flood provisions in the 2009 and 2012 I-Codes are consistent with NFIP requirements for buildings and structures, and communities can therefore rely on the I-Codes to fulfill some of the requirements they must meet to participate in the NFIP.[36] This statement has been described as providing communities a "safe harbor," allowing reliance on the codes as part of community participation in the NFIP.

The I-Codes achieve consistency with NFIP regulations for buildings and structures in large measure through reference to the American Society of Civil Engineers (ASCE) standard ASCE 24-05, *Flood Resistant Design and Construction*. FEMA prepared excerpts of the flood

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[35] Many states exempt specific buildings and structures from the codes. The most common exemptions are agricultural buildings and non-building facilities of utility companies.

[36] http://www.fema.gov/building-science/building-code-resources

provisions of the 2009 and 2012 I-Codes and a comparison of the 2009 I-Codes, ASCE 24, and NFIP requirements.[37]

Because the I-Codes contain provisions that are consistent with NFIP requirements for buildings and structures, in large part by references to ASCE 24-05 and ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*, states and communities have two primary tools for regulating development in flood hazard areas to participate in the NFIP: building codes that govern the design and construction of buildings and structures and floodplain management regulations that satisfy all other NFIP requirements for participation, including an administrative framework and specifications for regulation of all development other than buildings. Communities that enforce both building codes and floodplain management regulations should ensure that the codes and regulations are coordinated and designed to work together (Figure A-1).

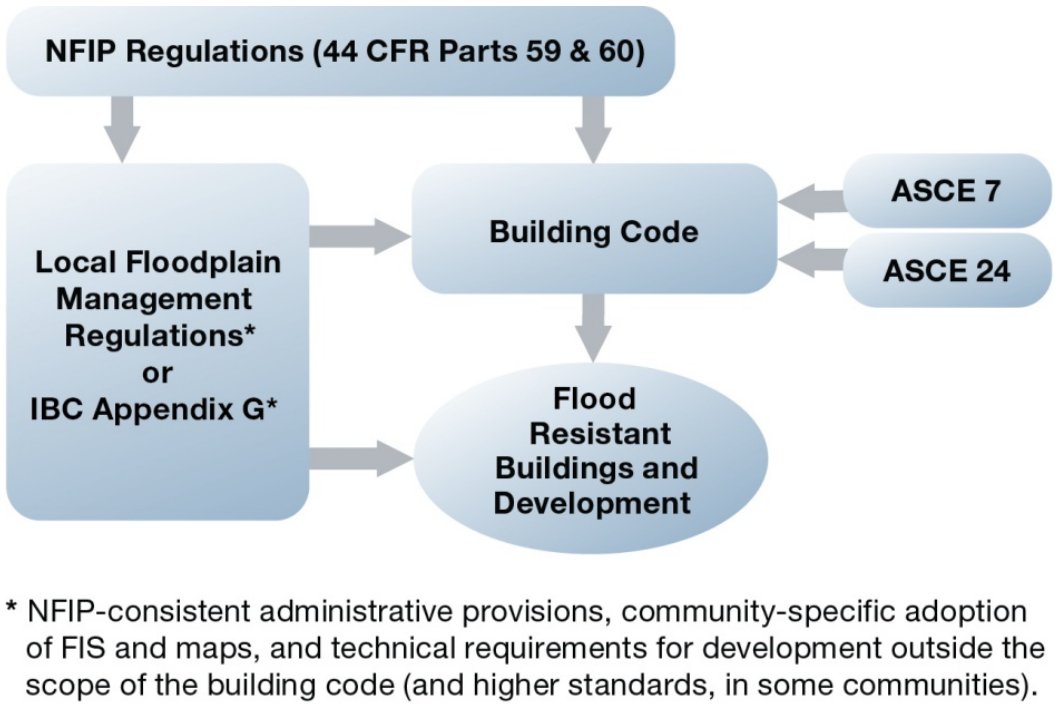

Figure A-1: Coordinating local flood regulations and building codes

A.2 Working Group Participants and Report Reviewers

This section includes a list of participants and questions used during the intensive 1-day working group meeting held on Friday, September 28, 2012, in Crystal City, VA. The working group participants include FEMA representatives, industry leaders, and subject matter experts in building codes, construction materials, building science, flood insurance, economics, legal, floodplain management, hazard mitigation, and engineering practices. They discussed the possible approaches for each stakeholder group and decided what different approaches and

[37] http://www.fema.gov/building-science/building-code-resources

methodologies should be used to evaluate the impacts of the code changes. Some of the working group participants provided comments through teleconference calls and follow up emails. A list of working group participants is provided in Table A-1.

Table A-1: Working Group Participants and Report Reviewers

Affiliation
FEMA, Office of Chief Council, Regulatory Affairs Division
Dewberry
Insurance Service Organization, Inc.
National Association of Home Builders
URS Group, Inc.
National Association of Mutual Insurance Companies (NAMIC)
FEMA, Office of Chief Council, Regulatory Affairs Division
Institute for Building Technology and Safety
FEMA, FIMA, Risk Insurance Division
FEMA, Office of Chief Council, Regulatory Affairs Division
Insurance Service Organization, Inc
H2O Associates
FEMA, FIMA, Risk Reduction Division
Chris Jones Assoc.
FEMA, FIMA, Risk Reduction Division
FEMA, FIMA, Risk Reduction Division
FEMA, FIMA, Risk Reduction Division
Institute for Building Technology and Safety
Association of State Floodplain Managers, Inc.
URS Group, Inc.
URS Group, Inc.
Greenhorne & O'Mara (G&O)
FEMA, Office of Chief Council, Regulatory Affairs Division
RC Quinn Consulting
Institute for Business and Home Safety
URS Group, Inc.
FEMA, FIMA, Risk Reduction Division
URS Group, Inc.
National Hazard Mitigation Association
FEMA, FIMA, Risk Reduction Division
FEMA, FIMA, Risk Reduction Division
National Ready Mixed Concrete Association
FEMA, FIMA, Risk Reduction Division
International Code Council

i. Working Group Questions

The following represents the goals provided to the working group participants and questions posed in a facilitated process to elicit responses and relevant exchange.

Discussion Points

1. Overview: What is your current vision of the study methodology?

   What do you think is the intended outcome of this provision of the NFIP reform act?

   Based on your individual experience, what do you think is an effective way to include building codes in floodplain management criteria?

   Can you identify any examples of private-sector codes and standards adopted into or referenced by federal statutes or regulations relating to infrastructure and hazard mitigation?

2. Feasible preliminary plan (*see questions in each Topic)*

3. Impacts analysis methodology development (*In Breakouts*)

   What do you think is needed to develop an analysis methodology of evaluating code impacts? (i.e., Issues, Strategies, Questions, and Actions)

   In your opinion, what would be the outcomes of an ideal alternative method? Provide a hand sketch of the process and final product.

4. Preferred plan development

   What are three features you would like to incorporate in the study methodology?

   How do you think a preferred plan could be decided?

   What do you think could be the level of detail of the method? (i.e. degree of prior study evidence vs. expert opinion and mix of quantitative and qualitative findings)

5. Collaboration and rapid feedback loop

   What disciplines do you believe would help to compare alternative methods?

   What other partners do you think FEMA could consult?

6. Final Working Group

   How do you think FEMA's findings could be conveyed in the congressional report? (i.e. messaging, format, graphics and tables, process vs. outcome)

   What do you think are three future study needs for anticipated gaps or uncertainty in determining the requested code impacts?

Questions for Topics

<u>Topic 1</u> – Impacts of building code requirements on homeowners, states and local governments, local land use policies, and FEMA

1. Overall

   1.1 What prior studies assessing impacts of the building code requirements are you aware of? What are their key findings?

   1.2 What do you believe are the key differences between the building codes and NFIP provisions?

   1.3 From your prospective, how do those difference influence construction and repairs?

   1.4 How does the framework and boundary of this study look to you? Consider

   - Regulatory boundaries on the study
   - Economic framework (direct/indirect; first/secondary; local/regional/national)
   - Financial framework (life cycle costs and benefits of code adoption)

2. Financial and Economic Impacts

   1.1 What do you think are suitable established approaches to estimate direct financial impacts to each of the above stakeholder groups? (i.e., maintenance costs, construction costs, tax revenues, code administration, NFIP budgeting)

   1.2 What modeling or data gaps do you think can be supported by expert opinion methods?

   1.3 How would your preferred scenario be administered by FEMA?

   1.4 How do you think a life-cycle cost and benefits analysis of building code compliance could be performed to support the financial and economic benefit of codes?

   1.5 Do you know of available studies or do you have an expert opinion on benefits of hazard resistant provisions of building codes (including avoided building damages, contents, displacement, and loss of function impacts)? What are the key findings?

   - ***Homeowners*** **–** Are you aware of any recent studies of costs of meeting building codes whenever new codes or additional requirements are introduced? What are they, and what are their key findings?
   - ***Local Governments*** **–** What studies that evaluate the added costs to local governments for implementing building codes are you aware of? What are the key findings?
   - ***State Government*** **–** What studies or methods for determining costs or benefits associated with establishing a state code agency are you aware of? What are the key findings?

- ***FEMA and Other Agencies*** – What studies or methods to determine the impacts to FEMA of administering the code requirements within the NFIP are you aware of? (i.e., testing, guidance, performance evaluations, and training/awareness)

<u>Topic 2</u> – Resources required of state and local communities to administer and enforce building code requirements

1.1 What methods of code adoption and enforcement do you think could be encouraged by this study?

1.2 What do you think are preferred financing methods for operating building departments?

1.3 In your experience, what are challenges that local building departments are faced with in code administration and enforcement? (i.e., training, administrative conflicts, delays, understaffing, fees, challenges from dual departments)

1.4 What is the experience in states that currently incorporate mandatory code compliance related flood provisions?

1.5 What do you think are the pros and cons of a joint building department and NFIP program office?

<u>Topic 3</u> – The effectiveness of such a building code requirement in reducing flood-related damage to buildings and contents

1.1 What studies determining effectiveness of codes in reducing flood damage are you aware of? What are the key findings?

1.2 How do you determine and rank which code items to measure to develop a methodology?

1.3 How would you extrapolate and aggregate those items to impacts on a regional and national level?

1.4 How do you think FEMA can measure differences in code inspection and enforcement practices?

1.5 How do you think FEMA could approximate structure performance in estimating losses avoided for this study? (i.e., Benefit-Cost Analysis, Depth Damage Functions, future floodplain construction practices)

1.6 How do you think FEMA could evaluate and convey future conditions as building inventory changes over time?

1.7 What procedure would you recommend for data or methodology gap coverage?

1.8 What aspects of complying with model codes might work against reducing flood losses?

<u>Topic 4</u> – The impact of such a building code requirement on the actuarial soundness of the NFIP

1.1 What studies evaluating code impacts or other relevant mitigation impact on actuarial soundness are you aware of? What are the key findings and outcomes? (i.e., changes in claims, NFIP participation, or insurance rates)

<u>Topic 5</u> – The effectiveness of nationally recognized codes in allowing innovative materials and systems for flood-resistant construction

1.1 What studies where codes have effectively encouraged use of innovative materials and systems are you aware of? What are the key findings and outcomes?

1.2 From your prospective how do standards help or hinder the ease of the innovations and comparison of alternatives?

<u>Topic 6</u> – The feasibility and effectiveness of providing an incentive in lower premium rates for flood insurance coverage under such Act

1.1 What prior studies or examples of incentivizing lower insurance rates through hazard resistant building codes or other mitigation measures are you aware of? What are the key findings and how is the actuarial soundness conveyed?

<u>Topic 7</u> – The impact of such a building code requirement on rural communities with different building code challenges than urban communities

1.1 What code implementation case studies for rural communities or cooperation between rural communities are you aware of? What were the key findings?

1.2 What criteria and procedures do you think could be used to define relevant rural community criteria for this study (i.e., Small Business Administration, Office of Management and Budget, census, etc.)?

1.3 Can you provide some examples of rural communities with resources to carry out code requirements or those without sufficient resources?

<u>Topic 8</u> – The impact of such a building code requirement on Indian reservations

1.1 What prior studies have you participated in developing building codes on Indian Tribal lands?

1.2 Based on your knowledge what do you think are some extraordinary challenges that Indian Tribal organizations will be faced with in building code adoption?

A.3 Significant Federal Regulations

The information in this subsection was provided by the FEMA Office of Chief Counsel.

When issuing major rules, federal agencies must generally comply with the *Administrative Procedure Act* (5 U.S.C. §§ 701–708) and a number of other broadly applicable procedural and analytical requirements specified in law. There are 17 broadly applicable statutes and executive orders with rulemaking requirements that federal agencies should review but this appendix provide only significant federal regulations to the proposed legislation.

i. Executive Order 11988, Floodplain Management

Executive Order 11988, Floodplain Management, requires Federal agencies to apply a decision making process to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid the direct or indirect support of floodplain development whenever there is a practicable alternative. In accomplishing this objective, each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for the following actions:

- acquiring, managing, and disposing of federal lands and facilities;
- providing federally-undertaken, financed, or assisted construction and improvements, <u>including critical facilities</u>; and
- conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

In 1978, the Water Resources Council issued Floodplain Management Guidelines for implementing Executive Order 11988. The guidelines provide an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to or within the floodplain. If there is no practicable alternative, the Federal agency must take steps to minimize any adverse impacts to life, property, and the natural and beneficial functions of floodplains. *See* 44 CFR § 9.6(b).

ii. Executive Order 12866, Regulatory Planning and Review

Pursuant to Executive Order 12866, FEMA must determine whether a rule is a significant regulatory action using the criteria listed in the Executive Order. If the rule is a significant regulatory action, it must be reviewed by the Office of Management and Budget (OMB) before it can be effective. FEMA must explain why the rulemaking is or is not a significant regulatory action.

The Executive Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more, or may adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

A rule that falls under category (1) is also known as an "economically significant" regulatory action. FEMA must do an in-depth cost/benefit analysis for any economically significant regulatory action. The analysis must include an assessment of benefits anticipated from the regulatory action together with, to the extent feasible, a quantification of those benefits, and an assessment of costs anticipated from the regulatory action together with, to the extent feasible, a quantification of those costs. The analysis must also include an assessment of the costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation. *See* Executive Order 12866, § 6(a)(3)(C).

iii. Regulatory Flexibility Act

Under the *Regulatory Flexibility Act of 1980* (5 U.S.C. §§ 601–612), FEMA would evaluate and consider whether any rulemaking would have a significant economic impact on a substantial number of small entities. The term "small entities" comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

FEMA would identify the type of small entities, if any, that a rulemaking would affect and explain why, and would describe all requirements for compliance with the rulemaking that would affect small entities, including an estimate of the type of professional skills necessary for compliance.

iv. Unfunded Mandates Reform Act

The *Unfunded Mandates Reform Act of 1995*, as amended (2 U.S.C. §§ 658, 1501–1504, 1531–1536, 1571), pertains to any proposed rulemaking which implements any rule that includes a Federal mandate that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. *See* 2 U.S.C. § 1532. Under the provisions of this Act, an agency must prepare a written statement which addresses a list of criteria found at 2 U.S.C. §§ 1532 and 1535. The criteria include an assessment of the anticipated costs and benefits of the Federal mandate, including the costs and benefits to State, local, and Tribal governments or the private sector, the effect of the Federal mandate on health, safety, and the natural environment, an estimate of the future compliance costs of the Federal mandate, any disproportionate budgetary effects of the Federal mandate upon any particular regions of the nation or particular State, local, or Tribal governments, urban or rural or other types of communities, or particular segments of the private sector, and estimates of the effect on the national economy. A summary of this statement is required to be included in the proposed and final rulemaking document. *See* 2 U.S.C. § 1532(b).

The Unfunded Mandates Reform Act also applies to any regulatory requirements that might significantly or uniquely affect small governments. *See* 2 U.S.C. § 1533. "Small government" has the same meaning as "small governmental jurisdiction" defined at 5 U.S.C. § 601(5). Before establishing any such requirements, an agency must develop a plan under which the agency would provide notice of the requirements to potentially affected small governments, enable officials of affected small governments to provide meaningful and timely input in the development of regulatory proposals containing significant Federal intergovernmental mandates, and inform, educate, and advise small governments on compliance with the requirements. *See* 2 U.S.C. § 1533(a).

v. National Environmental Policy Act

The *National Environmental Policy Act of 1969* (NEPA), as amended (42 U.S.C. §§ 4321, 4331–4335, 4344, 4365), declares that it is the policy of the Federal Government to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. *See* 42 U.S.C. § 4331(a). The Act states that it is the continuing responsibility of the Federal Government to use all practicable means to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations,

2. assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings,

3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences,

4. preserve important historic, cultural, and natural aspects of our national heritage, and maintain wherever possible, an environment which supports diversity and variety of individual choice,

5. achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities,

6. and enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. *See* 44 U.S.C. § 4331(b)(1)-(6).

For a rulemaking, i.e., a major federal action, that would significantly affect any of the above listed items, in other words, that would "significantly affect the quality of the human environment." FEMA would prepare a detailed statement addressing the environmental impact of the regulation. *See* 42 U.S.C. § 4332(2)(C), 44 CFR § 10.8. FEMA's regulations addressing NEPA are at 44 CFR Part 10.

vi. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 65 FR 67249, November 9, 2000, applies to agency policies that have tribal implications. This includes regulations that have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes. The Executive Order requires agencies to adhere to fundamental principles, listed in Section 2 of the Executive Order, in formulating and implementing such regulations. For example, the principles state that the United States has a unique legal relationship with Indian tribal governments, that the United States has recognized the right of Indian tribes to self-government, and that the United States supports tribal sovereignty and self-determination.

In addition to adhering to the fundamental principles in Section 2 of the Executive Order, agencies must adhere to a list of criteria in Section 3 of the Executive Order. For example, when undertaking to formulate and implement regulations that have tribal implications, an agency must encourage Indian tribes to develop their own policies to achieve program objectives, where possible, defer to Indian tribes to establish standards, and, in determining whether to establish Federal standards, consult with tribal officials as to the need for Federal standards and any alternatives that would limit the scope of Federal standards or otherwise preserve the prerogatives and authority of Indian tribes.

Under Section 5 of the Executive Order, to the extent practicable and permitted by law, no agency shall promulgate any regulation that has tribal implications, that imposes substantial direct compliance costs on Indian tribal governments, and that is not required by statute, unless funds necessary to pay the direct costs incurred by the Indian tribal government or the tribe complying with the regulation are provided by the Federal Government, or the agency, prior to the formal promulgation of the regulation, consults with tribal officials early in the process of developing the proposed regulation, includes a tribal summary impact statement in the preamble to the rulemaking which will be published in the *Federal Register*, and makes available to OMB any written communications submitted to the agency by tribal officials.

vii. Executive Order 13132, Federalism

Executive Order 13132, Federalism 64 *Fed. Reg.* 43255 (August 10, 1999), provides guidelines for Federal agencies issuing "policies that have federalism implications." Such policies include regulations that have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. *See* Executive Order 13132, § 1(a). If a regulation has federalism implications, an agency must adhere to the fundamental federalism principles listed in section 2 of the Executive Order. For example, the national government has specific enumerated powers as defined by the Constitution; all other sovereign powers are reserved to the States or to the people. Acts of the national government that exceed the enumerated powers violate the principle of federalism established by the Framers of the Constitution. *See* Executive Order 13132, § 2(b), (g).

Agencies also must adhere to the criteria listed in Section 3 of the Executive Order when promulgating regulations with federalism implications. For example, an agency must closely examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and shall carefully assess the necessity for such action. *See* Executive Order 13121, § 3(a).

There are additional guidelines in section 4 of the Executive Order that apply when a statute allows for preemption of State law. Finally, section 6 of the Executive Order requires each agency to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. Section 6 mandates that, to the extent practicable and permitted by law, no agency shall promulgate any regulation that has federalism implications, that imposes substantial direct compliance costs on State and local governments, and that is not required by statute, unless the agency, prior to formal promulgation of the regulation, consulted with State and local officials early in the process of developing the proposed regulation, provides a federalism summary impact statement in the preamble to the regulation published in the Federal Register, and makes available to OMB any written communications submitted to the agency by State and local officials.

viii. Office of Management and Budget Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, dated February 10, 1998

"Voluntary consensus standards" are standards developed or adopted by voluntary consensus standards bodies, both domestic and international. These standards include provisions requiring that owners of relevant intellectual property have agreed to make that intellectual property available on a non-discriminatory, royalty-free or reasonable royalty basis to all interested parties. OMB Circular A-119 directs agencies to use voluntary consensus standards in their regulatory actions in lieu of government-unique standards except where inconsistent with law or otherwise impractical. The policies in the Circular are intended to reduce to a minimum the reliance by agencies on government-unique standards.

If an agency is issuing or revising a regulation that contains a standard, the agency must follow these procedures (Section 11):

a. Publish a request for comment within the preamble of a Notice of Proposed Rulemaking (NPRM) or Interim Final Rule (IFR). Such request must provide the appropriate information, as follows:

(i) When an agency is proposing to use a voluntary consensus standard, provide a statement which identifies such standard.

(ii) When an agency is proposing to use a government-unique standard in lieu of a voluntary consensus standard, provide a statement which identifies such standards and provides a preliminary explanation for the proposed use of a government-unique standard in lieu of a voluntary consensus standard.

(iii) When an agency is proposing to use a government-unique standard, and no voluntary consensus standard has been identified, a statement to that effect and an invitation to identify any such standard and to explain why such standard should be used.

b. Publish a discussion in the preamble of a final rule that restates the statement in the Notice of Proposed Rule Making or Interim Final Rule, acknowledges and summarizes any comments received and respond to them, and explains the agency's final decision. This discussion must provide the appropriate information, as follows:

(i) When a voluntary consensus standard is being used, provide a statement that identifies such standard and any alternative voluntary consensus standards which have been identified.

(ii) When a government-unique standard is being used in lieu of a voluntary consensus standard, provide a statement that identifies the standards and explains why using the voluntary consensus standard would be inconsistent with applicable law or otherwise impractical. Such explanation must be transmitted in accordance with the requirements of Section 9a of OMB Circular A-119.

(iii) When a government-unique standard is being used, and no voluntary consensus standard has been identified, provide a statement to that effect.

Appendix B: Supporting Material for Topic 1

Regulatory, Financial, and Economic Impacts of Including Building Codes in Floodplain Management Criteria

B.1 FEMA and State Review of Local Requirement

B.2 States and Communities that Enforce Building Codes

B.3 NFIP/ASCE Checklist

B.4 State and Local Code Adoption Will Increase Consistency with NFIP and Require Monitoring

B.5 Four Cost Categories

B.6 Contrasting Views of Costs and Benefits of Building Codes

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the findings, which are in the main report.

B.1 FEMA and State Review of Local Requirements

One benefit of enforcing the NFIP-consistent requirements for buildings and structures in the International Code Series (or I-Codes) is ease of review. Between FEMA Regional Offices and the states, between 700 and 800 Community Assistance Visits are conducted each year (FEMA, 2011b). A key work element of these visits requires a detailed review of the community's floodplain management ordinance. Similarly, reviewing local ordinances is a key work element when FEMA issues revised Flood Insurance Studies and Flood Insurance Rate Maps, triggering a regulatory requirement for communities to ensure ordinances meet the NFIP minimum requirements. This effort is ongoing across the United States, with numerous map revision-related ordinance reviews conducted each year.

The level of effort necessary to review local ordinances should be reduced for communities that enforce the 2009 or 2012 I-Codes because the requirements for buildings and structures have already been deemed consistent with the NFIP requirements.

As a consequence, once FEMA determines that the flood provisions of a state's building code meet the NFIP requirements, then every community in the state that is either required to enforce, or that elects to enforce (if enforcement is not required) can be deemed to meet the NIFP requirements for buildings. The FEMA and state reviews can then focus on companion ordinances or Appendix G of the International Building Code (IBC) to ensure that all other requirements of the NFIP are satisfied. This simplifies the responsibility of states and FEMA staff to review local regulations each time a Community Assistance Visit is conducted and each time a flood study or map is revised. However, FEMA is aware that only a few states have modified their model floodplain management ordinances to explicitly coordinate with the I-Codes and are in the process of working with communities to adopt the new model.

B.2 States and Communities that Enforce Building Codes

There is no single, definitive source that identifies and describes every permutation of adoption and enforcement of building codes. To develop an estimate of the total number of states and communities that currently adopt and enforce building codes, FEMA used the following sources augmented with information acquired in recent years delivering training on the flood provisions of the I-Codes:

FEMA maintains the NFIP Community Status Book that lists every community that participates in the NFIP and communities that have been identified as prone to flooding but that have elected to not participate (or have been suspended). These data do not include communities that do not have identified Special Flood Hazard Areas (SFHAs) and thus is not a list of all counties and incorporated municipalities in the United States. The Community Status Book is online

at www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book (accessed November 14, 2012).

The International Code Council (ICC) maintains reports on state and jurisdiction adoption of the codes. The data are self-reported by each state and jurisdiction that elects to submit and data are not verified by ICC. The charts are revised monthly. For the most part, "jurisdiction" refers to local governmental entities, but many fire districts and some state agencies are included. Reports are available at http://www.iccsafe.org/gr/Pages/default.aspx (report dated October 2012).

The Association of State Floodplain Managers, Inc. surveys NFIP State Coordinating Agencies every few years to produce reports on the state of floodplain management. The most recent, *2010 State and Local Programs*, includes data for three questions related to building codes (identified as questions 72, 72.1, and 73). Some states did not respond to the survey, while others did not answer every question. The report is available at http://www.floods.org/index.asp?menuID=732&firstlevelmenuID=186&siteID=1 (accessed October 2012).

The Insurance Service Organization, Inc. (ISO) administers the Building Code Effectiveness Grading Schedule (BCEGS). Data on code adoption and enforcement are provided by local jurisdictions[38] and used to assess the building codes in effect in each participating community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Under a cooperative agreement with ISO, FEMA has access to certain data on adoption of codes and use of the flood provisions in those codes. For more information, *see* http://www.isomitigation.com/bcegs/0000/bcegs0001.html.

Based on the available information, FEMA assumes that every community in the 22 states identified in Table B-1, the District of Columbia, Guam, Northern Marianas, Puerto Rico, and the U.S. Virgin Islands either enforce state-adopted codes that are based on the IBC / International Residential Code (IRC) (and International Existing Building Code [IEBC], in some cases) or adopt and enforce the IBC/IRC (and IEBC, in some cases).

Table B-1: NFIP Participation in States & Territories That Mandate Local Enforcement of Building Codes

State	Total Number of Communities Identified As Having Special Flood Hazards*	Percent Participating in the NFIP*
Arkansas	508	82%
California	529	99%
Connecticut	177	100%
District of Columbia	1	100%
Florida	472	96%
Georgia	642	83%
Guam	1	100%
Indiana	483	89%

[38] As used by ISO, the term "local jurisdiction" is broader than the NFIP definition of "community."

State	Total Number of Communities Identified As Having Special Flood Hazards*	Percent Participating in the NFIP*
Louisiana	335	93%
Maine	1,009	97%
Maryland	141	98%
Massachusetts	350	96%
Michigan	1,091	87%
New Jersey	555	99%
New York	1,508	99%
North Carolina	616	92%
Northern Marianas Is	1	100%
Oregon	262	99%
Pennsylvania	2,492	99%
Puerto Rico	3	100%
Rhode Island	40	100%
South Carolina	256	87%
Utah	240	87%
Virgin Islands	1	100%
Virginia	302	95%
Washington	306	95%
Wisconsin	605	89%
TOTALS	**12,926**	**94%**

*Information obtained from: www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book (accessed November 14, 2012)

Table B-2 identifies the 28 states that do not adopt building codes or may adopt building codes only for certain buildings, such as state-owned buildings, schools, hospitals, and other specific occupancies. Some of these states specify that certain communities are required to enforce codes (typically based on population), while others are permissive. ICC's self-reported jurisdiction data and ISO's BCEGS data were used to estimate the number of communities that adopt and enforce building codes. The number of communities that do not enforce codes can be derived by subtracting the number of communities that enforce codes from the total number of communities. FEMA assumes that some communities that elect to adopt codes do not report to ICC and ISO's data may not have been collected from all communities in the listed states.

Table B-2: NFIP Participation in States That Do Not Mandate Local Enforcement of Building

State	Total Number of Communities Identified as Having Special Flood Hazards*	Percent Participating in the NFIP*	Percent Enforcing Codes**
Alabama	489	85%	18%
Alaska	35	91%	26%
Arizona	106	98%	94%
Colorado	261	94%	72%
Delaware	51	96%	20%
Hawaii	4	100%	100%
Idaho	187	94%	11%
Illinois	998	87%	34%
Iowa	746	83%	12%
Kansas	525	85%	10%
Kentucky	399	87%	15%
Minnesota	679	85%	9%
Mississippi	363	90%	12%
Missouri	813	80%	19%
Montana	143	92%	3%
Nebraska	486	83%	8%
Nevada	34	100%	74%
New Hampshire	230	93%	13%
New Mexico	112	89%	25%
North Dakota	350	93%	6%
Ohio	846	88%	17%
Oklahoma	513	76%	22%
South Dakota	258	88%	10%
Tennessee	412	95%	34%
Texas	1,380	89%	28%
Vermont	267	89%	0%
West Virginia	281	98%	15%
Wyoming	93	89%	28%
TOTALS	**11,061**	**87%**	**20%**

*www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

**Estimate derived from ICC jurisdiction report and ISO BCEGS data

B.3 Summary of NFIP, 2009 I-Codes, and ASCE 24 Checklist

FEMA funded the development of a checklist comparing the provisions within the NFIP, 2009 I-Codes, and American Society of Civil Engineers (ASCE) standard ASCE-24, *Flood Resistant Design and Construction* to inform floodplain managers, building officials, and designers of cross references. The checklist compares the requirements of the NFIP to the flood provisions of the IBC, the International Mechanical Code, the International Plumbing Code, the International Fuel Gas Code, the IRC, the IEBC, and ASCE 24-05. The checklist has two parts: NFIP requirements and definitions. The NFIP requirements section includes a short statement of the NFIP requirement with the specific citations; I-Code sections that include requirements to meet or exceed the NFIP requirement; and provisions of ASCE 24-05 that include requirements to meet or exceed the NFIP requirement for buildings and structures.

The I-Codes include NFIP-consistent flood-related provisions that help regulate two aspects of development in flood hazard areas: (1) the building code provisions that govern the design and construction of buildings and structures and (2) IBC Appendix G ("Flood-Resistant Construction"), which governs site planning and infrastructure development. The ICC designed this information to work together to coordinate development of both buildings and other development to achieve greater resistance to flood loads and flood damage. Appendix G can augment or replace local floodplain management regulations depending on local preference.

When states and communities adopt and enforce the flood provisions of the I-Codes, they must ensure full consistency with the NFIP requirements for buildings and structures in one of the following ways without weakening any of the building code flood provisions:

Adopt the IBC with Appendix G and IRC, and for existing buildings, either retain IBC Chapter 34 or adopt IEBC.

Adopt code-coordinated companion floodplain management regulations and adopt the IBC (without Appendix G) and IRC, and for existing buildings, either retain IBC Chapter 34 or adopt IEBC.

Adopt one or more of the I-Codes and continue to use NFIP-compliant, locally adopted standalone floodplain management regulations, allowing the "more restrictive prevails" concept to apply.

B.4 State and Local Code Adoption Will Increase Uniform Application with NFIP and Require Monitoring

Including building codes into NFIP criteria would have an impact on the states and NFIP communities that currently do not enforce building codes. All communities would enforce the higher standards within the I-Codes (primarily freeboard via code reliance on ASCE 24).

Although FEMA informally monitors state and local code adoption activity, some means of engagement in a new oversight role would be required to ensure that the provisions of both programs are applied uniformly between states. Currently, there is no formal mechanism or funding to engage in these state or local regulatory and statutory processes.

FEMA has not conducted complete analysis of how each state adopts the I-Codes at the state level or how they may have modified the flood provisions, but some states have removed flood provisions (usually in lieu of state provisions), some have weakened them (i.e., redefining substantial damage), and some have strengthened them (i.e., used a 500-year flood event or added freeboard).

Potential restrictions to local code provision amendments by respective code jurisdictions (state or local) would need to be harmonized with corresponding NFIP community regulations. This could also better promote innovation developing and adopting higher standards beyond code minimums.

B.5 Building Code Adoption Related Costs

Construction costs are affected in several ways if building codes are included in the NFIP criteria. These include initial adoption cost, code change costs, freeboard costs, and permit fees.

Initial Adoption Cost: Anecdotal findings of the National Association of Home Builders and subject matter expert opinion suggest that overall housing costs would initially increase about 2 to 5 percent as a result of adopting building codes in jurisdictions that did not already have codes. This is widely believed by subject matter experts to have no deterrent effect on construction markets because of associated benefits, including increased property values and economies of scale that will develop from uniform standards community to community and even state to state.

Triennial Code Change Costs: The ICC updates the I-Codes every 3 years and new provisions are introduced with each edition. When states and communities move from one edition to another, some incremental changes in construction costs are associated with those new provisions. Added materials requirements may increase costs and revised hazard maps may increase or decrease loads affecting design and material costs.

Cost to Comply with Code Provisions that Exceed NFIP (e.g., Freeboard Costs): A recent study examined NFIP standards and found they sufficiently minimize losses at a reasonable cost to communities and property owners in SFHAs (Jones, Coulbourne et al., 2006). This study found that for homes that already have to be elevated, the benefits of adding freeboard or installing a more flood-resistant foundation at the time of construction exceed the added construction costs. The costs identified as a function of added freeboard is about 0.25 to 0.5 percent per foot of freeboard for a 1500-square-foot, one-story house in Zone A for typical foundation types.

Building Permit Fees: Most local governments charge permit fees for inspecting new construction, or issuing permits during construction and after completion to document compliance with building codes. There are various approaches to determining permit fees based

upon property values, construction costs, municipal funding structure, and the volume of construction a building department supports.

B.6 Contrasting Views of Costs and Benefits of Building Codes

The Multi-hazard Mitigation Council conducted a study in 2005 to quantify the future savings from hazard mitigation activities. This study did not explicitly evaluate building code provisions. However, some implicit code effect is evident given the majority of flood mitigation grants studies were to elevate or acquire residential properties and to undertake nonstructural projects, such as warning, building code, and hazard mitigation plans. The primary finding is that the use of hazard mitigation grant funds to reduce the risk of natural hazards is a sound investment. On average, $1 spent by FEMA on hazard mitigation will save $4 in future losses. The study also found that more than 220 fatalities and 4,700 injuries were avoided by implemented FEMA-funded mitigation projects for floods, hurricanes, tornados, and earthquakes between 1993 and 2003. For flood projects, $1 spent on hazard mitigation will save $5 in future losses, which is greater than other hazard mitigation projects.

Whether building codes have impacts on land use is unclear. Dehring (2006) conducted a study to examine the effect of building codes on land values. She hypothesized that vacant land prices are determined by lot size, distance from work, proximity to recreational amenities, and other physical and legal attributes, such as applicable building code or zoning regulations. To examine the hypothesis she selected Lee County, Florida, which joined the NFIP in 1984 and imposed coastal construction regulations in coastal Zone A and V areas. She found the NFIP program and construction requirements had a negative impact on land values in coastal Zone A areas, which were reduced by about 10 percent. However, land values in Zone V were not affected because of the proximity to the ocean, even though Zone V requires more stringent construction requirements. Her conclusion is that property owners are willing to pay the price for safety and amenities in Zone V and the perceived benefits of code requirements in Zone A are variable.

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Appendix C: Supporting Material for Topic 2

Resources Required of State and Local Communities to Administer and Enforce Building Codes

C.1 BCEGS Evaluation Questionnaire (Enforcement Section Only)

C.2 ICC Building Valuation Data

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the findings, which are in the main report.

C.1 Working Group Evaluation Questionnaire

The Building Code Effectiveness Grading Schedule (BCEGS)[39] conducts ongoing surveys of building departments across the approximately 6,600 participating jurisdictions nationwide that also participate in the NFIP. The surveys are conducted to monitor building code adoption and enforcement activities. The information obtained by BCEGS is included in the rating for each community and is used in a variety of analytical activities.

A summary of the information obtained and tracked in the BCEGS database follows, adapted from the BCEGS multi-page questionnaire.

1. Indicate the number of inspections completed for all types of inspections, including re-inspections, during the reporting period: ___

2. Provide the number of inspections for each category (Building, Electrical, Fuel Gas, Mechanical, or Plumbing:
   a. Residential/Commercial
   b. New Buildings
   c. Additions (includes garages)
   d. Renovations
   e. Manufactured / Modular
   f. Other Building Related
   g. Other Non-Building Related

3. Indicate the average number of building inspections, including building, electrical, plumbing, fuel gas, and mechanical inspections, performed each day per inspector for the period.

   Does the building department:

   3A. Conduct building inspections on new one- and two- family dwellings?

   3B. Use certified building inspectors for footing, foundation, framing, sheathing or insulation, and final building inspections?

[39] http://www.isomitigation.com/bcegs/0000/bcegs0001.html

3C. Conduct building inspections on new multi-family dwellings?

3D. Conduct building inspections on new commercial buildings?

3E. Maintain detailed records of inspection activity as described below?

4. Does the department use an outside inspection service, such as the state, or a third-party inspection agency? If yes, complete an Employee Data Sheet and explain reasons.

5. Does the jurisdiction have the authority to issue stop work orders?

   a. If yes, how many stop work orders did the jurisdiction issue in the reporting period?

   b. If the jurisdiction did not issue any stop work orders in the reporting period, provide the date of the last one issued.

6. During the reporting period, what approximate percentage of construction inspections received correction notices requiring re-inspection?

7. During the reporting period, what approximate percentage of construction inspection correction notices resulted in stop work orders?

8. Does department policy require the use of a detailed written checklist for code compliance during on-site inspections? If yes, does the checklist become a part of the permanent record?

9. Does the building department require special inspections for specific structural elements?

10. Does the jurisdiction require special inspectors to be certified by exam, experience, interview, other? Is there no required certification?

11. Does the jurisdiction have inspection programs that focus on construction features that mitigate the natural hazards common in the area? Examples of such programs include load path inspections including inspection of hold downs, shear wall and roof diaphragm nailing patterns, and hurricane clips.

12. Does the department perform final inspections after the building is completed and before issuing a certificate of occupancy?

13. Does the jurisdiction require certificates of occupancy for new buildings before the building is occupied?

14. How does the department evaluate the performance of inspectors?

C.2 Examples of Costs and Revenues of Building Departments

Several examples of costs and revenues of building departments are provided to illustrate a variety of considerations of some of the resources required to include building codes in the NFIP criteria. Examples include a basis for permit fees, and examples of third-party services in three states.

i. Example 1-Basis for Setting Permit Fees

One approach used by many communities to establish permit fees is based on Building Valuation Data updated by the International Code Council (ICC) every 6 months (ICC, 2012b). The permit fee is determined using the building gross area, the construction cost per square foot, and the permit fee multiplier, which is a function of historic costs and permit revenue goals of the department.

The Building Valuation Data are national averages and do not take into account regional cost differences. The data are provided for 25 building occupancies (e.g., assembly, educational, institutional, mercantile, and residential) and nine different building types. The average costs include foundation work; structural and nonstructural building components; and electrical, plumbing, mechanical, and interior finish material. The data are offered as an aid for to building officials to determine whether permit valuations submitted by applicant are reasonable.

ii. Example 2-Summary of Costs for Institute for Building Technology and Safety (IBTS) to Implement Third Party Building Department Services in Pennsylvania

Third-party building department services have been found to be feasible providing a cooperative service serving a large geography with residential emphasis in Pennsylvania.[40] Individual operators, support code administrative offices serving councils of governments, and form larger networks of inspectors and plan reviewers throughout the state.

Estimated costs for a typical code service provider are provided in Table C-1 for a very small rural community and a larger township or borough with significant commercial activity. Revenue generated (permit and inspection fees) by these sample communities respectively are about $1,100 for small community to $51,000 for larger townships.

An example of third part services is a program provided by IBTS for 39 communities in Pennsylvania performed with a staff of two full-time inspectors, one full-time operations permit technician, and one full-time staff member performing permit technician work and some rental and property maintenance inspections in addition to administrative duties. The combined costs of running this operation in the busier months are shown in Table C-1. The IBTS processes about 600 permits annually and conducts around 300 inspections per month.

By comparison, the Pennsylvania Department of Labor and Industry (DLI) performs commercial inspections only, and no residential inspections or associated plan review. Homeowners have the

[40] Information provided by charette member from ITBS

option of paying for third-party service providers or DLI services. The DLI uses centralized plan reviewers in their offices in Harrisburg as well as field inspectors who operate out of their homes across the state. Its costs derived based upon their compensation (inspectors receive annual salaries ranging from $38,000 to $65,000), per diem, and allowance paid to them for use of their home offices are shown in Table C-1 for small townships to larger ones. Vehicles are provided by DLI. The costs of plan reviews vary according to the complexity of projects.

Table C-1: Pennsylvania 2012 Costs of Code Administration and Enforcement

Pennsylvania Building Code Service Provider	Annual Cost Small Community	Annual Cost Large Township
Typical Pennsylvania code service provider	$700	$35,000
IBTS	$13,500 average	
Pennsylvania DLI (commercial only)	$500	$20,000

iii. Example 3-Post Katrina Code Enforcement Supplemental Programs

After Hurricane Katrina destroyed or damaged approximately 64,000 homes and thousands of businesses in South Mississippi, Mississippi Development Authority set aside $5 million to support local building code enforcement activities. This decision was made due to the complete decimation of local tax base and massive number of reconstruction funded with the influx of the Community Development Block Grant Katrina Homeowners program funding. The Code Enforcement Supplemental Program funds can be used for salaries, fringe benefits, travel and training to hire new code enforcement officials.

Also the State of Louisiana was faced with tremendous challenges in rebuilding communities in a sustainable way so that houses and business will not suffer the same level of devastation from future disasters. The state adopted a new building code in every Louisiana jurisdiction and provided financial resources to enforce stringent building codes. The state provided three categories of grants:

1. Department of Public Safety grants
2. Aid to Local Government grants: competitive grants administered by the state
3. Governor's Office of Homeland Security and Emergency Preparedness grants: state-administered grants awarded by the Federal Emergency Management Agency

Under the ***Department of Public Safety grants***, a third party can be contracted to implement or augment local code enforcement capabilities, depending whether a code enforcement department existed prior to Katrina.

Under the ***Governor's Office of Homeland Security and Emergency Preparedness grants,*** FEMA allows for basic office expenditures in administering building codes including training and vehicles.

iv. Example 4-Cost of Administering Building Code Department, Nevada County, CA

Nevada County, CA, is located in the Sierra Nevada of California and its population was 98,764 as of 2010. Of the total 66,656 people living in unincorporated areas, there were 51,013 houses, including single and multifamily housing. The county Building Department has over 50 staff performing building inspections for electrical mechanical and plumbing, code review, and plan examination for residential and commercial buildings.[41]

The department's operating budget for 2012-2013 is $1,183,090. The 2012 revenues from licenses, permits, service charges, and franchises was $1,177,890. The department reports this accommodated 7,041 inspections, 300 building plan reviews, training, outreach and other related activities.

[41] http://www.mynevadacounty.com/nc/cda/building/Pages/Building-Codes.aspx

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Appendix D: Supporting Material for Topic 3

The Effectiveness of Building Code Requirements in Reducing Flood-Related Damage to Buildings and Contents

D.1 Studies on Reduced Losses from Building Code Adoption

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the findings, which are in the main report.

D.1 Studies on Reduced Losses from Building Code Adoption

This section describes the processes and findings of several studies to calculate the avoided losses in communities that have adopted building codes.

i. Flood Damage Loss Estimation Basis

A common means of estimating flood losses requires determining variations in hazard intensity impacting a structure or property and allocating a degree of damage relative to its total value. Numerous studies have examined the effectiveness and economic impacts of building code adoption and enforcement, many related to wind provisions, and some for flood. In both cases, the resistance of buildings to the hazard tends to follow an S-shaped curve, with little damage associated with low hazard levels, followed by a steep increase in damage as the hazard intensity increases, and followed by a leveling off in the damage as the intensity increases further (Figure D-1). The leveling off usually occurs at very high damage levels where there is relatively little of the building left that can be damaged further as the hazard intensifies.

Mitigation measures have the effect of shifting a particular building down the damage-versus-hazard intensity curve, or shifting to a different (less damaging) curve. The net effect is that a building incorporating measures that mitigate against a hazard sustains less damage (increased losses avoided) when compared to an unmitigated building.

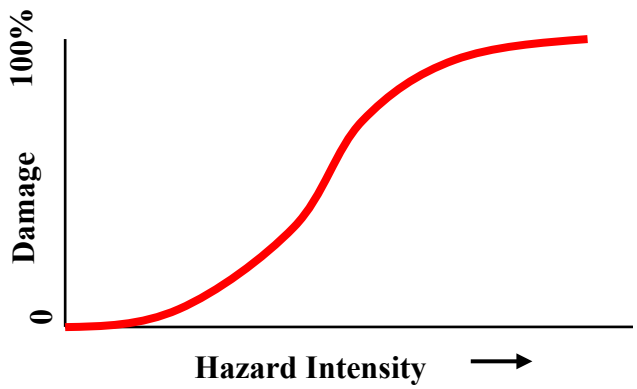

Figure D-1: Generalized damage-versus-hazard intensity curve (damage ratio represents the fraction of the building value damaged)

In the case of flood, depth-damage functions have been developed by FEMA, the U.S. Army Corps of Engineers (USACE), and others that show the characteristic S shape. The exact shape of the curve depends on the nature of the flood hazard (whether or not waves are present) and the

characteristics of the flooded structure (single-family residential, commercial, number of stories, presence of basement, etc.). The FEMA depth-damage functions were developed mostly for residential structures and manufactured housing, and are based on a combination of flood insurance claims data and expert opinion. The USACE curves were developed by various USACE districts for non-residential structures, and are based on a combination of post-flood damage assessments and expert opinion.

ii. Measuring Flood Loss Reduction Obtained Through Implementing Flood Mitigation Measures

Flood-related studies of reduced losses from flood mitigation, also referred to as *losses avoided* studies, are often conducted by FEMA, more recently with FEMA's Hazus software. Mecklenburg County, North Carolina, performed a comprehensive flood loss avoided studies (ABS Consulting, 2003) using Hazus and parcel-specific building inventory data. The study compared future flood losses under two scenarios: one based on projected development patterns and future conditions hydrology using the effective Flood Insurance Rate Maps (FIRMs) and one based on projected development patterns and FIRMs based on future conditions hydrology (i.e., future maps incorporating freeboard). The study justified the adoption of freeboard to guide future development. Other notable recent flood losses avoided studies using analytical procedures were conducted by FEMA in several states, with prominent studies in Georgia, Wisconsin, and California.

Two studies that examined flood and wind damages are those by Davlasheridze, et al. (2012) and Dehring and Halek (2012). The former investigated the role of adaptation and mitigation measures in lessening property loss during hurricanes. The study controlled for important drivers of property losses, economic and population growth, and socioeconomic vulnerability. Findings indicated "there is clear evidence of the importance of regulatory-based loss mitigation strategies as exhibited by improved building codes and the effectiveness of enforcement."

The latter study (Dehring and Halek, 2012) investigated whether the adoption of state and federal building regulations reduced hurricane damage. They found that Zone A structures built under minimum NFIP requirements had more damage relative to similarly located structures built under prior county regulations that required pile foundations and freeboard in Zone A.

iii. Losses Avoided As a Result of Adopting and Enforcing Building Codes

FEMA is currently completing a pilot Hazus study using parcel level data to modeling reduced losses for estimated performance of I-code structures in the building inventories of Salt Lake County, Utah, and Charleston County, South Carolina. The pilot study report, *Pilot Study Results of Salt Lake County, UT, and Charleston County, SC,* presents the quantitative estimates of reduced losses for the seismic hazard in Salt Lake County, Utah, and for both the hurricane and flood hazards in Charleston County, South Carolina. The reduced losses for three hazards represent a potential combined effect of this primary hazard provisions in the I-Codes.

The seismic pilot study for Salt Lake County, Utah, used a combination of County Assessor's data and the results of a previous Hazus development effort conducted as part of the 2010 Utah *ShakeOut* scenario and exercise. A total of 34,224 buildings were included in the study. The

results of the I-code related reduced seismic losses modeled in Hazus for the primary M7.0 scenario analysis in Salt Lake County are shown in Table D-1.

The flood pilot study conducted for Charleston County, SC, included data from five incorporated towns and cities. The study analyzed five occupancy types, including three residential and two commercial, representing a total of 21,671 buildings. The results of the I-Code related reduced flood losses modeled in Hazus analysis in Charleston County are shown in Table D-1 for 100-year and 500-year return period events.

The hurricane wind pilot study also conducted for Charleston County, South Carolina included key building attribute data correlating to I-code wind provisions. To assess the range of potential hurricane wind losses, the hazard was analyzed for the 10-, 20-, 50-, 100-, 200-, 500-, and 1,000-year wind events. The same five Hazus building occupancy types and inventory used in the flood analysis were maintained. The results of the I-code related reduced wind losses in Charleston County are indicated in Table D-1.

Additional modifications to the Hazus damage curves to better account for the full range of I-Code provisions reflected in building model characteristics will be developed in a Phase 2 demonstration study an entire region of the United States. The Hazus modeling reveals benefits of code related performance unique to each community based upon the hazard intensity, the building inventory characteristics, data quality and the assigned damage function relationships for local code adoption provisions. The code related reduced losses were shown to be significant in the short term for these particular cases, and more pronounced with long term growth estimates.

Table D-1: Summary of Losses Avoided for Seismic, Flood, and Hurricane Pilot Study Analyses

Hazard	Hazard Scenario	Losses Avoided for Building and Contents Damages ($1,000s)
Seismic	M7.0 Salt Lake City Segment of the Wasatch Fault Scenario	**$327,749**
	Average Annualized Loss	**$3,512**
Flood	100-Year Flood Event (upper bound)	**$163,231**
	500-Year Flood Event (upper bound)	**$195,206**
Hurricane	100-Year Hurricane Wind Event	**$132,048**
	500-Year Hurricane Wind Event	**$1,648,690**

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Appendix E: Supporting Material for Topic 5

Innovative Materials and Systems for Flood-Resistant Construction

E.1. Evaluation Services Outside of Formal Approval

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the findings, which are in the main report.

E.1 Evaluation Services Outside of Formal Approval

Thousands of building products are produced by hundreds of manufacturers. If a material is not included in a standard developed by ASTM International or if an expedited approval process is desired, evaluation services are available to determine code or standard compliance of the building material. Two such non-profit evaluation services are the International Code Council (ICC) Evaluation Service (ICC-ES) and the International Association of Plumbing and Mechanical Officials (IAMPO) Evaluation Service. Products that receive ICC-ES evaluation reports can be specified by design professionals, used by builders, and accepted by building officials with the assurance that documentation to support use of materials to satisfy code requirements has been evaluated.

ICC Evaluation Service: The ICC-ES is a non-profit organization that performs technical evaluations of a variety of building materials at the request of manufacturers. The evaluation process results in a technical report that addresses code compliance or acceptance criteria established by ICC-ES. ICC-ES evaluation reports are public documents and are available on the Web. Currently, the ICC-ES program evaluates building, plumbing, mechanical, fuel gas, and sustainable products. The ICC-ES Web site (http://www.icc-es.org/) includes documentation on both standards for evaluation and specific products that have been evaluated.

To evaluate the building material, ICC-ES receives an application from the manufacturer or interested party. In addition, supporting data, such as product information and test reports, are provided. Once the applicant has satisfactorily answered all questions raised by ICC-ES staff, an evaluation report is issued and posted on the Web. Technical reports are valid for 1 year and may be renewed on a 1- or 2-year basis.

International Association of Plumbing and Mechanical Officials Evaluation Service: The IAMPO Evaluation Service provides a standard approach to evaluate how practices satisfy code requirements (http://www.iapmoes.org/Pages/default.aspx).

State and Community Evaluation: At least one state, Florida, manages its own product approval system and maintains an online database of approved products and manufacturers, with a particular emphasis on wind resistance of building envelop products (windows, exterior doors, roofing products, skylights, shutters, panel walls, and innovative products). In addition to formalized evaluation services, several communities evaluate building materials based on their local criteria. For instance, Miami-Dade County, Florida, provides evaluations for wind hazards and the City of Los Angeles provides evaluations for seismic hazards.

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Appendix F: Supporting Material for Topic 6

The Feasibility and Effectiveness of Providing an Incentive by Lowering Premium Rates for Flood Insurance Coverage under Such Act

F.1 Relationship of NFIP Insurance and Rating Criteria to Building Characteristics

F.2 Upgraded Building Codes and Insurance Premium

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The information presented in this Appendix provides contextual information on the National Flood Insurance Program (NFIP), building codes, the working group held in support of the main report, and the regulatory obligations of the Federal Emergency Management Agency (FEMA). This information was considered in developing the finding, which are in the main report.

F.1 Relationship of NFIP Insurance and Rating Criteria to Building Characteristics

Table F-1 shows Table 3B from the Flood Insurance Manual and illustrates how rates change depending on building type and elevation of the lowest floor (lowest horizontal structural member for Zone V) relative to the base flood elevation (BFE).

Table F-1: Table 3B in Flood Insurance Manual

TABLE 3B. REGULAR PROGRAM – POST-FIRM CONSTRUCTION RATES
ANNUAL RATES PER $100 OF COVERAGE
(Basic/Additional)

FIRM ZONES AE, A1–A30 – BUILDING RATES

ELEVATION OF LOWEST FLOOR ABOVE OR BELOW THE BFE[1, 4]	1 FLOOR No Basement/Enclosure/ Crawlspace[2]		MORE THAN 1 FLOOR No Basement/Enclosure/ Crawlspace[2]		MORE THAN 1 FLOOR With Basement/Enclosure/ Crawlspace[2]		MANUFACTURED (MOBILE) HOME[3]	
	1–4 Family	Other Residential & Non-Residential	1–4 Family	Other Residential & Non-Residential	1–4 Family	Other Residential & Non-Residential	Single Family	Non-Residential
+4	.24 / .08	.20 / .08	.24 / .08	.20 / .08	.24/ .08	.20 / .08	.28 / .10	.24 / .10
+3	.30 / .08	.24 / .10	.25 / .08	.22 / .08	.27 / .08	.22 / .09	.31 / .10	.27 / .10
+2	.42 / .08	.32 / .10	.31 / .08	.25 / .08	.30 / .08	.24 / .09	.52 / .10	.42 / .11
+1	.75 / .10	.56 / .13	.57 / .09	.36 / .09	.38 / .09	.30 / .10	.94 / .13	.83 / .14
0	1.78 / .13	1.60 / .17	1.30 / .12	.99 / .17	.91 / .10	.77 / .16	2.55 / .17	2.15 / .22
-1	4.40 / 1.10	5.39 / 1.15	3.70 / 0.80	3.80 / .50	2.40 / .50	2.15 / .58	***	***
-2	***	***	***	***	***	***	***	***

Source: http://www.fema.gov/library/viewRecord.do?id=6393

Although the NFIP minimum building standard calls for the first floor to be at or above the BFE, lower rates are applied to buildings that are elevated up to 4 feet above BFE. The annual rates of 0.24/0.08 per $100 of coverage for buildings elevated 4 feet above the BFE represent the minimum rates that can be charged even for buildings with the first floor 5 or more feet above the BFE.

Model building codes are similarly characterized as minimum standards with implicit accommodations for exceeding that level.

F.2 Upgraded Building Codes and Insurance Premium

An example the effect of upgrading building codes on insurance premiums is provided by Fargo, ND. After the 1997 flood, city officials upgraded local building codes to better protect new construction in and around the floodplain. The changes require the lowest floor of newly built

structures to be 2.5 feet above the BFE. Previously, the lowest floor only had to be 1 foot above BFE. The change applies to new structures both inside and within 150 feet of the floodplain.

Because of the NFIP's "rounding up rule," buildings that have lowest floors elevated 2.5 feet above the BFE are rated at 3 feet above BFE. Buildings outside the Special Flood Hazard Area (SFHA) shown on the Flood Insurance Rate Map (FIRM), but within 150 feet of the SFHA boundary, are rated as Zone X. Unless they qualify for the Preferred Risk Policy (refer also to the Topic 4 discussion of this report), standard Zone X rates apply in accordance with Table F-2.

Table F-2: Table 3A in Flood Insurance Manual

TABLE 3A. REGULAR PROGRAM – POST-FIRM CONSTRUCTION RATES

ANNUAL RATES PER $100 OF COVERAGE

(Basic/Additional)

FIRM ZONES A99, B, C, X

		SINGLE FAMILY		2-4 FAMILY		OTHER RESIDENTIAL		NON-RESIDENTIAL	
	OCCUPANCY	Building	Contents	Building	Contents	Building	Contents	Building	Contents
BUILDING TYPE	No Basement/Enclosure	.91 / .24	1.39 / .43	.91 / .24		.85 / .24		.85 / .24	
	With Basement	1.03 / .35	1.57 / .50	1.03 / .35		1.09 / .35		1.09 / .35	
	With Enclosure	1.03 / .39	1.57 / .57	1.03 / .39		1.09 / .39		1.09 / .39	
	Elevated on Crawlspace	.91 / .24	1.39 / .43	.91 / .24		.85 / .24		.85 / .24	
	Non-Elevated with Subgrade Crawlspace	.91 / .24	1.39 / .43	.91 / .24		.85 / .24		.85 / .24	
	Manufactured (Mobile) Home[1]	.91 / .44	1.39 / .43					1.09 / .45	
CONTENTS LOCATION	Basement & Above[2]				1.77 / .65		1.77 / .65		1.82 / .71
	Enclosure & Above[3]				1.77 / .75		1.77 / .75		1.82 / .84
	Lowest Floor Only – Above Ground Level				1.39 / .69		1.39 / .69		1.12 / .50
	Lowest Floor Above Ground Level and Higher Floors				1.39 / .43		1.39 / .43		1.12 / .36
	Above Ground Level – More Than 1 Full Floor				.41 / .14		.41 / .14		.25 / .14
	Manufactured (Mobile) Home[1]								.98 / .61

Source: http://www.fema.gov/library/viewRecord.do?id=6393

As of late 2012, the annual rates for buildings within the SFHA are 0.30/0.08 per $100 of coverage, while rates for buildings that are just outside the SFHA are about 0.91/0.24, nearly three times more than a building located within the SFHA. The reason for this difference is that there are no minimum building standards specified for buildings in Zone X and rates are based on loss experience within the entire Zone X class, while SFHA rates for new buildings are based on depth damage functions.

This comparison illustrates a situation in which more stringent codes required for certain situations do not positively influence flood insurance rates. Twenty percent of all claims and one-third of disaster assistance for flooding are for properties located in areas shown on FIRMs as Zone X.

Appendix G: Summary of Findings

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A summary of the findings of this report are provided in Table G-1. No advice, recommendations, conclusions or consensus from a group were obtained for this report. As mandated by Section 100235 of BW12, this report identifies the impact of amending Section 1361. FEMA makes no recommendations based on its findings.

Table G-1: Summary of Findings

Topic 1. Regulatory, Economic, Financial Impact
1.1. Current model building codes have flood provisions that are consistent with NFIP requirements for buildings and structures. Appendix B.3 includes a checklist comparing the flood provisions of the codes with NFIP provisions. Including widely used building codes in the NFIP would have an overall positive effect in reducing losses and creating improved regulatory and use practices.
1.2. In any future rulemaking involving the inclusion of a nationally recognized building code standard into the NFIP criteria, FEMA would need to comply with all appropriate and relevant requirements. At the federal level, rulemaking involves satisfying numerous statutory and Executive Order requirements.
1.3. The majority (approximately 70 percent) of NFIP communities currently enforce building codes with flood provisions based on the model I-Codes, so the net financial and economic impact of including building codes in the NFIP would be relatively small in those communities. The statutory enforcement authority of the building official, however, would improve the level of enforcement attained compared to when floodplain management ordinances are administered by an office or agency other than the building department.
1.4. Communities that participate in the NFIP and have not adopted current I-Codes would be affected by the inclusion of the codes in the NFIP. The primary impact is that they would be required to adopt the codes and create a system to enforce them. It is expected that provisions would be established so that some small communities with limited development can be addressed on an individual basis.
1.5. Over the long-term, the relatively small additional upfront investment in code-compliant hazard-resistant building construction would result in both direct and indirect economic benefits.
1.6. It is possible that there could be a small risk that enforcing building codes may have a short-term negative economic impact on land values and increased costs to homeowners in some locations. It is anticipated that over an extended time frame, this impact would be negligible.
1.7. The financial impact at an agency level to FEMA and other federal agencies would likely be minimal. The inclusion of building codes in the NFIP would, however, add a mission for FEMA requiring specific capabilities and resources for a national oversight role. Such an addition would require funding to meet the new requirements.
Topic 2. Resources to Administer Codes
2.1. Twenty-two states already adopt building codes at the state level and mandate enforcement at the local level (refer to Appendix B.2) which means separate action by communities is not required. Including building codes in the NFIP would have minimal effect on the resources of those states.
2.2. Twenty-eight states either have some level of adoption of codes at the state level, but may not mandate enforcement at the local level, or may permit adoption at the local level (refer to Appendix B.2). Most of those states have some form of commission or council that already serves some degree of administrative function.
2.3. Since many communities in the United States already administer and enforce building codes, even many communities in states that do not mandate local enforcement of codes, the effect on resources of including building codes in NFIP would be minimal for those communities.
2.4. For those communities that do not currently administer and enforce building codes additional resources would be required. The inclusion of the building codes in the NFIP would create a requirement for NFIP communities to establish an administrative infrastructure for building code enforcement, or to expand existing capabilities that are already in place to enforce floodplain management requirements.
2.5. The inclusion of building codes in the NFIP would require increased resources to provide coordination between NFIP State Coordinating Agencies and state building agencies and commissions, and increased

coordination between local floodplain management agencies and local building departments.

Topic 3. Effectiveness in Reducing Flood Related Losses

3.1. The model building codes are effective in reducing flood-related building damage because of specific design requirements, primarily the minimum elevation requirements and, in some cases, the inclusion of additional elevation (freeboard) and foundation improvements.

3.2. The effectiveness of NFIP ordinances separately enforced by communities is very similar to that of building code flood provisions that except codes have more specific requirements than the NFIP. In addition, the codes include certain provisions that exceed the NFIP minimum requirements (also called "higher standards").

3.3. By including building codes into the NFIP, it may be difficult for such amendments to weaken flood provisions.

3.4. Including building codes into the NFIP would increase the effectiveness of enforcing compliance because States that mandate local enforcement provide clear statutory authority for enforcement by building officials.

Topic 4. Impact to Actuarial Soundness

4.1. The short-term impact of including building codes in the NFIP on the actuarial soundness of the NFIP would be small to negligible.

4.2. The long-term impact of including building codes in the NFIP is expected to be beneficial. When the rate adjustments in BW12 fully take effect over the next 5 to 10 years and the effects of most subsidies are phased out, significant rate reductions for those structures where these requirements apply should be expected.

4.3. The current NFIP insurance program has many built-in elements that inhibit achieving true actuarial soundness: requiring enforcement of stringent construction standards such as those found in model codes would not address all of these issues. The lack of actuarial soundness is almost entirely due to the cost of government-subsidized policies.

4.4. Including building codes in the NFIP would have a positive long-term impact on the program soundness because the insured structures impacted by this action would, over the long-term, be better able to withstand the effects of future flooding.

4.5. The actuarial benefits of including building codes in the NFIP would be impaired without improved FIRMs that delineate flood hazards with reasonable accuracy.

4.6. The soundness of the pool would also improve because the size of the insured pool would increase due to lower rates and updated maps attracting more participants.

Topic 5. Effectiveness in Allowing Innovative Materials for Flood Resistant Construction

5.1. Including building codes in the NFIP would not alter authority of building officials to approve alternative materials nor would it alter the process used by ICC to accept AMMs in the codes.

5.2. The process that the ICC uses to accept AMMs in the codes is usually effective in ensuring that new AMMs meet appropriate safety and performance standards. However, the process is lengthy and can be cost prohibitive to smaller manufacturers, thereby eliminating potential beneficial technological advances.

Topic 6. Effectiveness at Lowering Insurance Rates

6.1. The inclusion of building codes in the NFIP would be somewhat effective in lowering premiums because the codes require structures in certain situations to be built or protected to higher elevations than the minimum elevations required under the NFIP.

6.2. It is feasible for adopting building codes into the NFIP to provide this incentive of lower insurance rates to property owners nationally because it requires all NFIP communities to adhere to building codes.

6.3. Including building codes into the NFIP would reinforce the existing CRS incentives, which already provide credits for adoption of building codes.

Topic 7. Impact on Rural Communities
7.1. The financial and regulatory impacts on rural NFIP communities that do not currently administer and enforce building codes would be from additional resources required if the building code is included in the NFIP. The inclusion of the building codes in the NFIP would create a requirement for NFIP communities to establish an administrative infrastructure or expand existing capabilities that are already in place to enforce floodplain management requirements.
7.2. The potential benefits of including the I-Codes into the NFIP would be realized by rural communities, just as they would be by more urban communities.
Topic 8. Impact on Indian Reservations
8.1. Indian reservations and tribes that participate in the NFIP and have not adopted current I-Codes would be affected by the inclusion of the codes in the NFIP. The primary impact on tribes that have not adopted I Codes is that they would be required to adopt the codes and create a system to enforce them.
8.2. The potential benefits of including the I-Codes into the NFIP would be realized by Indian reservations, just as they would be by other jurisdictions.

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Appendix H: Acronyms

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Acronym List

ASCE	American Society of Civil Engineers
AMM	alternate materials and methods
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BW12	Biggert-Waters Flood Insurance Reform Act of 2012
CBO	Congressional Budget Office
CFR	Code of Federal Regulations
CRS	Community Rating System
DLI	Department of Labor and Industry (Pennsylvania)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAO	General Accounting Office
HUD	Department of Housing and Urban Development
IAMPO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code
IBTS	Institute for Building Technology and Safety
ICC	International Code Council
ICC-ES	ICC Evaluation Service
IEBC	International Existing Building Code
IRC	International Residential Code
ISO	Insurance Service Organization, Inc.
NEPA	National Environmental Policy Act
NFIA	National Flood Insurance Act of 1968
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NIBS	National Institute of Building Sciences
OMB	Office of Management and Budget
PRP	Preferred Risk Policy
SFHA	Special Flood Hazard Areas
USACE	U.S. Army Corps of Engineers

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Appendix I: References and Resources

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