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The Evaluation of the National Flood Insurance Program Final Report

NFIP Evaluation Final Report Working Group

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October 2006

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Prepared as part of the 2001–2006 Evaluation of the National Flood Insurance Program

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October 2006

EVALUATION OF THE NATIONAL FLOOD INSURANCE PROGRAM

This Evaluation comprises a series of reports prepared by the American Institutes for Research (AIR) and selected subcontractors under a contract managed by AIR. These reports assess questions identified and prioritized by a Steering Committee about the National Flood Insurance Program. Individual reports will be posted on the FEMA website as they are finalized. The website URL is <http://www.fema.gov/business/nfip/nfipeval.shtm>. The reports in the Evaluation are

The Evaluation of the National Flood Insurance Program – Final Report American Institutes for Research and NFIP Evaluation Final Report Working Group

Assessing the Adequacy of the National Flood Insurance Program's 1 Percent Flood Standard. Galloway, Baecher, Plasencia, Coulton, Louthain, and Bagha, Water Policy Collaborative, University of Maryland.

The Role of Actuarial Soundness in the National Flood Insurance Program. Bingham, Charron, Kirschner, Messick, and Sabade, Deloitte Consulting.

Costs and Consequences of Flooding and the Impact of the National Flood Insurance Program. Sarmiento and Miller, Pacific Institute of Research and Evaluation.

Developmental and Environmental Impacts of the National Flood Insurance Program: A Review of Literature. Rosenbaum, American Institutes for Research.

The Developmental and Environmental Impact of the National Flood Insurance Program: A Summary Research Report. Rosenbaum and Boulware, American Institutes for Research.

An Evaluation of Compliance with the National Flood Insurance Program Part A: Achieving Community Compliance. Monday, Grill, Esformes, Eng, Kinney, and Shapiro, American Institutes for Research.

An Evaluation of Compliance with the National Flood Insurance Program Part B: Are Minimum Building Requirements Being Met? Mathis and Nicholson, Dewberry.

Evaluation of the National Flood Insurance Program's Building Standards. Jones, Coulbourne, Marshall, and Rogers, Christopher Jones and Associates.

Managing Future Development Conditions in the National Flood Insurance Program. Blais, Nguyen, Tate, Dogan, and Petrow, ABSG Consulting; and Mifflin and Jones.

The National Flood Insurance Program's Mandatory Purchase Requirement: Policies, Processes and Stakeholders. Tobin and Calfee, American Institutes for Research.

The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications. Dixon, Clancy, Seabury, and Overton, RAND Corporation.

Performance Assessment and Evaluation Measures for Periodic Use by the National Flood Insurance Program. Miller, Langston, and Nelkin, Pacific Institute of Research and Evaluation.

State Roles and Responsibilities in the National Flood Insurance Program. Mittler, Morgan, Shapiro, and Grill, American Institutes for Research.

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Evaluation of the National Flood Insurance Program

(Biographies provided in Appendix A)

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Acknowledgments

The Working Group commends the authors of all the Evaluation substudies for their exhaustive efforts at deepening understanding of both the accomplishments and unrealized potentials of the National Flood Insurance Program. Readers should note that the reports issued for each of the substudies have many detailed recommendations that, because of space constraints, were not included in this report but should nevertheless be pursued.

Appreciation is extended to the many professionals who took their time to provide the Working Group with insights and observations on earlier drafts of this report. Thanks are due in particular to Michael Robinson of Michael Baker Jr., Inc. and to Claudia Murphy and Thomas Hayes of FEMA for their ongoing guidance and input on technical issues, as well as to many others at FEMA for lending their expertise to the numerous issues in the substudy reports that underlie this summary.

*The Working Group dedicates this report
to the memory of Gilbert F. White.*

EXECUTIVE SUMMARY

The National Flood Insurance Program (NFIP) plays a major role in efforts to reduce both flood losses to property and the loss of natural floodplain functions. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 and made major changes to the program in 1973, 1994, and 2004. The NFIP's creation was based on the federal government's consideration of several factors. First, floods are costly to property owners and to federal, state, and local governments. Second, despite the federal government's significant investment in structural mitigation, such as dams and levees, flood losses were high and had continued to increase. Finally, the private insurance industry had found (and still finds) the provision of flood insurance to be uneconomical.

The Evaluation

One purpose of the National Flood Insurance Act of 1968 was to authorize "continuing studies of flood hazards...in order to provide for a constant reappraisal of the flood insurance program and its effect on land-use requirements." This clear call for evaluation and the fact that the NFIP had never been the subject of a comprehensive evaluation led FEMA in 2000 to contract with the American Institutes for Research (AIR), an independent, not-for-profit corporation, to design, lead, and manage the Evaluation of the NFIP.

The Evaluation consisted of more than a dozen individual research studies, using widely varying methods, that focused on a range of subjects determined to be critical to assessment of the NFIP's progress (see the 13 topical reports listed at the front of this document).*

This Final Report is the product of a Working Group of experts assembled by AIR to review the methods, findings, conclusions, and recommendations of the Evaluation project's 13 studies and then to take a measured and informed look at their results. This report presents the Working Group's over-arching conclusions, its summary of the Evaluation's findings, and its list of concerns and recommendations about the NFIP's progress towards meeting its goals.

Goals of the NFIP

The National Flood Insurance Act had several explicit and inter-related goals, which have been built upon by subsequent NFIP legislation. In the course of preparing for the Evaluation, FEMA, AIR, and the Steering Committee agreed to the following concise expression of the NFIP's goals:

1. Decrease the risk of future flood losses,
2. Reduce the costs and adverse consequences of flooding,
3. Reduce the demands and expectations for disaster assistance after floods, and
4. Preserve and restore the natural and beneficial values of floodplains.

* It should be noted that all scopes of work for the reports and most of the data collection were completed before the dramatic 2005 hurricane season.

Findings

In general, the Evaluation has shown that the NFIP is moving towards achievement of its goals. The progress made to date is impressive compared with the state of knowledge about and management of floodprone areas in 1968, although it has perhaps been slower than had been anticipated at the outset. Two notable trends have contributed to this progress: there is more widespread acceptance by local governments of the need for land use management to minimize flood damage, and there is broader support for various measures aimed at protecting and preserving natural resources, including streams, wetlands, and other floodplain features.

In the face of the considerable accomplishments of the NFIP, noted below, it is nevertheless clear that the future will require even more strenuous efforts to combat flood losses. Past strategies are unlikely to remain adequate to the challenge of the increased losses expected to occur as a result of population growth and movement and the pressure to build in even more hazardous and sensitive areas, such as the coastal zone. The Working Group concurred with the following summary of the NFIP's accomplishments, areas in need of improvement, and concerns illuminated by the substudies.

- Although the overall goals of the NFIP are clear, consensus has not been reached on specific, interim national floodplain management goals and objectives. Further, the data available to measure progress towards such objectives are limited. Progress towards goals cannot be evaluated if information is not available.
- The NFIP operates in coordination with state governments, but the states' potential for furthering the goals of the Program has not been fully utilized. Coordination with other federal and private-sector programs that have similar objectives could be improved.

Goal 1: Decrease the Risk of Flood Losses

- Over a billion dollars in flood damage are being prevented each year.
- Most floodprone areas are still subject to being developed, in part because the NFIP has no strong provisions to guide development away from floodplains, even those with extreme flood hazards or valuable natural resources.
- Flood maps have been prepared for over 20,000 communities as a basis for flood insurance rates, insurance purchase requirements, and local floodplain management programs. NFIP flood maps, now being updated in the major Map Modernization initiative, have become the primary source of flood data for the nation and the maps are used for many purposes other than implementation of the NFIP.
- Flood maps do not delineate some types of high hazard areas, areas with floodplain resources worthy of preservation, or unmapped areas with known flood hazards. Many maps have a short shelf life because they do not account for expected changes in the uses of the land or in flooding conditions.

- Most buildings being constructed in the floodplains now are built according to NFIP standards and have been proven to be less vulnerable to flood damage.
- Although the NFIP requirements provide significant protection to new buildings, many new buildings constructed to the NFIP standards will still be at risk of damage even in the base flood because of gaps in the construction standards.

Goal 2: Reduce the Costs and Consequences of Flooding

- The NFIP's current system of regulations, insurance incentives, and mitigation funding is not ridding the nation of its stock of existing floodprone buildings as quickly as expected.
- Through the NFIP, millions of people have flood insurance protection for losses for which they would otherwise have been uncompensated.
- Many owners of floodprone property in the United States still lack flood insurance, and those who have it may still suffer costs and consequences from damage not covered by their policies.

Goal 3: Reduce the Demand for Federal Assistance

- The NFIP results in a savings of millions of dollars in federal expenditures annually, by reducing flood damage and by providing flood insurance coverage for individual property owners and renters.
- The NFIP has reduced some federal disaster assistance expenses, but the majority of disaster assistance dollars expended are outside the scope of the NFIP. The NFIP has some incentives to help reduce these federal expenditures, but there are gaps in their coverage and implementation.
- Federal government support for the NFIP has been reduced, but some federal support will always be needed because the NFIP is designed to achieve public policy objectives beyond the provision of flood insurance.

Goal 4: Preserve and Restore Natural and Beneficial Floodplain Functions

- An estimated 9,000 square miles of the nation's most floodprone land are protected from future development because they are delineated as floodways to allow for the unhindered conveyance of flood waters.
- At least 6,000 acres of previously developed floodplain land have been returned to open space, through grant programs for purchasing and removing damage-prone buildings.
- Most natural and beneficial floodplain functions in the United States are still subject to degradation by development, in part because the NFIP has not emphasized the protection of those functions and has few tools to help restore them, once impaired.

Improving Performance

In order to find ways to improve the NFIP's performance in reaching its goals, the Working Group sought common themes among the findings presented above. It identified five reasons why progress towards the goals of the NFIP could have been better.

Lofty Targets: The nation's flood problem is immense—there are over 7 million properties subject to flood damage in the mapped Special Flood Hazard Area and millions more in unmapped areas. Development is pushing into areas that are hazardous and environmentally sensitive. Federal budgets have been constrained. The NFIP has accomplished a great deal with the amount of resources provided by Congress, but those resources are not sufficient to achieve all the goals fully, or to keep pace with urbanization or changes in climate.

Lack of Data: A perennial problem is that some types of pertinent data, in the proper format for measurement and analysis, are not routinely collected, catalogued, or shared. Many types of data have been accumulated and in recent years have been made more readily available, but there are still important gaps and some data are still too expensive to collect. For many potential goals and objectives, a baseline measurement or estimate has never been established. Progress towards goals cannot be evaluated if information is not available.

Orientation Towards the 100-year Flood: Current mapping criteria, regulatory standards, and insurance provisions are oriented towards the 100-year flood, which was established as the Program standard as a compromise level that would serve as a guideline but was never expected to provide full protection. Unfortunately, it has tended to become a default target rather than the intended minimum standard that federal, state, and local programs would exceed. Further, it has tended to focus attention on the areas within the 100-year boundary, when in fact flooding, flood damage, and activities that cause them do occur outside of that area. This standard is not adequate or appropriate for a long-term program if used as the ultimate level of protection. Although changing to another standard may not be practical, the 100-year standard's effectiveness as a minimum level of protection can be readily improved with relatively minor changes in how it is implemented.

Perceptions and Assumptions: There have been historical assumptions, misconceptions, and misplaced emphases within and outside of the NFIP that have affected its progress. These included (1) the prediction that it would not take long to replace the nation's existing floodprone buildings with new, flood-protected ones; (2) the assumption that the NFIP should show developers how to "safely" build in the floodplain rather than show the public and local decision makers the value of guiding development away from floodplains; and (3) the expectation that the NFIP could be completely self-supporting over the long run, as a private insurance company would be, while still meeting its four primary public policy goals.

Fragmentation: The successes that the NFIP has had were due largely to the design of the program, which envisioned interrelationships among the Program's mapping, floodplain management, and insurance components; coordination and cooperation among federal, state, local, and private sector stakeholders; and a comprehensive approach rather than a sole focus on insurance. Further, Congress clearly intended, as stated in the 1968 Act, that progress be made towards a "unified national program" for managing the nation's floodplains. Over the years, efforts were made, with variable success, to work on this directive.

The current trend, however, is towards less, rather than more, coordination among federal programs and sub-programs and between them and the state, local, and private partners in flood loss reduction and in land and water resources management. This fragmentation is not limited to or caused by FEMA or the NFIP, but it limits the effectiveness of the NFIP and inhibits its ability to function as a point of national leadership in minimizing flood losses.

Finally, although there is coordination and cooperation with the states, that partnership is far less productive than it could be and needs to be, given the number of communities in the Program and the authority and capacity that reside in the states.

Recommendations

Although the NFIP has accomplished much, consideration now must be given to changes in orientation, differing perceptions, and the way the program is managed if this positive trend is to be continued into the future. Many specific and detailed recommendations are made in the Final Report and in the 13 Evaluation substudies. In general, they call for the following actions.

- Revise the NFIP flood hazard mapping criteria to identify natural functions worthy of preservation, high hazard areas that should be avoided, areas protected by flood control structures, and areas of known flood hazard, as well as to reduce the need to revise the maps over time;
- Revise the NFIP floodplain management criteria by adding a few stronger provisions that have been proven to be effective and by encouraging local programs to adopt other higher regulatory standards;
- Devote more resources to improving state and local floodplain management programs;
- Refine the tools for and fully fund a comprehensive strategy to reduce losses to existing buildings;
- Revise insurance procedures to encourage greater coverage and take steps to increase compliance with the mandatory purchase requirement;
- Implement known techniques that protect natural functions while also reducing damage, offer a variety of resource protection incentives, and coordinate more closely with other federal and state resource protection programs; and
- Gather and maintain needed data, use it to measure progress towards the goals of the program, and share the data with Congress and the rest of the program's stakeholders.

Recommitment to the Mission

Long-term success for the NFIP will be a function of some changes in perspective on the part of decision makers (including Congress), floodplain managers, and citizen stakeholders.

- The NFIP and all its stakeholders at all levels need to adopt a broader perspective and think beyond a single program and beyond minimum standards. Every state and

community needs to use the NFIP as merely a base upon which to build a broader, more effective, and locally appropriate program to prevent and reduce flood losses and to protect floodplain functions and resources.

- Congress, floodplain managers, and the general public should recognize that the NFIP will always need some level of federal government support in order to accomplish its fundamental non-insurance, public policy objectives.
- Floodplain managers within and outside of FEMA need to move the NFIP from a program that focuses on specifying *how* to build in the floodplain to one that also *discourages* inappropriate and hazardous development in the floodplain in order to protect both buildings and floodplain functions.
- If it is to fulfill its mission, the NFIP needs to continue to exist and function as designed—as an integrated program that combines mapping, floodplain management, mitigation, and insurance.
- FEMA needs to collaborate more closely with those outside the agency whose goals and programs are consistent with the NFIP, including other federal agencies, states, communities, environmental protection interests, mapping partners, insurance companies and agents, the development industry, and property owners.

First Steps

To inspire appropriate shifts in thinking that work towards the NFIP mission and to build an institutional framework that nurtures action in that direction, the following changes are called for—all of which can be implemented relatively quickly.

- A stakeholders' advisory council should be created to provide overall guidance on working towards the goals of the NFIP and to monitor progress. The council would include representatives from all components of the NFIP and other related FEMA programs and also from the states, communities, environmental protection interests, developers, insurance industry, and lenders. The council would be charged with reporting to the Mitigation Director on the various components' progress towards the goals. It should assume responsibility for a national consensus on measurement and data collection, and serve to instill a more global and future-oriented perspective on the Program.
- The Community Assistance Program should be remodeled so that it can become a true partnership between each state's governor's office and FEMA, with a state commitment to financial support and to ensuring that all relevant state agencies and programs will fulfill their responsibilities with regard to floodplain management.
- States should adopt and enforce strong floodplain management programs that cover all their activities, and ensure that state agencies comply with them. If state agencies do not comply fully with such programs, they should face the same NFIP sanctions that communities face.

1. INTRODUCTION AND PURPOSE

1.1 Background

Throughout history, humans have been attracted to sites near water for places to live, establish commerce and industry, and enjoy recreation. When the United States was being settled, waterside locations provided the access to transportation, water supply, and water power that people needed to establish their communities. In addition, these areas had fertile soils, making them prime agricultural lands. In recent decades, development along waterways and shorelines has been spurred by the aesthetic and recreational assets of these sites.

Today's communities inherited these patterns of floodplain development along with the benefits of established neighborhoods, affordable housing, and an economic base worth protecting and preserving. At the same time, local governments face pressures to maintain and expand their development patterns by building new structures in floodplains.

Floods pose no problem for floodplains that are in their natural, undeveloped, state—in fact, they are beneficial to those areas. However, one result of all the historic settlement in floodplains is that floods have become the nation's most common natural disaster. Between 1955 and 1999 floods were estimated to have caused \$270 billion in losses, or an average of about \$6 billion each year (1999 dollars). The decades were punctuated by single years of severe storms with catastrophic losses: the 1973 flooding from Hurricane Agnes resulted in damage that exceeded \$30 billion; another \$22 billion occurred during the 1993 floods on the Mississippi River (National Center for Atmospheric Research, 2001). Since the turn of the millennium the pattern has continued: in 2005 alone, over \$150 billion in flood and hurricane losses were recorded. The costs in human lives are just as dramatic: each year floods kill about 100 people on average, with much larger numbers in some years.

Despite the havoc floods cause, they are among the most preventable natural disasters. The majority of floods occur relatively frequently, and in defined geographic areas. A range of predictive, evaluative, mitigation, and management techniques is available to significantly reduce the risk of and damage to property from flooding.

At the same time, floodplains should not always be viewed as land waiting for human development. Floodplains can be preserved from development for their intrinsic benefits. Their natural function is as areas in which flood waters can flow and be stored temporarily, in a natural cycle that serves biological and ecological functions that also benefit humans. Flood damage is essentially the result of human occupation and use of floodplains that also can have negative effects on the natural flooding process itself—often unintended and unforeseen.

The National Flood Insurance Program (NFIP) plays a major role in efforts to reduce both flood losses to property and the loss of natural floodplain functions. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (Public Law 90-448) and made major changes to the program in 1973, 1994, and 2004. The NFIP's creation was based on the federal government's consideration of several factors. First, floods are costly to property owners and federal, state, and local governments. Second, despite the federal government's significant investment in structural mitigation, such as dams and levees, flood losses had continued to increase. Finally, the private insurance industry had found (and continues to find)

the provision of flood insurance to be uneconomical. Because flooding is unpredictable and catastrophic in nature, only those most at risk would be likely to purchase the insurance, precluding the accumulation of funds sufficient to cover claims that would have to be paid. This phenomenon is known as “adverse selection” and is inconsistent with a sound private insurance program.

The NFIP was created in response to the cycle of increasing and repeated costs and consequences, with no solution available through the private sector. More details on how the NFIP works are provided in Section 1.6.

1.2 The Evaluation

One purpose of the National Flood Insurance Act of 1968 was to authorize “continuing studies of flood hazards...in order to provide for a constant reappraisal of the flood insurance program and its effect on land-use requirements” (Public Law 90-448 §1301). This clear call for evaluation and the fact that the NFIP had never been the subject of a comprehensive evaluation led FEMA in 2000 to contract with the American Institutes for Research (AIR), an independent, not-for-profit corporation, to design, lead, and manage the evaluation of the NFIP.

The NFIP Evaluation was guided by a Steering Committee (see list of members on page iv) that determined priorities of topics to be examined, such as compliance among participating communities with the NFIP’s building and land use criteria, the Program’s actuarial soundness, and the NFIP’s developmental and environmental impacts. The purpose of the overall evaluation was to develop data and information needed to formulate better policies for floodplain management, risk assessment, and insurance, and to support long-term planning and policymaking for the NFIP.

Although there were sufficient research questions developed by the Steering Committee to support a potentially very large number of investigations, with available resources it was not possible to conduct a completely comprehensive evaluation of all aspects of the NFIP’s progress. Thus, the Evaluation focused on the subjects covered by the 13 topical reports listed at the front of this document. It should also be noted that all scopes of work for the reports and most of the data collection were completed before the dramatic 2005 hurricane season.

Due to the variety of research topics and the complexity of the subject matter, each of the reports used widely varying, and sometimes multiple, methods. These methods included key informant interviews, engineering surveys, case studies, database analyses, flood hazard modeling, legal and regulatory reviews, and cost-benefit analyses.

1.3 The Final Report

The assessments conducted under each of the studies of the Evaluation provide considerable information about the Program, but do not provide a single comprehensive picture of the progress of the NFIP towards its goals. In some cases, the reports have sufficient scope, data availability, and research tools to consider the “null hypothesis” of a world in which the NFIP’s insurance and floodplain management provisions do not exist and/or to consider the extent to which the NFIP is meeting one or more of its goals. Other reports focus on more specific issues that were of critical interest to the Evaluation’s Steering Committee.

Consequently, the 13 reports do not contribute evenly or broadly to evaluating progress towards the goals of the NFIP.

In addition, some important NFIP-related topics were purposely not addressed during the Evaluation. For example, it was deemed unproductive to attempt to evaluate the NFIP mapping effort while it was undergoing massive changes with the advent of the Map Modernization initiative. Similarly, at the time the Evaluation commenced, FEMA had just completed a study of the economic effects of eliminating the subsidy for pre-FIRM properties and also was examining the problems of properties that experience repetitive losses, so those two topics were not addressed in detail during the Evaluation.

To fill in these and other gaps and provide the perspective needed to underlie the determinations made in this Final Report, AIR assembled a Working Group of professionals with expertise and experience in the fields and topics covered by the Evaluation. Its members and the technical support personnel are listed on page v.

The Working Group reviewed the methods, findings, conclusions, and recommendations of the Evaluation project's 13 studies to take a measured and informed look at the results and draw over-arching conclusions. The group met in Washington, D.C., in August 2006 to integrate its observations, reach agreement on the most salient findings of the Evaluation, and to draft this report. The members' knowledge of the factors that influence the effectiveness of the NFIP—and their willingness and ability to ponder the difficult questions that underlie this important public policy issue—made it possible to draw conclusions from the vast quantity of data and observations made in the course of the Evaluation.

This Final Report is the product of the Working Group. It presents the group's conclusions, concerns, and recommendations about the NFIP's progress towards meeting its goals, drawn from the findings and recommendation of the other 13 NFIP Evaluation reports and supplemented by other recent materials and professional knowledge.

This report is structured to examine progress made towards the four goals of the NFIP, introduced below in Section 1.4. Subsequent sections address each of the four goals. The final section makes overarching conclusions about the findings of the Evaluation and summarizes the actions that are recommended.*

1.4 Goals of the NFIP

The National Flood Insurance Act of 1968 (Public Law 90-448), which created the NFIP, had several explicit, inter-related goals, and subsequent NFIP legislation has added to or built upon those goals. In the course of preparing for the Evaluation, FEMA, AIR, and the Steering Committee reached consensus on the expression of these many goals in more concise and specific terms. Thus, for purposes of the Evaluation, the goals of the NFIP are to

- Decrease the risk of future flood losses,

* For a compilation of the recommendations from all of the Evaluation reports see *The Evaluation of the National Flood Insurance Program—Recommendations from the Individual Reports* (AIR, 2006).

- Reduce the costs and adverse consequences of flooding,
- Reduce the demands and expectations for disaster assistance after floods, and
- Preserve and restore the natural and beneficial values of floodplains.

The progress that has been made in achieving these four goals is described in this Final Report. For each goal, one or more assessments of progress or performance are presented, along with findings from the Evaluation and conclusions of the Final Report Working Group pertaining to that goal. Consideration is given to the changes that could be made to move the NFIP closer to achievement of that goal, and appropriate recommendations for that action are presented.

Before the progress towards goals is discussed, some essential groundwork for interpretation of the Evaluation's findings is presented in the next three subsections. They supply some important contextual issues, describe the framework of the NFIP, and discuss selected national trends that affect the NFIP.

1.5 The NFIP in Context

It should be noted that the NFIP, as with many such programs, cannot reach 100% of all of its goals. In the context of the nation's priorities, the Program faces a series of competing objectives that must be kept constantly in balance. Here are some examples of the balancing that is required.

- At the outset of the program, a national standard was needed to enable all properties to be treated similarly. The 100-year or base flood was selected as a trade-off between two possible extremes. At one end of the spectrum, the Program could have sought to protect everyone from almost all floods, no matter how large or rare (which would place economic improvement restrictions on very large areas). At the other end, the Program could have provided protection only for the smaller floods (which would have left many buildings exposed to damage). The 100-year standard was the balance point between the pros and cons of both extremes.
- The U.S. Constitution does not allow government to deprive people of all uses of their property and Congress did not intend to prevent all floodplain development, especially in areas where the flood hazard is minimal and such development contributes to the nation's economy. The risk of future flood losses could only be eliminated if all future development in all flood hazard areas were terminated. Because some development must take place, some future flood risk must be accepted.
- As a government program designed to help solve a national problem, the NFIP was intended to have some federal support, even though it is modeled on an insurance program. In order to make flood insurance affordable to most property owners, the flood insurance offered under the program purposely does not cover everything that may be lost during a flood, and a subsidy is provided to structures built before a community's flood risk was identified. Even with the NFIP there will still be a need for federal assistance in various forms if the nation wants to continue to help flood

victims. The assistance will be in the form of disaster aid, Congressional forgiveness of NFIP debt incurred in catastrophic loss years, and lower premium rates.

- There is strong support in society for protection of the environment, but there usually is stronger support for protecting people and property from suffering and damage. Protecting human development from flooding will result in some loss of natural and beneficial floodplain functions.

Those responsible for making the policies and administering the NFIP recognize that a balance must be maintained among these competing desires of society. They also recognize that there will never be enough resources to accomplish everything everyone wants the Program to do. If this balancing act were easy or inexpensive, its management would not have fallen to the federal government.

1.6 Administration of the NFIP

Responsibility for administering the NFIP initially fell to the Department of Housing and Urban Development, but this authority was transferred to the Federal Emergency Management Agency (FEMA), an independent agency created in 1979. FEMA became part of the Department of Homeland Security in March 2003. FEMA's Mitigation Division manages the NFIP. The Mitigation Division oversees the identification and mapping of floodprone communities, reviews community adoption and implementation of floodplain management and building construction measures, sets flood insurance rates for different mapped zones of risk, provides flood insurance, and funds mitigation projects that are cost effective for the National Flood Insurance Fund.

There are three basic parts to the NFIP: mapping, floodplain management, and insurance. These three parts are interconnected and mutually supportive—the fundamental elements of a federal program to reduce flood losses as envisioned in the 1968 Act. First, the flood hazard is identified, via mapping of the hazard and appropriate zones of flood risk. Next, communities that decide to participate in the NFIP manage their floodplains by applying land use regulation and construction standards in an effort to reduce future flood losses. Finally, insurance is provided under a scheme that makes the policies affordable yet still allows generation of revenue to pay claims without resort to extensive federal funding.

1.6.1 Flood Hazard Mapping

Flood Insurance Rate Maps (FIRMs) have been prepared for over 20,000 communities with flood problems. After they have been reviewed by the affected community and people have a chance to comment on them, the maps become official. Local floodplain management programs, flood insurance rates, and insurance purchase requirements are based on these maps. The NFIP flood maps have become the primary source of flood data for the nation and the maps are used for many purposes other than implementation of the NFIP. Procedures are in place to amend or revise the maps based on more accurate information, changes in terrain or watershed development, or new flood studies. A major initiative—Map Modernization—was begun in 2003 to modernize and update the nation's Flood Insurance Rate Maps.

1.6.2 Floodplain Management

As directed by the 1968 Act, future flood losses were to be mitigated through two avenues: guiding new development away from the flood hazard areas and ensuring that any new development that did take place in the floodplain was constructed in such a way as to minimize damage to each structure. The NFIP was designed so that these two missions would be carried out at the state and local levels, where land use authority resides. In this way, over the years, the potential for flood damage was to be gradually diminished. It was anticipated that state and local governments would develop a commitment to and expertise in managing flood hazards within their jurisdictions that would yield ongoing wise use of the nation's floodplains into the future. To receive the advantages of the NFIP, and help accomplish these two objectives, participating communities enact and enforce floodplain management provisions on new development in the mapped floodplains.

Local management of floodplains and building construction goes hand-in-hand under the NFIP to achieve the program's goals. Buildings that comply with community floodplain management regulations not only face lower risk of flooding but also pay premiums based on flood insurance rates that are in most cases significantly lower than the subsidized rates charged to the older, pre-FIRM buildings. However, buildings constructed in violation of the community's floodplain management ordinance face much higher premiums, which can be up to thousands of dollars a year.

An additional floodplain management practice the NFIP has encouraged in the last 15 years is flood mitigation through state and local projects that reduce the risk to structures that were already in the floodplain when the community began to manage its flood hazard. The NFIP and other FEMA programs provide mitigation grants to share with state and local governments the costs of activities that reduce flooding to existing structures.

1.6.3 Flood Insurance

The 1968 Act authorized the federal government to establish and implement "a national flood insurance program," the mechanism by which victims of flooding

NFIP Terminology

Community: A political entity that has the authority to adopt and enforce floodplain ordinances for the area under its jurisdiction

Base flood: The flood having a 1 percent chance of being equaled or exceeded in any given year. It also known as the 1 percent chance or 100-year flood. It has been adopted by the NFIP as the basis for mapping Special Flood Hazard Areas, insurance rating, and regulating new construction.

FIRM: Flood Insurance Rate Map, An official map of a community, on which the Special Flood Hazard Area has been delineated.

Special Flood Hazard Area: The area shown on the FIRM as being inundated by the base flood.

Base flood elevation or BFE: The elevation (in relation to sea level or other datum) of the crest of the base flood.

A Zone: The non-coastal area shown on a Flood Insurance Rate map as being inundated by the base flood. There are several types of A Zones, depending on the type and depth of flooding expected at the site.

V Zone: The Special Flood Hazard Area subject to coastal high hazard flooding, , i.e., where the waves during the base flood are at least three feet high.

Coastal A Zone: The part of the coastal floodplain where waves do not reach the 3-foot height of a V Zone but can still cause structural damage to a building. Currently shown on FIRMs as A zones without a special coastal designation.

X Zone: The area shown on a FIRM outside of the Special Flood Hazard Area.

Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

could be compensated for flood damage. Flood insurance also provides a way to remove from the federal government some of the financial burden of flood losses, such as for federal disaster assistance and casualty loss deductions under federal income taxes. The National Flood Insurance Fund was established within the U.S. Treasury by the 1968 Act as the funding mechanism of the NFIP. Premium income and policy fees are deposited into the Fund and Program expenses come out of the Fund. The NFIP has the authority to borrow from the Treasury, and then repay the sum along with interest.

The NFIP authorizing legislation separated the flood insurance ratemaking process into two distinct categories: subsidized rates and actuarial rates. Congress authorized the NFIP to offer policies at “subsidized” rates (less than full actuarial risk rates) to existing buildings constructed on or before the effective date of the initial Flood Insurance Rate Map. Because these buildings were built without the occupants’ full knowledge of the flood risk, the premiums set for them using actuarial rating could have made the flood insurance prohibitively expensive. The availability of this lower-cost insurance also was intended to encourage communities to join the NFIP and adopt building standards that would reduce the risk faced by new buildings. It was expected that, over time, new, safer, construction would replace the existing housing stock in the nation’s flood hazard areas.

Even though only such general rating factors as flood-risk zone, occupancy type, and building type are used to set rates for policies on buildings in this subsidized class, the occupants pay for at least part of the cost of the insurance (on average, 35 to 40 percent of what the full risk premium should be) and no longer need most disaster assistance. (Note: “subsidized” means that the insureds are paying less than their full-risk premium—the amount that would be needed to fund the long-term expectation of the flood losses to the building. The difference is made up over the short term by surpluses from other classes of property in the NFIP. Ultimately, the federal government has to make up for the foregone revenue when a catastrophic loss year occurs.)

For the other category of structures, those built or substantially improved after the community’s first Flood Insurance Rate Map (or after December 31, 1974, whichever is later), full actuarial rates must be charged, reflecting the structure’s risk of being damaged by the base flood. The flood insurance rates take into account a number of different factors including the flood risk zone shown on the Flood Insurance Rate Map, the elevation of the lowest floor above or below the base flood elevation (BFE), the type of building, the number of floors, and the existence of a basement or an enclosure. They also take into account the expected losses in an “average historical loss year.” Using this insurance ratemaking approach, the National Flood Insurance Fund is expected to run small surpluses in some years and deficits in others, but accumulates no loss reserves for very high loss years.

In response to the small numbers of flood insurance policies that were sold in the first five years of the program, the Flood Disaster Protection Act of 1973 added a key requirement to the NFIP known as the “mandatory purchase requirement.” It makes flood insurance a prerequisite for receiving funds from a federal agency or a federally supported financial program. The two most important implications of this provision are that (1) property owners in Special Flood Hazard Areas in participating communities are required to purchase and retain flood insurance for the life of their federally backed mortgage loans, and (2) communities must join the NFIP to allow their residents to benefit from federally supported programs, like Small Business Administration loans, Veterans Administration mortgage guarantees, Department of Housing and

Urban Development housing, and disaster assistance. The amount of insurance that must be purchased depends on several factors, primarily the amount of financial assistance or the outstanding principal balance of the loan and the maximum amount of insurance available through the NFIP.

The mandatory purchase provision has turned out to be one of the driving forces of the NFIP. The percentage of homes that are insured against floods is much larger among those subject to the mandatory purchase requirement than among those that are not (Dixon *et al.*,

2006). The emphasis on the purchase of flood insurance at the time of a mortgage transaction translates, in turn, into support for continual improvements in flood mapping.



When people occupy nearshore areas, they invite high risks even as they benefit from coastal amenities.

1.7 National Trends

In addressing the overall Evaluation of the NFIP, it has been necessary to be mindful of several trends that are affecting the nation as a whole, the practice of floodplain management, and the provision of flood insurance. The Working Group noted several of the more pertinent trends, discussed below. Although some trends are encouraging, all of them taken together point to substantially increasing—and sometimes unanticipated—flooding-related challenges that must be clearly and forthrightly met and addressed.

1.7.1 Growth and Distribution of U.S. Population

Perhaps the most significant factor in shaping the challenges faced by the NFIP since its inception continues to be the growth of the U.S. population and its gradual migration to the coastal areas of the continent. The population of the United States is anticipated to increase by about 29 percent between 2000 and the year 2030, according to the U.S. Census. This will add approximately 82 million new residents. Increased demand for land for housing and other development will continue to push new development into risky areas, and place further strains on those natural ecosystems and their resources.

Population of the United States and Coastal Counties for Selected Years (data from Crossett <i>et al.</i> , 2004)		
	U.S. population (millions)	Coastal county population (millions)
1980	226	120
2003	296	153
2015	322	165

More important than the amount of growth is how and where it is happening. People are richer than they were in 1968 and they tend to spend their extra money on larger, more expensive homes. They are locating their homes (and their recreation and retirement homes) in attractive settings, such as along rural streams and lakes and along the ocean coast. In urban and suburban areas, development pressures are great enough to warrant the extra expense of providing

structural flood protection or filling to remove properties from the mapped flood hazard area. The nation's population has also migrated westward and towards the south. In the West, new development is built on or near alluvial fans, moveable stream beds, and other arid-region flood hazards that are not directly addressed by the NFIP regulatory criteria. The commercial and government infrastructure to support these homes has followed and has subsequently become exposed to flood damage.

Beaches and nearshore areas in particular have become more densely developed than they were in 1968, even though barrier islands and other coastal landforms are dynamic natural systems that pose risks to human development that exceed those of inland floodplains. These risks include hurricanes, coastal flooding and storm surge, high winds, and erosion. To exacerbate the situation, human development tends to undermine the coastal area's natural defenses to these hazards and degrade its natural and beneficial floodplain functions, important habitats, and recreational assets.

1.7.2 Increasing Flood Losses

Flood losses in the United States continue to climb. Total flood damage is increasing in absolute dollars, although not as a percentage of national wealth. Direct flood damage to property, crops, and infrastructure throughout the 1990s was estimated to average about \$5 billion annually (Pielke *et al.*, 2002, p.1) and is likely to continue to increase.

Although, as will be discussed below, the NFIP has been successful in reducing damage to new buildings, that does not mean that national flood losses will decrease. First, buildings account for only one portion of overall flood losses. Second, the value of floodplain development is increasing, because there are more at-risk buildings in the floodplain and the size and value of the new buildings is increasing. Third, residual losses due to floods larger than the base flood are inevitable. Fourth, the NFIP has no impact on agricultural crop losses and only a moderate impact on infrastructure losses. Finally, flooding in many areas is likely to increase over time due to factors such as the urbanization of watersheds, coastal erosion, and climate change.

1.7.3 Segmentation of Federal Programs

Since the inception of the NFIP, there have been repeated calls for nationwide coordination of water-related programs at all levels of government. Congress clearly intended, as stated in the 1968 Act, that progress be made towards a "unified national program" for managing floodplains. Over the years efforts have been made, with varying degrees of success, to set and implement coherent and collaborative policies, standards, procedures, and goals among (and within) federal programs to address flood loss reduction and related water resources issues.

Commentators have noted, however, that the current trend is towards less, rather than more, coordination among federal programs and sub-programs and among them and the states and localities that are partners in flood loss reduction. The scope of agencies with flood-related programs at the federal level can be seen in the partial list in the box on the next page. An atmosphere that inhibits intra- and inter-agency cooperation greatly hinders the successful implementation of a "unified national program."

One unfortunate by-product of this lack of coordination is the emergence of the “lowest common denominator” as the default federal standard. Without coordinated national standards and goals, federal flood protection programs often seek the minimum level of protection that will simply relieve local property owners of the requirement to purchase flood insurance. For example, if a property is outside the mapped flood hazard area, it is deemed “safe” from flooding by many programs, even though the mapping criteria do not include small watersheds, the maps do not convey the residual risk faced by properties just outside the mapped area, and the rate of growth and urbanization in many locales tend to outstrip updates to the maps.

1.7.4 Acceptance of Restrictions on Development

At the outset of the NFIP, according to many state and federal officials, considerable resistance was encountered in having flood hazard ordinances adopted and enforced by local governments. Public attitudes tended to hold property rights inviolate and to downplay the public safety interest of restricting development in floodprone areas. The number of locales in which this attitude prevails has diminished markedly. For the most part, NFIP and state staff indicate, local governments now shoulder the responsibility for protecting residents from flood hazards, working to minimize flood damage, and preserving floodplain functions and resources. Thousands of communities have adopted flood loss reduction standards and floodplain resource protection measures that exceed the requirements of the NFIP.

Along with local officials, the general public has become more accepting of regulations. People are more likely to be aware of the fact that unregulated development in floodplains, along shorelines, and elsewhere in the watershed can have an adverse impact on their own properties, neighborhoods, and communities.

1.7.5 Appreciation for Environmental Protection

Compared to the situation several decades ago, there is now more widespread acceptance of efforts to protect the environment. Along with this has come broader public understanding and appreciation of the inter-connectedness of ecological systems and how altering the flow or quality of water in one place affects others downstream, upstream, or along the shore. Public interest polls confirm that Americans are more committed to environmental protection than in the past. Water quality and outdoor recreational opportunities are important to people. Grass-

Partial List of Federal Agencies with Programs Relating to Floodplain Management

- Bureau of Reclamation
- Department of Homeland Security/FEMA
- Department of Housing and Urban Development
- Environmental Protection Agency
- Fish and Wildlife Service
- Natural Resources Conservation Service
- National Oceanic and Atmospheric Administration
- National Park Service
- Small Business Administration
- Tennessee Valley Authority
- U.S. Army Corps of Engineers
- U.S. Geological Survey

The U.S. Water Resources Council, the federal coordinating body for national floodplain management and other water resources issues, was disbanded in the early 1980s. Its partial successor, the Federal Interagency Floodplain Management Task Force, could not provide the same high level of interagency coordination, and last met in the late 1990s.

roots efforts to protect and restore streams, wetlands, and other water-related features are more numerous and visible.

1.7.6 Changing and Conflicting Perceptions of Federal Flood Insurance

The National Flood Insurance Program can be depicted as the fabled elephant being described by a group of blind men. Understanding the different aspects and operations of the NFIP, and developing a shared perspective on its nature and aims, has been problematic since its inception, even among professionals in the field. The different vantages from which the program is viewed have also shifted over time. The Working Group noted some recent transformations in the viewpoints of various stakeholders in the NFIP.

- There is growing conviction, reflected in the media and in increased Congressional debate, that the NFIP should operate as a self-supporting commercial activity (an insurance company) rather than as a government program designed to use public resources to help people when necessary.
- Many people expect more federal involvement in flood disasters (including disaster payments of various sorts), even though one objective of the NFIP was to reduce it. Floodplain management professionals have emphasized the responsibility of local governments and property owners to manage their flood hazards as much on their own as possible. Yet the intense and extensive media coverage of the 2004 and 2005 hurricane disasters, along with well-publicized opinions about the proper role of the federal government in disaster preparedness and relief, may well have resurrected public conviction that there is a federal bailout after every storm.
- Some flood insurance policy holders have come to view flood insurance as an individual financial investment that should yield a return, rather than as protection against possible future losses. Some of those who have policies appear to believe that because they pay insurance premiums they are entitled to be “made whole” when they do suffer a flood and that, further, a future return on those premiums is somehow guaranteed. Others drop their policies after a few dry years because they have not collected any claims payments. On the other hand, insurance professionals stress that insurance is a part of an overall risk management program and should be considered the last safety net, which comes into play only when other loss protection measures have failed to prevent all damage.

With the history and operations of the NFIP, its context, and these trends in mind, this report now turns to an assessment of the progress made towards the Program’s four goals.

2. NFIP GOAL—DECREASE THE RISK OF FLOOD LOSSES

The NFIP goal of decreasing the risk of flood losses contemplates decreasing the exposure of damageable property to floods over the long run. Reducing or avoiding present and future flood damage is done primarily by implementing land use management measures that guide future development away from floodprone areas and by applying construction standards to buildings that are sited in floodprone areas. For this goal, the Evaluation looked primarily at buildings—the category of property for which the NFIP provides insurance and sets regulatory standards. Risks to infrastructure, life safety, agriculture, etc. are generally outside the scope of the NFIP. Losses to natural resources and functions are covered separately in Section 5.

There are two fundamental ways to meet this goal: either locate development a horizontal distance away from the flood hazard, outside all or part of the floodprone area,* or construct the development so that it is vertically removed from flood waters (that is, elevated above the expected flood level) or floodproofed. Accordingly, the Working Group summarized the Evaluation reports' findings under these two general approaches to reducing future flood risk:

- (1) The use of land use management measures to guide development away from flood hazard areas; and
- (2) Requirements that new buildings in the floodplain meet construction standards to protect them from floods.

2.1 Guiding Development away from Flood Hazards

As noted in Section 1.4, although “guiding development away” is a stated goal of the NFIP in the 1968 Act, the extent to which this can and should occur is a function of a balance of competing needs, interests, and available resources. There are also constitutional limits on the restrictions that can be placed on private property. Accordingly, “guide development away” does not mean “prevent all development.”

Is Development Guided away from Floodprone Areas?

The number of total Special Flood Hazard Area structures is projected to increase from the 6.6 million estimated in 1997 to 8.7 million in 2022, an annual average increase of about one percent (PricewaterhouseCoopers, 1999, p. 1).

2.1.1 Findings

It is recognized that the total number of buildings in the 100-year floodplains of the United States has increased over time. There are now an estimated 6 to 8 million commercial and residential buildings in the mapped 100-year floodplains of the nation, and an estimated 3 to 7 million additional floodprone buildings lying outside that area but within the 500-year floodplains. There are no accurate counts of such structures and have never been any, meaning that there is no baseline for an accurate comparison of growth in such areas over time.

* This “horizontal” protection technique comes with a bonus that vertical protection does not. When development is sited outside of the floodprone area, not only is the development protected from flood damage, but also the floodplain is protected from the development. Without the adverse impacts that development brings, the floodplain can continue serving its natural functions. This is discussed further in Section 5.

Not only had development already occurred in the floodplains before the NFIP, but also there were no clear indications it was decreasing at the time. The Evaluation studies and other research indicate that the combination of the NFIP's building elevation requirement and restrictions on floodway development, the cost of construction in the floodplain, and the requirement for purchasing flood insurance probably has reduced the rate at which new buildings would have been expected to be constructed in the floodplains had there been no NFIP. However, this dampening effect of the NFIP on development remains unquantified and, when coupled with ongoing development pressure, has not been sufficient to diminish exposure to losses appreciably.



When development is guided away from the floodplain, the normal flooding process takes place without causing costly damage.

In short, development continues to occur throughout the nation's floodplains. There are four main reasons why more development is not guided safely away from flood hazard areas.

Few Restricted Areas. First, the NFIP has only two restrictions on where construction and other development can occur. The first restriction is that no new construction is allowed seaward of mean high tide. That area amounts to a miniscule portion of the nation's flood hazard areas.

The second restriction can have a much larger effect: a participating local government must prohibit any encroachment within its riverine floodway that would result in any increase in flood heights. While this has slowed development in and provided substantial protection to floodways, it has not stopped it for four reasons:

- The rule does not prohibit floodway development. Instead, it allows development that can be shown not to cause an increase in flood heights. For example, a parking lot would be acceptable if an engineer can certify that its presence does not obstruct flows or increase flood heights;
- Most rural areas have floodplain maps that do not show floodways, so there is no obligation to enforce floodway restrictions in those areas;
- Through physical changes to the floodplain (such as channelizing a stream), a developer can rearrange and remap the floodway boundary to free up floodprone land for construction; and

- Traditional mapping allows a large floodplain fringe to be developed because the floodway delineation is based on the area needed to discharge the base flood without “cumulatively increasing the water surface elevation more than one foot.” This results in a relatively narrow floodway in which most development is excluded (Galloway *et al.*, 2006). In some states and communities a smaller surcharge is allowed (in order to minimize the increase in water surface elevation that results from development), which results in a wider floodway that is preserved and protected from development.

Although these two provisions prevent much development in very small parts of coastal floodplains and in mapped floodways, the NFIP has no other regulatory provisions for keeping floodplains clear, even in high hazard areas, such as mountain canyons, alluvial fans, and barrier beaches and islands. Further, veteran professionals in floodplain management have noted a decided shift in the administration of floodway provisions. At one time encroachments and revisions were rare but more recently they seem to be more common. This may be the result of both a retreat from the original intent of the floodway provisions as well as engineers’ having more computer-based modeling capability at their disposal now than in the past.

No Requirements to Protect Natural Functions. Second, the NFIP has no requirements that directly protect areas that are important to the natural and beneficial functions of floodplains. Except for a prohibition on the alteration of mangroves and dunes, the NFIP does not address development of environmentally sensitive areas such as barrier islands or riparian habitats. In fact, except for conveyance, there has been no specification under the NFIP of the essential functions of or the benefits provided by floodplains in their undisturbed state, such as recreation, habitat, filtration, groundwater recharge, or outdoor education. This is discussed further in Section 5.

No Limits on Siting Critical Facilities.

Third, there is no requirement in the NFIP that limits the location of critical (usually public) facilities, such as water treatment plants, hospitals, chemical storage, or communications networks—costly fixtures whose damage during a flood can also result in serious disruption and resultant indirect costs. Through the Community Rating System, communities are encouraged to prohibit the construction of critical facilities inside the 0.2 percent annual chance floodplain, and several states also recommend this standard, but it is nowhere near universal and floodplains remain candidates sites for such development (Galloway *et al.*, 2006).

The Community Rating System

The CRS is a voluntary program established within the NFIP in 1990 which rewards communities—with premium discounts for their policyholders—for carrying out floodplain management activities that exceed the minimum requirements of the NFIP. In 2005 just over 1,000 communities participated in the CRS, accounting for about two-thirds of the NFIP’s policies.

Fill in Floodplain Allowed and Facilitated. Fourth, under the NFIP earthen fill is an allowable method of elevating buildings outside of the floodway. Although fill is an effective way to reduce flood damage, it can have impacts on the natural functions of floodplains. The NFIP has a procedure that allows for a parcel of land to be “removed” from the regulatory floodplain by depositing fill so that the ground level is above the base flood elevation. Such exceptions are known as Letters of Map Revision based on Fill, or “LOMR-F.” Thousands of LOMR-Fs are issued each year but their cumulative impacts are not tracked. They have the effect

of removing parcels from the regulated Special Flood Hazard Area, so that NFIP construction standards do not apply and flood insurance is not required. The availability of this option fosters—rather than discourages—filling and development of floodprone land. Further, there is no requirement to compensate for the floodwater storage areas that are displaced by the fill, resulting in increased flood heights on other properties.

Filling in the Nation's Floodplains

Records from FEMA show that, in 2002 (considered a typical year), 12,653 properties were removed from the Special Flood Hazard Area by LOMR-Fs.

In summary: Most floodprone areas of the United States are subject to development in part because the NFIP has no strong provisions to guide development away from floodplains, even those with high-risk flood hazards or sensitive natural resources.

2.1.2 Recommendations

To more effectively decrease the risk of flood losses, the NFIP must do more to guide development away from floodprone areas.* Specifically:

- The flood hazard mapping criteria should be revised so that
 - Very high hazard areas, such as high velocity floodways, mountain canyons, and coastal erosion areas, are identified on future Flood Insurance Rate Maps;
 - Areas with intrinsic natural values and functions that are identified by other agencies (such as wetlands or habitat) are included as “habitat layers” or “resource layers” in Digital Flood Insurance Rate Maps;
 - A smaller surcharge is allowed than the one foot currently used as the basis for delineation of floodways; and
 - The procedures for issuance of Letters of Map Revision based on Fill are revised so that, at a minimum, filled areas are still subject to the floodplain management and insurance purchase requirements of regular floodplains.
- The criteria for local floodplain management programs should be revised so that
 - Communities are required to prohibit certain types of development, such as residences and critical facilities, from the mapped very high hazard areas, such as deep or high-velocity floodways;
 - Communities are encouraged (with greater Community Rating System credits or other incentives) and, where necessary, required, to

* Background on these and other recommendations, along with details and suggestions about how they can be achieved, can be found in the Evaluation substudies by Galloway *et al.* (2006), Jones *et al.* (2006), Mathis and Nicholson (2006), Mittler *et al.* (2006), and Monday *et al.* (2006).

- prohibit development in areas with intrinsic natural values and functions, such as wetlands and endangered species habitat;
- locate critical facilities outside of the 0.2 percent floodplain; and
- limit the use of fill in floodplains.

In summary: *The NFIP should prohibit certain types of development in high hazard areas and do considerably more to guide development away from floodplain areas worthy of protection.*

2.2 Protecting New Buildings

2.2.1 Findings

With the technique of protecting individual buildings (rather than whole areas) from the flood hazard, the NFIP has enjoyed more success. Most new buildings in floodplains nationwide are being built to meet the NFIP construction criteria, which have been shown to protect buildings from the 100-year flood in most instances (Jones *et al.*, 2006). Even those buildings that do not fully meet the NFIP standards almost always have their lowest floor properly elevated—the most significant protection against serious damage under base flood conditions (Mathis and Nicholson, 2006). Given the amount of construction occurring nationwide and the fact that building codes are enforced at the local level, this can be seen as a considerable accomplishment of the NFIP.

Overall compliance with the NFIP minimum requirements by communities appears to be good (see box) but there is considerable room for improvement. The level of community-wide compliance is a measure of ongoing local capability, which will be needed to ensure that land use and construction requirements are effectively implemented into the future. Current resources do not come close to delivering the level of technical assistance and other help to communities that would be needed to achieve a higher level of adherence to NFIP standards that will ensure safer buildings. Nor is there sufficient use of the negative incentives that were designed to encourage community compliance—probation and suspension.

Experience has shown that FEMA has insufficient staff and that they have too many diverse responsibilities to devote the needed attention to community compliance and technical

How well Protected are New Buildings?

- One partially random survey of construction estimated that 89 percent of post-FIRM buildings in Special Flood Hazard Areas are substantially protected from flood damage. That is, they have their lowest floor at or above the base flood elevation or within 6 inches of it (Mathis and Nicholson, 2006, p. ix).
- Of post-FIRM buildings in Special Flood Hazard Areas, 63 percent were found to meet all of the NFIP's building standards (Mathis and Nicholson, 2006, p. ix).
- It is estimated that between 70 and 85 percent of NFIP communities nationwide are operating local floodplain management programs in compliance with minimum NFIP standards. (Monday *et al.*, 2006, p. 8).
- In the history of the NFIP, 49 communities have been placed on probation; 10 have been suspended for failure to enforce their floodplain management ordinances. (Monday *et al.*, 2006, p. 111).

assistance. The program has not taken full advantage of the roles states can play in supporting the NFIP, assisting their communities, and coordinating other state and federal floodplain management programs (Monday *et al.*, 2006; Mittler *et al.*, 2006).

Although the NFIP has established effective mechanisms for protecting new buildings, damage to buildings nationwide will continue to increase in the future, for seven reasons.

First, even perfect compliance with the NFIP construction standards will not protect all buildings from damage by the base flood. The three greatest opportunities for improving the NFIP's standards are these:

- There are no limitations on the types of foundations that can be used to elevate buildings in coastal A Zones. Buildings supported on fill and/or crawl space foundations that meet the minimum NFIP criteria for A Zones cannot withstand the scour and lateral loads that are experienced in many coastal areas (Jones *et al.*, 2006).
- In inland Special Flood Hazard Areas, buildings can be built with the *top* of the lowest floor at the base flood level, allowing the floor joists and other supporting members to be inundated (although all portions of the building below base flood elevation must be constructed using flood resistant materials). This does not protect from the wave action that accompanies most floods. A better alternative is to require that the lowest horizontal structural member of the building be above the BFE (Jones *et al.*, 2006).
- Buildings are not required to be protected above the BFE. Adding only a one-foot margin of protection, known as “freeboard” has been shown by insurance claims experience to have a major impact on flood losses and adds very little to the cost of construction (Jones *et al.*, 2006).

The second reason that building damage can be expected to increase is that the flood information on the Flood Insurance Rate Maps, which dictates where the building criteria are enforced, becomes outdated—quite rapidly, in some areas. As development in watersheds and floodplains continues, natural storage and conveyance capacity is lost and impervious surface areas are increased. Both of these situations result in flood levels that are higher than those shown on existing maps and that also continue to increase over time (Blais *et al.*, 2006). In coastal areas, shorelines move landward as they are eroded, so the area subject to high-velocity waves moves inland as well. However, that change is not reflected on maps unless they are revised every few years.

Third, the nation has large developed areas that are behind levees and downstream of dams. These flood protection measures, like all structures, are both subject to failure and susceptible to being overtopped when a flood exceeds their design level. When either of these events occurs, catastrophic flood damage can result (Galloway *et al.*, 2006).

Fourth, the 1 percent annual chance (100-year) flood is not a level of protection that guarantees that no damage will occur. The 100-year flood was adopted as the NFIP standard as a compromise—the level that was acceptable to all parties concerned when the NFIP was crafted. Current research suggests that, given the fact that the 100-year standard is now fully

institutionalized and that the expense of shifting to another floodplain management standard would be prohibitive, the 100-year flood probably should remain as the NFIP base, even though its use does result in residual losses (Galloway *et al.*, 2006). However, the regulations, building standards, and other implementation mechanisms that have grown up around the NFIP could be improved (e.g., by the requirement of freeboard) to compensate for the now-acknowledged insufficiency of the 100-year level.

Fifth, the level that has been calculated and depicted on maps as representing the 100-year or base flood elevation is merely a central point within an estimated range. The actual vertical location of the surface of the base flood at any site could actually be higher or lower even if the optimistic assumptions made in the modeling hold true and no additional development occurs (Galloway *et al.*, 2006).

Sixth, uncertainties associated with climate variability—whether human-induced or natural—and with potential global warming, sea level rise, and more intense storms suggest that the protection standards and techniques of the past, and the data and models upon which they were based, may well be inadequate in the future (Galloway *et al.*, 2006).

Seventh, the current floodway delineation standard is not restrictive enough to minimize the amount of damage-prone development. The NFIP floodway standard allows the outer boundaries of a floodway to be set based on the area needed to discharge the base flood without “cumulatively increasing the water surface elevation more than one foot.” This enables the entire floodplain fringe to be filled and developed (providing construction standards are met), or sealed off by levees (Galloway *et al.*, 2006). Over the long term this produces increased flood heights and more damage.

In summary: *The NFIP requirements provide significant protection to new buildings, but many new buildings constructed to the NFIP standards will still remain at risk of damage even in the base flood because of gaps in the construction standards.*



2.2.2 Recommendations

The NFIP must do more to protect new buildings from flood damage.^{*} Specifically,

- The NFIP flood hazard mapping criteria should be revised so that
 - A new designation—Coastal A Zones—is delineated on all new Flood Insurance Rate Maps to account for the higher risks that those areas face;
 - Future Flood Insurance Rate Maps are based on the watershed and shoreline conditions that are expected in the future;
 - Floodway delineations on future Flood Insurance Rate Maps are based on a surcharge standard that does not allow filling and development to have an adverse impact on other properties; and
 - Special notations are used on Flood Insurance Rate Maps for areas deemed “protected” by structural projects to show that the areas are still subject to catastrophic flooding if the protective structures fail or the flooding exceeds their design protection level.
- The NFIP criteria for local floodplain management programs should be revised so that
 - Communities are required to adopt and enforce foundation standards in coastal A zones that are the same as those for V Zones;
 - All new buildings in all Special Flood Hazard Areas are required to be protected to a level at least one foot above the base flood elevation; and
 - All new buildings in Special Flood Hazard Areas are required to be elevated with the *bottom* of the lowest horizontal supporting structural member above the flood protection level.
- FEMA and the floodplain management community should
 - Encourage communities and builders to adopt a “100-year-plus” philosophy, meaning that base flood protection should be considered only a minimum and that margins for error should always be incorporated not only in building standards but also in planning, mitigation, and other activities;
 - Increase attention to, and resources in support of, local floodplain management, including the use of all positive and negative compliance incentives that the NFIP can provide; and

^{*} Background on these and other recommendations, along with details and suggestions about how they can be achieved, can be found in the Evaluation substudies by Galloway et al. (2006), Jones et al. (2006), Mathis and Nicholson (2006), Mittler et al. (2006), and Monday et al. (2006).

- Strengthen state involvement in the NFIP through an increased financial commitment to the Community Assistance Program in return for increased state commitment to compliance oversight of new development constructed by the private sector, local governments, and state and federal agencies.

In summary: The NFIP mapping and floodplain management criteria should be revised to provide better flood protection standards for new buildings, and more resources should be devoted to ensuring that local governments and builders can and do comply with those criteria.

3. NFIP GOAL—REDUCE THE COSTS AND CONSEQUENCES OF FLOODING

While the first goal of the NFIP, discussed above, is directed towards reducing the amount of development that is subject to flood damage, this goal addresses the fact that there will always be costs and consequences when floods do occur, even though effort has been made to minimize the exposure of development. Reducing the costs and consequences of flooding means

- (1) Reducing the number of existing buildings exposed to flooding (referred to here as “costs”), and
- (2) Using insurance to reduce the financial consequences to individuals when existing buildings are flooded (referred to here as “consequences”).

Measuring overall progress towards this goal is greatly complicated by three broad factors. First, there is no universally accepted framework for determining what costs and consequences are to be addressed or how they are to be measured. Second, there are inadequate data to quantify many of the potential costs and consequences of flooding. Third, there is insufficient agreement about what would constitute success in reaching this goal.

On the broadest scale, the Evaluation has provided evidence that the NFIP insurance and floodplain management provisions are reducing the net economic costs of flooding to society (see box). At another level, FEMA can accurately calculate the dollar value of claims payments that have been made under the NFIP and the dollars expended in federal outlays (see Section 4). Those figures represent a savings to the nation. However, there are still a great many unknown details.

For example, while statistics from the NFIP can provide a measure of building damage and dollars saved, the contributors to overall costs are subject to debate: erosion damage, agricultural damage, expenditures for temporary housing, damage to infrastructure, localized economic impacts, social disruption, and many more. The Evaluation found that much of what is known about overall costs and consequences comes from case studies, which have tended to focus on major disasters. Disruption to the social fabric of a community, for example, cannot be quantified but surely is a consequence of some floods. In addition, there is evidence of unquantified distributional effects from floods, since lower-income households are (1) more likely to be located in inland areas that are undesirable because of the higher flood risk, (2) cannot afford the NFIP insurance, (3) suffer disproportionately in floods, and (4) take longer to recover, if they recover at all (Sarmiento and Miller, 2006).

Reduction in the Costs and Consequences of Flooding

- The NFIP (insurance and floodplain management combined) is estimated to be reducing net costs to society by over \$1 billion annually (Sarmiento and Miller, 2006, p. 2).
- Modeling shows that the NFIP’s insurance claims payments reduce the consequences of flooding to individuals by \$1.5 billion annually (Sarmiento and Miller, 2006, p. 2).

How the costs and benefits of each of the potential components are to be measured is unsettled as well. Nor is there agreement on what baselines are relevant or how certain costs can be reasonably compared. For example, the costs of flooding per capita (in 1995 dollars) have doubled since the 1940s, but when compared to tangible wealth, the financial impact of flood losses has stayed about the same over time (Pielke *et al.*, 2002, pp. 56-58.)

Although figures such as a reduction in flood costs of over \$1 billion are impressive, there remain an estimated \$2 billion in average annual property losses alone (Sarmiento and Miller, 2006, p. 4). Transferring some of the costs from the federal government to flood insurance policy holders helps the federal government, but not necessarily the nation's economy. Further, these figures do not include costs of items not covered by an insurance policy, especially lost income and human suffering. Although the NFIP has helped to slow the increase, there is both general and political dissatisfaction with the economic and social costs that still occur.

In summary: There is no agreement on how to best measure the costs and consequences of flooding, but there is a consensus that progress to date has not been satisfactory and that better measurement would be very helpful.

Recommendation: FEMA and the floodplain management community should develop a consensus on the data needed to measure the outcomes from the NFIP. The data would best measure the costs and consequences of flooding to people, property, public agencies, and natural functions. The data should be collected and collated to summarize past, present, and expected costs and consequences, and be provided to Congress and other decision makers so they can see the costs, benefits, and impacts of different flood loss reduction strategies.*

3.1 Reducing Flood Damage to Existing Buildings

3.1.1 Findings

In most cases, buildings constructed in a community before its first Flood Insurance Rate Map (pre-FIRM buildings) were not built to resist flood damage, although they were built to different heights and so some are subject to less flood damage than others. The original expectation when the NFIP was established was that these existing buildings would be flooded, damaged by other causes, or just deteriorate and thus would disappear from the floodplains over time or be replaced by new, flood-resistant structures. This turnover initially was projected to take about 25 years (U.S. Department of Housing and Urban Development, 1966). Therefore, it would be just a matter of time until the existing stock of floodprone structures would be replaced by flood-resistant structures.

However, it was soon realized that the turnover of existing floodprone buildings would take longer than estimated and now, 40 years later, there are still significant numbers of pre-FIRM, unprotected structures in the floodplains of the United States. One study estimates this

* Background on the need for data and how this and related recommendations could be undertaken can be found in the Evaluation substudies by Galloway et al. (2006), Monday et al. (2006), Sarmiento and Miller (2006), and Miller et al. (2006).

number at more than 3.5 million, a number that is only declining at the rate of 1 percent per year (PricewaterhouseCoopers, 1999, p. 16).

One subset of these structures, repetitive loss properties, has been a particular problem for the NFIP—they represent only 1 percent of all flood insurance policies, but historically they account for nearly one-third of the claim payments (over \$4.5 billion to date).

Pre-FIRM buildings are not being replaced quickly for several reasons:

Turnover of Existing Floodprone Structures

“Dwellings and other buildings everywhere must in time be replaced. In a high hazard flood area, the life expectancy of any building is relatively short. Many buildings in such locations are destroyed every year; wooden ones float away, and others are undermined or the walls cave in. Still others are so severely damaged that substantial reconstruction is necessary.”

(U.S. Department of Housing and Urban Development, 1966, p. 134)

- The number of pre-FIRM structures is diminishing at about 1 percent per year, not as quickly as initially expected (PricewaterhouseCoopers, 1999, p. 1).
- The number of pre-FIRM structures is projected to decline from about 4.3 million in 1997 to about 3.2 million in 2022 (PricewaterhouseCoopers, 1999, p. 1).

- Building techniques and materials have improved, so that buildings last longer than before and more extensive, longer-lasting repairs and renovations can be made to structures that previously would have been torn down and replaced.
- The 1966 HUD report by the Department of Housing and Urban Development, which provided much of the foundation for the 1968 Act, focused on seriously damaging floods rather than the far more likely series of low-level floods. Buildings subject to low-level floods often can be readily repaired and renovated so that they are actually worth more (and are likely to last longer) than they were before the flood.
- Modeling results indicate that, because flood insurance is available at low cost for pre-FIRM buildings (relative to their true actuarial cost), many claims payments supply the funds for people to repair damage and reoccupy the buildings. One Evaluation report noted, “...the NFIP subsidy to pre-FIRM structures below BFE has . . . provided a negative incentive to invest in flood mitigation upgrades” (Sarmiento and Miller, 2006, p. 41).

The NFIP has a regulatory tool for reducing losses to existing buildings: the requirement that substantially damaged and substantially improved buildings be protected to the same criteria as new buildings. Although this requirement is the main vehicle for upgrading the flood-resistance of existing buildings, its implementation has been problematic:

- It is administratively complicated and politically unpopular, especially after a flood or other disaster that affects many properties. Local officials are reluctant to take actions that could force people out of their homes and are aware that many property owners do not have the funds necessary to apply mitigation measures to their buildings. As a result, it is not universally administered or fully enforced within NFIP communities (Monday *et al.*, 2006).

- It is only useful in mapped and regulated flood hazard areas. As indicated by data on flood insurance claims paid, many properties outside the Special Flood Hazard Area are damaged by floods.
- It only brings buildings up to the same protection standards as for new construction. As noted in Section 2.2, these standards will not always prevent damage by the base flood.
- It is not coordinated closely enough with the insurance mechanisms of the NFIP. Local officials often do not know what buildings have received substantial flood insurance claims (which would help them focus their enforcement efforts) and insurance on flooded buildings is not re-rated on an actuarial basis unless the local official declares them substantially damaged (Monday *et al.*, 2006).

A non-regulatory tool is also available to address existing buildings—funding of mitigation projects. The NFIP provides Increased Cost of Compliance flood insurance coverage that provides up to \$30,000 to help with the cost of mitigating substantially damaged or repetitively damaged properties. Although \$59 million has been paid for 3,209 Increased Cost of Compliance claims and another 1,213 are pending as of December 31, 2005, Increased Cost of Compliance has not been as used as frequently as was predicted when the coverage was first offered.

Several mitigation funding programs have spent about \$1.4 billion on buying, elevating, or otherwise protecting almost 30,000 existing buildings, according to FEMA records. Research indicates that the return on investment in such flood mitigation projects is just above five dollars worth of benefits for every dollar spent (Multihazard Mitigation Council, 2005, p. 147). Although these projects apply only to a small percentage of the total population of existing structures, more and more the funds are spent on repetitive loss and substantially damaged buildings, i.e., those with the greatest loss-reduction benefits. However, the funds have been limited to certain types of mitigation projects, generally the most effective measures, such as acquisition and elevation, which also tend to be the most expensive. The amount of funds and the program rules mean that there will still be many pre-FIRM floodprone and repetitive loss properties that will not qualify for FEMA mitigation funding.

In summary: *The NFIP's current system of regulations, insurance incentives, and mitigation funding is not ridding the nation of its stock of existing floodprone buildings as quickly as anticipated.*

3.1.2 Recommendations

To more effectively reduce the costs of flooding, more must be done to reduce flood damage to existing buildings.* Specifically,

* Background on these and other recommendations, along with details and suggestions about how they can be achieved, can be found in the Evaluation substudies by Galloway et al. (2006), Jones et al. (2006), Mittler et al. (2006), and Sarmiento and Miller (2006).

- The NFIP flood hazard mapping criteria should be revised so that areas of large or repetitive flood insurance claims currently in X Zones are designated Special Flood Hazard Areas. As a result, new, substantially improved, and substantially damaged buildings in all repetitively flooded areas will be required to meet the flood protection requirements of new construction in mapped floodplains.
- FEMA needs to adopt an overall flood loss reduction strategy for existing buildings (and especially repetitively flooded ones) that uses all tools at its disposal, including information and education, regulations, insurance, other government programs, and funding. Among other measures, the strategy should target
 - Improving local administration of the substantial damage regulations;
 - Ensuring that available funding is targeted to the greatest risks;
 - Leveraging FEMA's resources with the resources of states, communities, and property owners who want to protect themselves, their neighborhoods, and their economic bases from flood damage;
 - Encouraging substantial improvement/damage regulations based on cumulative instances or lower thresholds than the NFIP's 50 percent standard;
 - Streamlining the Increased Cost of Compliance payments and funding of mitigation projects, especially immediately after a disaster, before buildings are repaired to their pre-damaged condition; and
 - Increasing the flexibility of the requirements for mitigation grant programs so that less-expensive mitigation measures for structures subject to low-level but repetitive flood hazards can also receive funding.
- Continued Congressional support is needed for funding mitigation initiatives.

3.2 Using Insurance to Lessen the Consequences of Flooding

3.2.1 Findings

Today, roughly half of the homes in mapped floodplains nationwide have flood insurance (see box). Coverage outside mapped Special Flood Hazard Areas but within NFIP communities is about 1 percent (Dixon *et al.*, 2006, p. xiii). In these areas, public disclosure of a flood hazard is not required and the purchase of flood insurance is not mandatory. Some X Zones are designated as such because of a structural project, such as a levee, where people assume they are protected from all floods and discount the residual risk.

Many of the homes in floodplains that are covered by flood insurance have policies because of the mandatory purchase requirement enacted in 1973. Of those that are not subject to the requirement, only about 20 percent have policies (Dixon *et al.*, 2006, p. xiv).

The Evaluation studies identified a variety of reasons for the less-than-100 percent flood insurance coverage in floodprone areas:

- Improvements in enforcement of the mandatory purchase requirement have increased the coverage, but even this tool has its limitations. The regulation only requires that insurance coverage be sufficient to cover the portion of the mortgage that is outstanding. Therefore, as loans are paid off, coverage can be dropped (Tobin and Calfee, 2006).
- Full enforcement of the mandatory purchase requirement is problematic. Responsibility for implementing the law is disseminated among no fewer than eight federal financial agencies. FEMA has no authority over those agencies, even though the success of its program depends on how well they do their jobs (Tobin and Calfee, 2006).
- Insurance agents report reluctance to write NFIP policies because of the difficulty of reading flood maps, calculating premiums, and completing all the paperwork, which differs from that of most other insurance policies (Dixon *et al.*, 2006).
- Lower-income households tend not to be insured, in part because they cannot afford insurance (even contents coverage), but also because they tend not to be subject to the mandatory purchase requirement because they are renters or live in older, unmortgaged housing (Sarmiento and Miller, 2006).

A second concern about flood insurance coverage is whether people who have a policy are fully protected. Here are some examples:

Flood Insurance Coverage

- It is estimated that about 50 percent of the 3.6 million single-family homes (non-condominiums) in Special Flood Hazard Areas have flood insurance, although this percentage varies greatly by region (Dixon *et al.*, 2006, p. xiii).
- In coastal communities, 63 percent of single-family homes in the Special Flood Hazard Areas have flood insurance; in non-coastal communities, 35 percent do (Dixon *et al.*, 2006, p. xv).
- An estimated 50 to 60 percent of single-family homes in Special Flood Hazard Areas are subject to the mandatory purchase requirements, and compliance with it appears to be 75 to 80 percent. Of homes within Special Flood Hazard Areas not subject to the requirement, about 20 percent appear to have flood insurance (Dixon *et al.*, 2006, p. xiv).
- Of insurable single-family homes outside of designated Special Flood Hazard Areas (but within NFIP communities), about 1 percent have flood insurance (Dixon *et al.*, 2006, p. xiii).
- About 14 percent of the single-family homes with flood insurance carry the maximum coverage (Dixon *et al.*, 2006, p. xv).
- Modeling shows that uncompensated losses to individuals (flood costs that they never recover by insurance or federal assistance) are about \$771 million annually (Sarmiento and Miller, 2006, p. 1).

- The mandatory purchase requirement does not require contents coverage, so many people's possessions (and renters' personal property) are not covered.

- Properties that have flood insurance may be under-insured. The Evaluation found evidence that about 25 percent of single-family homes with flood insurance are not covered even up to the value of the property as represented in county tax records, which often are out of date (Dixon *et al.*, 2006).
- The standard flood insurance policy has coverage limits that, given increased building values, often do not allow the insureds to cover the cost of flooding (currently the limit for a single family home is \$250,000). On the other hand, there is private insurance that can cover losses beyond the NFIP policy limits, although such coverage is not widely publicized and may be unaffordable to most middle-income homeowners.

A third concern is that insurance only covers damage related to an insurable building and its contents. There are many other impacts from floods, such as health hazards, loss of income, damage to items outside a building, and damage to roads, utility lines, and other non-building infrastructure. Because it is modeled on an insurance program, the NFIP is not designed to address these other consequences.

In summary: Many owners and renters of floodprone property in the United States still lack flood insurance, and those who have it may still suffer costs and consequences from damage not covered by their flood insurance policies.

3.2.2 Recommendations

To more effectively reduce the consequences of flooding, the NFIP must increase the number of properties covered by flood insurance policies and their level of coverage.* Specifically,

- The NFIP flood hazard mapping criteria should be revised so that areas of known flood hazards outside the Special Flood Hazard Area are designated in such a way that they become subject to the mandatory purchase requirement. This includes
 - Areas of large or repetitive flood insurance claims,
 - Areas deemed protected by levees, and
 - Areas with watersheds smaller than the current NFIP mapping criteria, where the base flood would damage existing buildings.
- The NFIP insurance rating process should be revised to include actuarial rates in areas protected by levees and other structural flood control projects. The rates should reflect the protection provided against smaller, more frequent floods.

* Background on these and other recommendations, along with details and suggestions about how they can be carried out, can be found in the Evaluation substudies by Dixon *et al.* (2006), Galloway *et al.* (2006), Jones *et al.* (2006), Mittler *et al.* (2006), Sarmiento and Miller (2006), Tobin and Calfee (2006).

- FEMA should continue to explore
 - Ways to remove or reduce impediments to agents' selling insurance policies;
 - Whether it is cost-effective to pursue public information activities that
 - Advise people of their flood risk,
 - Encourage the purchase of insurance,
 - Encourage self-help mitigation measures to reduce the impact of a flood on items not covered by flood insurance, and
 - Advise people about private market insurance that can provide higher levels of coverage; and
 - Other government and private programs that address problems of lower-income households, including renters, to help reduce their exposure to flood damage (through non-insurance mechanisms if needed).
- Congress should consider
 - Enacting additional measures to increase compliance with the mandatory purchase (and retention) requirements;
 - Requiring the purchase of flood insurance for properties not currently covered by the mandatory purchase requirement (e.g., properties with mortgages from state-regulated lenders or areas deemed protected by structural projects, such as dam failure inundation zones); and
 - Making the maximum coverage available under the NFIP commensurate with increases in property values and the cost of construction for most homes since the last time the maximum coverage was revised.

In summary: A range of mechanisms should be implemented and explored to broaden mandates on flood insurance purchase and retention and to advise, encourage, and assist property owners in reducing their exposure to losses not covered by a flood insurance policy.

4. NFIP GOAL—REDUCE DEMAND FOR FEDERAL ASSISTANCE

This goal is sometimes expressed as “shifting the costs of flooding from the federal government onto those who bear the risk.” The NFIP can do this in four ways, by

- (1) Reducing the cost of flooding (if overall costs go down, federal expenditures go down as well);
- (2) Reducing federal disaster assistance costs;
- (3) Reducing flood-related expenditures by other federal agencies; and
- (4) Reducing federal support of the NFIP.

The first approach is covered under the first and second NFIP goals in Sections 2 and 3. The other three are reviewed in this section.

4.1 Reducing Federal Disaster Assistance Costs

4.1.1 Findings

Three types of federal assistance may be provided after a disaster:

- Assistance to individuals, such as that for temporary housing, unmet needs, reconstruction loans, and tax deductions. These programs are administered by FEMA and other agencies, such as the Small Business Administration and the Internal Revenue Service.
- Assistance to public and nonprofit agencies, such as Public Assistance, which is administered by FEMA, and many other programs administered by other federal agencies such as the Corps of Engineers and the Departments of Education, Housing and Urban Development, Agriculture, and others. Historically, the amount these agencies have spent on flood-related assistance has equaled or exceeded that spent by FEMA.
- Assistance during and after a flood to help prevent damage. The main example of this is emergency assistance, such as flood fighting and levee repairs, provided by the Corps of Engineers.

Impact on Federal Expenses:

According to modeling conducted as part of the Evaluation, federal expenditures for some forms of assistance to individuals after disasters have been reduced by the NFIP. For example, tax deductions and reconstruction loans are not

The NFIP and Federal Disaster Assistance Costs

- The results of modeling show that the NFIP has reduced the expected cost of flood-related government assistance to residences by \$526 million, a 70 percent reduction. An estimated \$286 million of the savings is due to flood mitigation measures and \$240 million due to insurance coverage of losses (Sarmiento and Miller, 2006 p. 4, table 7).

needed if a loss is covered by insurance. Assistance, including temporary housing, is not needed if a building is not damaged because it has been constructed in accordance with the NFIP rules. However, these costs account for a relatively small proportion of federal disaster expenditures.

A significant portion of federal disaster assistance dollars are spent on Public Assistance, which goes to local governments for repair and replacement of infrastructure, debris removal, and other services (Galloway *et al.*, 2006) and on other federal programs that provide similar types of assistance. As noted in Section 2, historically the NFIP has focused on protecting “insurable buildings,” rather than on guiding development away from floodplains. As a result, the NFIP is limited in its ability to minimize the amounts spent on most of the federal assistance that is provided during and after a flood disaster. In addition, the amount of coverage available under the NFIP is often not sufficient to completely cover all the costs that accompany flooding of insurable buildings.



The NFIP's focus on protecting buildings needs to be coordinated with other agencies' flood protection concerns in order to reduce federal expenses.

One option, increasing flood insurance market penetration, is unlikely to cause substantial reductions in disaster assistance, unless flood insurance policies were broadened to cover other types of losses, particularly temporary housing assistance. It also should be noted that such a move could result in a significant increase in the premiums charged to policy holders, a result that may be counter to other objectives of the NFIP.

Incentives to Reduce Federal Expenses: There are three incentives built into federal disaster assistance programs that work towards the goal of reducing federal disaster spending. The first is a requirement that recipients of SBA loans and other types of individual assistance purchase a flood insurance policy. This is to assure that the assistance will not be needed the next time there is a flood. However, this requirement does not often affect properties located outside identified Special Flood Hazard Areas and it is very difficult to ensure that recipients keep their flood insurance policies over time.

The second incentive is that the amount of flood insurance that is available (and could have been purchased) is deducted from the eligible repair costs for public buildings in the Special Flood Hazard Area that receive funds under FEMA's Public Assistance program. This amount is either covered by an insurance policy purchased by the community or borne by the community if there was no policy. Flood insurance must then be maintained on the building for it to be eligible for future assistance.

The third incentive is a requirement that local governments wanting certain types of disaster assistance must join the NFIP if they have a mapped Special Flood Hazard Area. Because this does not affect some programs, such as debris removal and emergency assistance from the Corps, and because most communities with a flood problem are already in the NFIP, its impact on future losses is limited.

In summary: *The NFIP has reduced some flood-related federal disaster assistance expenses, but the majority of the federal assistance dollars expended are outside the scope of the NFIP's influence. The NFIP has some incentives to help reduce federal expenditures, but there are gaps in their coverage and implementation.*

4.1.2 Recommendations

To more effectively reduce the demand for federal assistance, the NFIP can do more to cut federal disaster assistance costs.^{*} Specifically,

- The NFIP should do more to guide development away from floodprone areas as specified in Section 2.1.2.
- The NFIP flood hazard mapping criteria should be revised so that areas of large or repetitive disaster assistance payments outside the Special Flood Hazard Area are designated as Special Flood Hazard Areas so they would be subject to the mandatory flood insurance purchase requirement.
- FEMA should explore ways to link the NFIP more closely with disaster assistance programs so it can help induce mitigation that will reduce their payments. For example, FEMA could assess the floodplain management and loss reduction activities of communities applying for disaster assistance and use the results to set a sliding scale for the amount of their share of disaster assistance payments. Localities that have taken actions to prevent or reduce flood damage to their facilities would be entitled to pay a smaller share. Although this raises the federal share, overall expenditures would be lowered over time because mitigation would reduce damage.

4.2 Reducing Other Federal Expenditures

4.2.1 Findings

It is generally accepted that over the years, sensible local floodplain management will reduce the need for federally funded flood protection projects. However, no direct link has been demonstrated between the operation of the NFIP and a reduction in the expenditures of federal agencies that are responsible for such projects, such as the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, or the Tennessee Valley Authority. This is largely because the relevant information is not collected or cataloged in a useful form.

Other federal programs in general have a weak nexus with the NFIP, for two reasons. First, there is no national-level coordinating mechanism to ensure that program policies and procedures are mutually supportive. Hence each agency tends to go its own way, fulfilling its own mission without regard to potential synergies. Second, because of its insurance component the NFIP uses “buildings” as a key metric in its program analyses. Other federal programs use different techniques for assessing costs and benefits.

^{*} Background on these and other recommendations, along with details and suggestions about how they can be carried out, can be found in the Evaluation substudies by Dixon et al. (2006), Galloway et al. (2006), and Sarmiento and Miller (2006).

One impact the NFIP has had on other federal-related expenditures for floods is that the 100-year flood has become a *de facto* standard for flood protection projects and other programs. That level has tended to become the target, rather than a minimum level for flood protection (see Section 1.7). As noted in Section 2.2.1, the widespread use of this standard, especially for setting criteria for levees, can do more harm than good.

In summary: *Although the NFIP may have resulted in reduced spending by other federal agencies on flood protection measures, there have been no studies to make such a determination.*

4.2.2 Recommendations

In order to better reduce federal expenses, a flood-related coordinating mechanism should be established (or re-established) at a high level in the federal government. That mechanism would identify appropriate approaches to reduce federal flood expenditures, minimize conflicts and inconsistencies among programs, and establish independent metrics to measure progress.

4.3 Reducing Federal Support of the NFIP

4.3.1 Findings

Beginning in the 1980s, administration policy and budgetary constraints resulted in the establishment of a management goal of moving the NFIP to a more financially self-sufficient condition. Insurance premium rates were increased to bring in more revenue and many of the non-insurance aspects of the program, such as mapping and some mitigation grants, have been funded by policyholders since then (except for recent appropriations for Map Modernization). As a result, the amount of federal support to the NFIP has been reduced over the last 20 years. However, there are three reasons why this federal support cannot be completely eliminated.

Federal Support for the NFIP

- Of all flood insurance policies, 25 percent are for pre-FIRM buildings, compared to 83 percent in 1985 (Bingham *et al.*, 2006, p. v).
- The number of pre-FIRM policies is expected to continue to increase at about 1 percent per year due to improved market penetration (PricewaterhouseCoopers, 1999, p. 14).
- Modeling shows that subsidies for pre-FIRM structures account for about 18 percent of annual NFIP outlays, or \$166 million (Sarmiento and Miller, 2006, p. 1).

The NFIP is a Government Program. There will continue to be a need for federal support because the NFIP was designed to be an inclusive government program that would help reduce both costs and consequences of flooding, shift the costs of flooding “from the taxpayer to those who bear the risk,” and prevent future losses. The NFIP benefits the nation in more ways than simply providing insurance. Mapping of flood hazard areas, promoting wise floodplain use and management, and operating programs to mitigate specific flood problems have significant benefits to all levels of government, businesses, and the public at large, not just the NFIP’s policyholders.

Catastrophic Losses need Federal Support. As designed, the NFIP will always need federal support for catastrophic loss years. This is because the rates are set at levels calculated to generate enough funds to enable the Program to pay claims in an “average historical loss year,”

but not enough for a catastrophic year. The legislated limits on rate setting have not allowed the NFIP to charge high-enough premiums to build a reserve for the inevitable years in which catastrophic flooding occurs. This means that there will always be a need for federal support to fulfill the NFIP's contractual obligations to pay claims in some years. Before Hurricane Katrina, NFIP actuaries estimated this average annual premium shortfall was \$800 million per year (see also Bingham *et al.*, 2006).

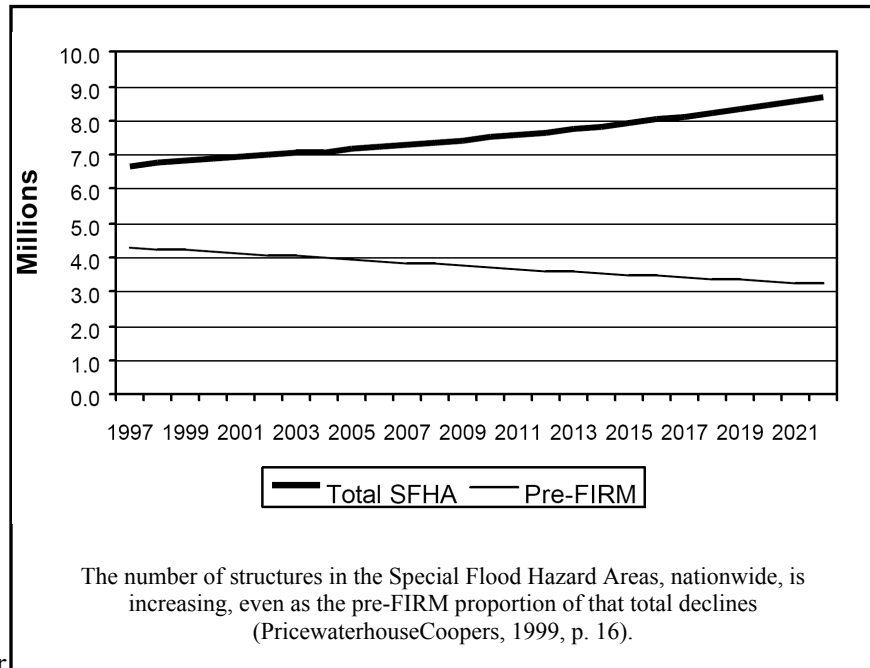
The claims paid out for damage from Hurricane Katrina had a devastating impact on the National Flood Insurance Fund. Congress has reacted quickly by increasing the borrowing authority of the NFIP, yet has been slow to recognize that catastrophic loss years cannot be repaid by reliance on the insurance mechanism alone. As indicated in the report by Bingham *et al.* (2006), a catastrophic event leading to losses over an order of magnitude larger than previously experienced by the NFIP could never be fully covered by a self-sustaining government-based insurance program like the NFIP. That is because the Program was designed with the objectives of prioritizing floodplain management and compensation of losses through a weak and partial mandatory purchase requirement and a mandate to subsidize certain properties. Lack of understanding of this issue could put the whole program at risk.

Premium Subsidy Still Needed. Although their numbers are dwindling, pre-FIRM buildings will persist for a long time. The proportion of NFIP policies that is made up of pre-FIRM buildings with subsidized policies has diminished (resulting in relatively fewer policies that need to be subsidized), but the number of floodprone pre-FIRM structures is not being reduced as quickly as originally anticipated or desired (see Section 3).

Offering subsidized rates for pre-FIRM buildings was part of the original motivation for and design of the NFIP. If all pre-FIRM buildings were charged actuarial rates instead, the owners of many of those properties would face premiums up to five times higher than current rates. Some people would let their policies lapse and depend instead on disaster assistance or simply not recover from the losses. The 1 million pre-FIRM policy holders that are currently subsidized and their local officials would be more likely to push legislators for individual federal "bailouts" outside of the NFIP framework. Nor is it fair to transfer these costs to post-FIRM policy holders who are paying actuarially based rates on compliant buildings, as discussed above, or on the many pre-FIRM policyholders whose buildings are well-situated and therefore have chosen to pay actuarial rates.

The number of pre-FIRM policies is increasing at 1 percent per year due to the mandatory purchase requirement and successful marketing efforts, even though there are fewer pre-FIRM buildings than before (PricewaterhouseCoopers, 1999, p. 14). More pre-FIRM policies means a need for more federal support for the NFIP in a catastrophic loss year although, as noted above, it does decrease some other forms of government-funded disaster aid.

Due to changing flooding conditions and given the gaps in the minimum NFIP construction standards (see Section 2.2), many of today's post-FIRM buildings will be exposed to increased risk of flooding in the future. As watersheds become urbanized, flooding is likely to increase over what is shown on the current flood maps. The number of administratively grandfathered properties will expand as new maps that become available through Map Modernization show wider floodplains with higher flood elevations. Finally, erosion-related losses (for which the NFIP has few protective strategies) will rise. All these factors will result in more properties that have insurance but are not paying actuarially based rates. Although premiums can be raised to address this increase in risk, there is a limit to how high premiums can be raised and still have a viable program.



In summary: Federal support for the NFIP has been reduced, but some support will always be needed because the Program is designed to achieve public policy objectives beyond the provision of flood insurance.

4.3.2 Recommendations

Although some federal support will always be needed for the NFIP, steps can be taken to reduce its impact.*

- Congress, federal staff, floodplain managers, and the general public should recognize that the NFIP will always need some level of federal support in order to accomplish its fundamental, non-insurance objectives of floodplain management, reduction in consequences of flooding, and shifting of costs to those bearing the risk.
- FEMA needs to use all tools at its disposal to reduce the number of floodprone buildings that qualify for subsidized flood insurance rates, particularly those that have suffered repetitive losses.

* Background on these and other recommendations, along with details and suggestions about how they can be carried out, can be found in the Evaluation substudies by Bingham et al. (2006), Dixon et al. (2006), Galloway et al. (2006), Sarmiento and Miller (2006), and Tobin and Calfee (2006).

5. NFIP GOAL—PRESERVE AND RESTORE NATURAL AND BENEFICIAL FLOODPLAIN FUNCTIONS

Although the goal of preserving and restoring natural floodplain functions and resources was not articulated in the National Flood Insurance Act of 1968, it has been adopted by FEMA as a legitimate goal of the NFIP, based on several factors.

First, although the Act is silent on natural and beneficial values, it does direct the Program to “guide future proposed construction, where practicable, away” from floodplains and provide for “sound land use” of floodprone areas. The Act also called for the NFIP to be “integrally related to a unified national program for floodplain management” (Sections 1302(c) and (e) of the National Flood Insurance Act of 1968). The Unified National Program that was developed subsequent to the Act clearly states that the “management of floodprone lands has a twofold purpose”: reducing flood damage and preserving and restoring the natural resources of the nation’s floodplains (Federal Interagency Floodplain Management Task Force, 1994, p. 7).

Second, FEMA is required to adhere to an array of environmental laws affecting floodplains, including the National Environmental Policy Act, the Endangered Species Act, and other environmental legislation passed after the program was established, as well as Presidential Executive Orders 11988, *Floodplain Management* and 11990, *Protection of Wetlands*, all of which are directed towards protection of a range of floodplain resources.



Natural floodplains and wetlands have a range of beneficial functions and values.

Third, the 1994 amendments to the National Flood Insurance Act (Reigle Community Development Act of 1994, P.L. 103-325) specified the “protection of natural and beneficial floodplain functions” as an activity worth recognizing under the NFIP’s Community Rating System. Elsewhere in that Act, Congress expressed further commitment to protecting natural floodplains when it established the Task Force on Natural and Beneficial Functions of the Floodplain to recommend how to reduce flood losses by protecting those functions.

Fourth, there has been ongoing concern that the NFIP was seen as encouraging floodplain development and its accompanying destruction of habitat and natural functions. Some of these concerns have come in the form of lawsuits.

Finally, there has been growing scientific and public acknowledgement of the importance of natural functions in the flood regime.

There are three ways by which the NFIP can work towards the goal of protecting natural and beneficial value of floodplains:

- (1) Preventing development from harming the natural functions of floodplains;
- (2) Meeting the standards and procedures specified in federal environmental laws and policies; and
- (3) Restoring the floodplain functions that have already been damaged or lost.

5.1 Preventing Development from Harming Natural Floodplain Functions

In general, an undeveloped floodplain is a naturally functioning floodplain. Therefore, the straightest path to protecting floodplain functions is to prevent development from taking place in the floodplain, or at least the portion of it that is critical to its natural functions and its resources.*

5.1.1 Findings

As noted in Section 2.1, development is not being kept out of floodplains; in fact, the number of structures in those areas is growing.

Conveyance Function Protected. One function of floodplains—conveyance of flood waters—has been protected. The NFIP has significantly reduced the amount of development in the central portion of the floodplain, known as the floodway, where floodwaters usually are deepest and fastest. As noted in Section 2.1.1, development in floodways has been slowed and most floodways remain undeveloped, although the regulations are not as effective as they appeared to be at one time (Galloway et al., 2006).

Protecting Floodplain Functions

- Under the NFIP, the conveyance function of about 9,000 square miles of floodway land has been protected (Task Force on the Natural and Beneficial Functions of the Floodplain, 2002, p. A-2).
- Even though conveyance has been protected, allowable activities in the floodplain fringe and floodway have resulted in continued disruption of natural terrain and vegetation, often affecting some of the highest quality natural and beneficial functions (Galloway *et al.*, 2006).

Most Natural Functions not Identified. The natural functions of floodplains—except for conveyance of floodwaters—are not recognized within the NFIP. Further, the relative importance of the various functions and the effects of development on them are not well understood or quantified. The lessons the NFIP has learned from regulating floodways to protect conveyance could be transferred to other functions and values by identifying those functions, delineating them on maps, and setting standards for avoiding adverse impacts to them, as noted in Section 2.1. Significant other natural functions may be protected by the floodway restriction because it tends to keep development out of the channel and immediately adjacent areas (see Galloway et al., 2006), but this has not been well established by scientific research and in any case will vary from floodplain to floodplain. A precedent for identifying natural functions on Flood Insurance Rate Maps is the delineation of units of the Coastal Barrier Resources System.

* This approach also serves to guide development away from floodprone areas, thus limiting the amount of property at risk (the first NFIP goal, discussed in Section 2.1) and minimizing the Program's exposure to losses.

Those sensitive areas are noted on the maps so that communities can alert property owners that NFIP insurance is not available there.

Mapping and Regulatory Criteria Silent on Functions. The NFIP has regulations that restrict development in floodways because of their conveyance function and that prohibit alteration of mangrove stands and dunes because of their protective function, but none that addresses in any way the other functions such as storage, habitat, carbon sequestration, groundwater recharge, filtration of pollutants, aesthetic attributes, or recreational opportunities. Further, the map revision process (particularly LOMR-Fs) and floodplain management criteria indirectly promote the filling and channeling of the floodplain without consideration of the impacts of those activities on stream function and ecology (Rosenbaum and Boulware, 2006; Galloway *et al.*, 2006).

Methods for Function Protection Undeveloped. Aside from restricting development seaward of mean high tide along coastal shorelines and in mapped floodways, no other methods for protecting floodplain functions have been specified under the NFIP. There are ways to preserve storage, decrease the impermeability of paved surfaces, or preserve vegetation that are compatible with some types of development. For example, many communities already require no net increase in stormwater runoff for new developments, which results in the incorporation of holding ponds, vegetation, and other techniques that protect natural functions, provide aesthetic benefits, and increase property values. The 2002 report to Congress by the Task Force on Natural and Beneficial Functions of Floodplains (chaired by FEMA) outlined a range of broad and specific actions that should be taken to protect and improve floodplain functions (Task Force on Natural and Beneficial Functions of Floodplains, 2004).

In summary: *Most natural and beneficial floodplain functions in the United States are still subject to being degraded by development, in part because the NFIP has not emphasized the protection of those functions and has few tools to help restore them, once impaired.*

Natural and Beneficial Resources and Functions of Floodplains

Natural Flood & Erosion Control

- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation

Water Quality Maintenance

- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperature fluctuations

Groundwater Recharge

- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows

Biological Productivity

- Support high rate of plant growth
- Maintain biodiversity
- Maintain integrity of ecosystem

Fish and Wildlife Habitat

- Provide breeding and feedings grounds
- Create and enhance waterfowl habitat
- Protect habitats for rare and endangered species

Harvest of Wild & Cultivated Products

- Enhance agricultural lands
- Provide site for aquaculture
- Restore and enhance forest lands

Recreational Opportunities

- Provides areas for active and passive uses
- Provide open space
- Provide aesthetic pleasure

Areas for Scientific Study and Outdoor Education

- Contain cultural resources (historic and archaeological sites)
- Provide opportunities for environmental and other studies

(Federal Interagency Floodplain Management Task Force. 1994, p. 41)

5.1.2 Recommendations

To more effectively preserve natural and beneficial functions, the NFIP must develop more tools to do so.* Specifically,

- The NFIP flood hazard mapping criteria should be revised so that
 - Areas with intrinsic natural values and functions identified by other federal or state programs, such as wetlands and endangered species habitat, are incorporated into the databases that will accompany future Digital Flood Insurance Rate Maps; and
 - The process for reviewing and issuing Letters of Map Revision based on Fill accounts for the environmental impacts and cumulative effects of fill on natural and beneficial floodplain functions.
- Some programmatic changes in the NFIP should be explored, including
 - Identifying, prioritizing, and setting baselines for the natural and beneficial functions of floodplains that need to be preserved; and
 - Setting floodplain management standards that also provide greater protection for natural and beneficial functions, such as establishing a zero-rise floodway standard, prohibiting development in identified wetlands, or setting appropriate restrictions on development in other environmentally sensitive areas.
- FEMA and the floodplain management community need to educate their stakeholders and the public about the benefits of preserving natural and beneficial functions.
- FEMA should implement the recommendations made by the Task Force on the Natural and Beneficial Functions of the Floodplain for reducing flood losses while protecting and restoring floodplain resources and functions.

5.2 Meeting Federal Environmental Standards

As a federal government agency implementing the NFIP, FEMA is committed to compliance with the National Environmental Policy Act, the Endangered Species Act, and Executive Orders 11988 and 11990, among other rules, whose goals include protection of resources that occur on floodplains.

5.2.1 Findings

Environmental Reviews Dated. When NFIP regulations were promulgated and revised, reviews of their potential impacts were conducted pursuant to the National Environmental Policy Act and the Executive Orders to ensure that adherence to the regulations would not result in adverse consequences to floodplain resources. Several of those reviews were done more than 25

* Background on these and other recommendations, with details and suggestions about how they can be carried out, can be found in the Evaluation substudies by Galloway *et al.* (2006), and Rosenbaum and Boulware (2006).

years ago (e.g., the Environmental Impact Statement on the NFIP floodplain management regulations was done in 1976). In light of program experience, intensification of development (particularly in coastal areas), and vast advances in scientific knowledge about floodplain resources and functions, these analyses may not adequately reflect the impacts of the program today (Rosenbaum and Boulware, 2006).

Endangered Species Status Unresolved.

A series of lawsuits brought against FEMA claimed that the NFIP has had a detrimental effect on the habitat of particular endangered species in some parts of the United States. Although there has not been thorough research into this potential connection, FEMA and the appropriate agencies have entered into consultation to ensure that such impacts on species are prevented. Evidence in three cases suggested a “possible relationship between specific elements of the NFIP, urban development, and adverse impacts on endangered species habitat” sufficient to require consultation in at least some circumstances (Rosenbaum and Boulware, 2006, p. 71).

Meeting Environmental Standards

- Programmatic reviews of NFIP regulations under the Executive Orders and National Environmental Policy Act are dated, in light of recent environmental research and accumulated experience in implementing the NFIP (Rosenbaum and Boulware, 2006, pp. 16, 68).

Environmental Leadership not Fully Exercised. Historically, the entity responsible for administering the NFIP has had a lead position among federal agencies for fostering the floodplain management and related water resources and disaster management goals of other federal agencies. For many years FEMA chaired the Federal Interagency Task Force on Floodplain Management and later, pursuant to the 1994 Flood Insurance Reform Act, chaired the Task Force on the Natural and Beneficial Functions of the Floodplain. The NFIP also has demonstrated environmental initiative by establishing CRS incentives for local communities to take action to protect floodplain resources.* There is more potential in the NFIP for demonstrating federal leadership in floodplain resource protection than has been exploited to date, and particularly in recent years, when agency reorganization and the need for more disaster assistance activities have hampered efforts in that direction (Rosenbaum and Boulware, 2006).

In summary: *The NFIP has met the letter of most environmental laws, but the impact of some aspects of the program on the environment is still unclear, and there is unrealized potential for the NFIP to assume a lead role in coordinating floodplain management resource protection among federal agencies.*

5.2.2 Recommendations[†]

- FEMA should take the lead among all levels of government and the private sector in coordinating and supporting programs that clear floodplains for open space, restore

* It should be noted that, although the CRS communities account for a significant proportion of the NFIP policy base, they constitute only a small proportion of the floodplain acreage of the nation. Thus, although they can be a useful proving ground for resource preservation techniques and incentives, widespread protection of floodplain functions cannot be achieved solely through the CRS mechanisms.

[†] Background on these and other recommendations, along with details and suggestions about how they can be carried out, can be found in the Evaluation substudies by Galloway *et al.* (2006), and Rosenbaum and Boulware (2006).

floodplains to natural conditions, otherwise protect natural and beneficial functions, and restore floodplains to natural conditions.

- FEMA should consider new programmatic reviews of the NFIP regulations to analyze Program compliance with the National Environmental Policy Act and Executive Orders 11988 and 11990.
- FEMA needs to incorporate protecting natural and beneficial functions of floodplains into its internal planning goals to focus attention on this aspect of the NFIP.

5.3 Restoring Natural Functions of Floodplains

5.3.1 Findings

The NFIP has only a minor impact on encouraging the restoration of the natural functions of the floodplain since most current NFIP floodplain management requirements are aimed at affecting and guiding future human development rather than on the floodplain lands themselves. The Community Rating System does provide incentives for the acquisition and relocation of buildings and the creation and protection of open space, but only for CRS communities. The NFIP and other FEMA mitigation programs do encourage and fund acquisition and relocation of floodprone buildings and have resulted in the return of an estimated 6,000 acres of floodplain land to open space.* These efforts enable local governments to purchase floodplain parcels, remove the structures, keep the land in public ownership, and return it to open space. In addition, often the federally provided funding is the launching pad for local or regional “buyout” initiatives that continue for many years until the area is fully returned to open space.

Restoring Natural Functions

- Through the NFIP and related FEMA programs, an estimated 6,000 acres of floodplain lands have been cleared of existing structures and returned to public open space.

There is little or no documentation about the performance of the floodplain functions after the land is returned to open space. Anecdotal evidence (absence of damage to buildings, for example) demonstrates that some conveyance and storage functions are recovered, some open space reverts to natural vegetation and eventually riparian habitat, and that some reclaimed properties are used for recreation. Further, FEMA’s acquisition projects are done on a voluntary, individual-parcel basis. Sometimes this leaves vacant lots adjacent to properties owned by people who opted not to participate. This checkerboard pattern of land clearance is not conducive to restoring natural functions on an effective scale.

Information about the recovery of other functions such as groundwater recharge, habitat provision, or filtration, is absent. Once floodplain areas are cleared of development and turned to public open space use, their management has been a local and state concern and therefore the role of the NFIP in the restoration of floodplain functions, if any, has been minor.

* FEMA’s records as of 2004 show that 24,799 properties have been acquired with mitigation program funds. Assuming, conservatively, that each structure was sited on a quarter-acre lot, the total acreage returned to open space is calculated at 6,199.

In summary: *The NFIP has helped begin restoring floodplain functions by contributing to the removal of existing structures and requiring that the vacated land be left in open space.*

5.3.2 Recommendations

- The NFIP should explore ways to enlist states and localities to use their authority to restore natural and beneficial floodplain functions where they have been lost.
- Existing programs to fund and otherwise support the removal of existing structures from the nation's floodplains should be continued, expanded, and revised to allow more emphasis on those areas and parcels that would best help restore natural and beneficial floodplain functions.

6. CONCLUSIONS AND SUMMARY

6.1 Findings

In general, the Evaluation has shown that the NFIP is moving towards achievement of its goals. Over a billion dollars in flood damage are being prevented each year, millions of dollars in federal expenditures are being saved annually, and millions of people have flood insurance protection for losses for which they would otherwise have been uncompensated.

It would be comfortable if the Program could rest on its laurels. However, the aim of the Evaluation was to find ways to improve the NFIP and it appears that past strategies may well prove inadequate to the challenges posed by the increased losses expected in the future. The Working Group concurred with the following summary of the findings from the substudies and this report.

- Although the overall goals of the NFIP are clear, consensus has not been reached on specific, interim national floodplain management goals and objectives. Further, the data available to measure progress towards such objectives are limited. Progress towards goals cannot be evaluated if information is not available.
- The NFIP operates in coordination with state governments, but the states' potential for furthering the goals of the program has not been fully utilized. Coordination with other federal and private-sector programs that have similar objectives could be improved.

Goal 1: Decrease the Risk of Flood Losses

- Most floodprone areas are still subject to being developed, in part because the NFIP has no strong provisions to guide development away from floodplains, even those with extreme flood hazards or valuable natural resources.
- Flood maps do not delineate some types of high hazard areas, areas with floodplain resources worthy of preservation, or unmapped areas with known flood hazards. Many maps have a short shelf life because they do not account for expected changes in land uses and flooding conditions.
- Although the NFIP requirements provide significant protection to new buildings, many new buildings constructed to the NFIP standards will still remain at risk of damage even in a base flood because of gaps in the construction standards.

Goal 2: Reduce the Costs and Consequences of Flooding

- The current system of regulations, insurance incentives, and mitigation funding is not ridding the nation of its stock of existing damage-prone buildings as quickly as expected.

- Many owners of floodprone property in the United States still lack flood insurance, and those who have it may still suffer costs and consequences from damage not covered by their policies.

Goal 3: Reduce the Demand for Federal Assistance

- The NFIP has reduced some federal disaster assistance expenses, but the majority of the disaster assistance dollars expended are outside the scope of the NFIP. The NFIP has some incentives to help reduce these federal expenditures, but there are gaps in their coverage and implementation.
- Federal government support for the NFIP has been reduced, but some federal support will always be needed because the NFIP is designed to achieve public policy objectives beyond the provision of flood insurance.

Goal 4: Preserve and Restore Natural and Beneficial Floodplain Functions

- Most natural and beneficial floodplain functions in the United States are still subject to degradation by development, in part because the NFIP has not emphasized the protection of those functions and has few tools to help restore them, once impaired.

The Evaluation's substudies identified opportunities for improvement in these areas, which are summarized in the four previous sections of this paper. The Working Group found common themes to these findings and identified the following five overarching reasons why progress towards the goals of the NFIP could have been better.

Lofty Targets: The nation's flood problem is immense—there are over 7 million properties subject to flood damage in the mapped Special Flood Hazard Area and millions more in unmapped areas. Development is pushing into areas that are hazardous and environmentally sensitive. Federal budgets have been constrained and reduced for many programs while flood hazards increase due to both human and natural causes. Given the amount of resources that Congress has provided to support the NFIP, the program has accomplished a great deal. However, those resources are not sufficient to accomplish 100 percent of such goals as preventing and reducing flood losses and restoring natural floodplain functions or to keep pace with urbanization or changes in climate.

Lack of Data: A perennial problem is that some types of pertinent data, in the proper format for measurement and analysis, are not routinely collected, catalogued, or shared. Many types of data have been accumulated and in recent years have been made more readily available, but there are still important gaps and some data are still too expensive to collect. For many potential goals and objectives, a baseline measurement or estimate has never been established. Progress towards goals cannot be evaluated if information is not available.

Orientation Towards the 100-year Flood: Current mapping criteria, regulatory standards, and insurance provisions are oriented towards the 100-year flood. Over the years this has tended to become a default target rather than the intended minimum standard that federal, state, and local programs would exceed. It has become clear that the 100-year standard is

inadequate for a successful long-term program to reduce flood losses unless it is viewed as a starting point to which additional levels of protection are added as appropriate.

Perceptions and Viewpoints: There have been historical assumptions, perceptions, misconceptions, and misplaced emphases within and outside of the NFIP. These include:

- The prediction that it would not take long to replace existing buildings in the floodplain with new ones built to flood protection standards;
- That floodplain management efforts and flood insurance coverage should be limited to the mapped Special Flood Hazard Area, even though a significant portion of claims and repetitive losses lie outside that area, and activities within the watershed but outside of floodplains have significant impacts on flood problems;
- The belief by some that the NFIP should show developers how to “safely” build in the floodplain rather than show the public and local decision makers the value of guiding development away from floodplains;
- The view by some that the NFIP is primarily and essentially an insurance program and that the floodplain management and mitigation aspects are secondary; and
- The expectation of some decision makers that the NFIP should be completely self-supporting over the long run, as a private insurance company would be, while still meeting its four primary goals.

Fragmentation: The NFIP is single program and must be managed as such. The NFIP’s mapping, floodplain management, and insurance components were designed to work together and must do so to achieve the program’s goals and objectives. The successes that the NFIP has had are largely due to the design of the program that envisioned the interrelationships among these program elements and that took a comprehensive approach rather than focusing on solely on making insurance available. Breakdowns in coordination among the insurance, floodplain management, and mapping sectors and in coordination and cooperation among federal, state, local, and private-sector stakeholders, can only harm the NFIP and undermine the Program’s effectiveness.

More recently, the components of the NFIP and a unified national floodplain management program have become disconnected from other programs that affect floodplains and land and water resources within the federal government and within the states, local governments, and the private sector. This is not limited to or caused by FEMA or the NFIP, but is a government-wide trend. Lack of coordination limits the effectiveness of all federal resource management programs, not just the NFIP. However, this disjointedness makes it even more difficult for the NFIP to function as a point of national leadership in minimizing flood losses.

Although there is coordination and cooperation between the NFIP and the states, that partnership is less productive than it could be and needs to be, given the number of communities in the Program, and the authority and capacity that reside in the states.

In summary: Although the NFIP has accomplished much, changes in orientation and in perceptions of the Program will be needed to continue this positive trend into the future. Closer links should be forged with other agencies, programs, and stakeholders.

6.2 Recommendations

6.2.1. Specific Recommended Actions

Sections 2 through 5 provided specific and detailed recommendations for a variety of actions, as summarized below.

- Revise the flood hazard mapping criteria to identify natural functions worthy of preservation, high hazard areas that should be avoided, areas protected by flood control structures, and areas of known flood hazard.
- Modify the flood hazard mapping criteria to reduce the need to revise the maps over time.
- Revise the NFIP floodplain management criteria for by adding a few stronger standards that have been proven effective and encourage local programs to adopt other higher regulatory standards that will go further towards preventing future losses.
- Devote more resources to improving state and local floodplain management programs.
- Refine the tools for and fully fund a comprehensive strategy to reduce losses to existing buildings.
- Revise insurance procedures to encourage greater coverage, such as better administration of the mandatory purchase requirement and incentives for agents to sell more policies.
- Implement known techniques that simultaneously reduce losses and protect natural functions, offer a variety of resource protection incentives, and coordinate more closely with other federal and state programs.
- Gather and maintain needed data, use it to measure progress towards the goals of the program, and share the data with Congress and the rest of the program's stakeholders.

6.2.2 Recommitment to the Mission

The specific actions recommended in the Evaluation's substudies and summarized earlier in this report will be of significant assistance in improving the NFIP. However, long-term success is dependent on some attitudinal changes on the part of decision makers (including Congress), floodplain managers, citizen stakeholders, and the Program staff. It will take time to change some current perceptions and build universal personal commitments to work towards the original goals of the NFIP.

- The NFIP and its stakeholders at all levels need to adopt a broader perspective. It is no longer sufficient to think only of a single program or only of achieving the minimum standards. The NFIP is but one part of the nation's efforts to reduce flood losses and their consequences. Every state and community needs to use the NFIP as a base upon which to build a broader, more effective, and locally appropriate program to prevent and reduce flood losses and to protect floodplain functions and resources.
- Congress, floodplain managers, and the general public should recognize that the NFIP will always need some level of federal support in order to accomplish its fundamental non-insurance, government program objectives.
- Floodplain managers within and outside of FEMA need to move the NFIP from a program that specifies how to build in the floodplain to one that protects both buildings and floodplain functions by also discouraging inappropriate and hazardous development in the floodplain. The more floodplains there are in open space nationwide, the less potential there will be for damage to property and loss of life and the more the natural and beneficial functions of floodplains will be preserved.
- The NFIP needs to exist and function as an integrated program if it is to fulfill its mission. FEMA and its staff also need to collaborate more closely with those outside the agency whose goals and programs are consistent with the NFIP. These include other federal agencies, state and local partners, environmental interests, mapping partners, insurance companies and agents, the development industry, and property owners.

6.2.3 Some First Steps

Changes in outlook and perspective will occur over time. To inspire appropriate shifts in thinking that work towards the NFIP mission and to build an institutional framework that nurtures action in that direction, the following changes are called for—all of which can be implemented relatively quickly.

- A stakeholders' advisory council should be created to provide overall guidance on working towards the goals of the NFIP and monitor progress. The council could be modeled on the Technical Mapping Advisory Council, which advised FEMA on the launching of the Map Modernization initiative. It would include representatives from all components of the NFIP and other related FEMA programs and also have representatives from the insurance industry, states, communities, environmental interests, developers, and lenders. The council would be charged with reporting to the FEMA Mitigation Director on the various components' progress towards the goals. It could assume responsibility for the recommendation in Section 3 for a national consensus on metrics and serve to instill a more global perspective on the Program.
- FEMA should strengthen the role of its most important partners in reducing the nation's flood losses—the states. Having 50 states and their many different agencies and programs working towards the goals of the NFIP would greatly leverage FEMA's limited resources. Specifically,

- The Community Assistance Program (CAP) should be remodeled so that it can become a true partnership through each state's governor's office;
- The CAP and other signed agreements with the states should ensure that all relevant state agencies and programs are committed to fulfilling their appropriate responsibilities with regard to floodplain management; and
- State financial participation should be expected as part of all federally funded projects.

Advancing the goals of the NFIP should not rest entirely on FEMA's shoulders: all stakeholders must contribute. The 50 states should set the example for their communities and for the nation. Given their varied flooding conditions and political structures, they offer a tremendous opportunity for trying different approaches.

- As a start, each state should adopt and enforce strong floodplain management programs that cover all state activities. If state agencies do not comply fully with such programs, they should face the same NFIP sanctions that communities face.
- Each state should expand and improve its floodplain management programs to best meet its conditions. It is no longer sufficient to think of floodplain management as a state NFIP job. Rather, it should be a statewide concern that involves all the state agencies' resources to work together to prevent and reduce flood losses.

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APPENDIX A.

Steering Committee, Evaluation of the National Flood Insurance Program

George K. Bernstein, The Bernstein Law Firm, was the first Federal Insurance Administrator, from 1969 to 1974, and is an attorney and expert witness, specializing in insurance regulation and disaster mitigation. He received his B.A. and L.L.B. from Cornell University. Before serving in the Department of Housing and Urban Development, he was a New York State Assistant Attorney General, and was Deputy Superintendent and General Counsel and First Deputy Superintendent of the New York State Insurance Department. He was twice Chairman of the Insurance Committee of the Association of the Bar of the City of New York. During his time at HUD, he was also the Interstate Land Sales Administrator as well as insurance advisor to the White House. He is a recipient of many awards, including HUD's Distinguished Service Award and the Torch of Liberty Award of the B'nai B'rith Anti-Defamation League. Since 1983, he has also acted as Special Deputy of the Vermont Insurance Department, managing that state's insurance company rehabilitations and liquidations. He has served on numerous presidential and state commissions, authored articles and studies on insurance and disaster mitigation and chaired several commissions for the Federal Emergency Management Agency.

Timothy A. Cohn is a **Hydrologist** in the **Office of Surface Water at the U.S. Geological Survey** and previously served as the Director's Science Advisor for Hazards at USGS. He has coauthored more than 25 publications on flood frequency analysis and natural hazards, and is currently a member of the Governing Board of the American Institute of Physics. He was a AAAS Congressional Science Fellow in the office of Senator Bill Bradley (D-NJ) in 1995-97. He holds a B.A. in mathematics from Swarthmore College (1979) and M.A. (1984) and PhD (1986) degrees in water resource systems from Cornell University.

David R. Conrad, Water Resources Specialists, National Wildlife Federation began his work on water resource issues in 1977. He has served 12 years with the National Wildlife Federation, the nation's largest conservation education organization. For the previous 8 years, he was legislative representative and water specialist for Friends of the Earth, also in Washington D.C.. In these and a previous position with American Rivers from 1977 to 1981, he has been an advocate for river and water resources protection. Conrad has been involved in recent years in the water resource development programs of the Army Corps of Engineers and the Bureau of Reclamation and federal river protection and floodplain management programs. He was instrumental for six years in the formulation and passage of the comprehensive National Flood Insurance Reform Act of 1994. Conrad recently has been involved in floodplain management legislation and policy-related activities with focus on helping relocate high-risk residences and businesses out of flood-prone areas, and expanding opportunities for nonstructural flood damage reduction. He has also been actively involved in policy-related matters involving several Water Resources Development Acts, authorizing projects for the U.S. Army Corps of Engineers. He is the author of the major report on the nation's repetitive flood loss problems and the use of non-structural approaches, *Higher Ground—A Report on Voluntary Buyouts in the Nation's Floodplain*. Conrad received a B.A. in Environmental Sciences from the University of Virginia in 1974.

Ann-Margaret Esnard is an **Associate Professor and Director of the Visual Planning Technology Lab, Florida Atlantic University**. Her research interests and expertise include GIS/spatial analysis, vulnerability assessment, land use planning, natural hazard mitigation and disaster planning. She is currently working on projects related to community vulnerability and resilience indicators and assessments in coastal areas, 3D modeling and emergency management applications, and institutional barriers to GeoSpatial technologies for planning by community based organizations. Prior to joining FAU, she was a faculty member and director of the City and Regional Planning GIS facility from 1997-2005 where she directed the natural hazards and vulnerability mapping project for eleven New York

counties, and served as the mapping/educator partner with several Project Impact communities. Esnard served on the Disasters Roundtable of the National Academy of Sciences from 2002-2004, and currently chairs the review committee for the Institute for Business & Home Safety's Award for Scholarship in Planning and Natural Hazards. She has holds a B.Sc. in Agricultural Engineering from the University of the West Indies-Trinidad, an M.S. in Agronomy and Soils from the University of Puerto Rico-Mayaguez, and a Ph.D. in Regional Planning from the University of Massachusetts-Amherst. She completed a two year post-doc at University of North Carolina-Chapel Hill.

Robert M. Hirsch is the **Associate Director for Water, US Geological Survey**. In this capacity he is responsible for the USGS water science programs nationwide. These include the collection and management of basic hydrologic data, studies of hydrologic systems, and basic research on hydrologic processes. Hirsch began his career with the USGS in 1976 as a hydrologist. He conducted and directed research leading to methods for analysis of: the risk of water-supply shortages, water-quality trends, transport of pollutants in rivers, and flood frequency. He has published numerous journal articles, USGS reports, book chapters and a text book. He also was instrumental in the design and initiation of USGS programs including the National Water-Quality Assessment Program, Global Change Hydrology Program, and Watershed Modeling Systems Program. In addition to his role as Associate Director of the USGS he also serves as co-chairman of the Subcommittee on Water Availability and Quality, of the Committee on Environment and Natural Resources of the National Science and Technology Council. He is a recipient of the Department of the Interior's Distinguished Service Award, has twice been conferred the rank of Meritorious Executive by the President of the United States, and was elected a Fellow of the American Association for the Advancement of Science. Hirsch received his BA in Geology from Earlham College, an MS in Geology from the University of Washington, and Ph. D. in Geography and Environmental Engineering from Johns Hopkins University.

Larry A. Larson, Executive Director, Association of State Floodplain Managers, Inc. had an active role in the formation of the ASFPM, serving as Chair from 1979 to 1982 and as voluntary Executive Director ever since, until 1997 when growth of the organization necessitated that the role become a staff position. As such, he coordinates the Association's policy issues; communications with other organizations; oversees finances, contracts, and conferences; and oversees management of membership, publications, newsletters, and other related activities. Larson recently retired from his position as Chief of the Dam Safety & Floodplain Management Program for the State of Wisconsin Department of Natural Resources where he had been since 1975, with responsibilities for civil engineering, management, and intergovernmental coordination with the state, local, and federal programs. He has a B.S. in Civil Engineering from the University of Wisconsin and is a registered professional engineer in Wisconsin and California.

Dennis S. Mileti is **Professor Emeritus, University of Colorado—Boulder** where he served as Director of the Natural Hazards Center and as Chair of the Department of Sociology. He is author of over 100 publications, most on the societal aspects of hazards and disasters. His book *Disasters by Design* summarized a national effort to assess knowledge and U.S. policy in the U.S. for hazards and disasters. He has served on a variety of advisory boards including the Committee on Natural Disasters in the National Academy of Science's National Research Council (Chairman), Board of Visitors to FEMA's Emergency Management Institute (Chair), Board of Directors of the Earthquake Engineering Research Institute, Research Advisory Board to the U.S. Geological Survey's Research Program on Earthquakes and Volcanoes, the Expert Advisory Panel to the National Institute of Standards and Technology's study of Evacuation of the World Trade Center Towers on September 11th, and the Independent Expert Panel overseeing the Army Corps of Engineer's assessment of the New Orleans levee failures and consequences. Mileti is founder and Co-Editor-in-Chief of the all-hazards, all-disciplines journal the *Natural Hazards Review*. He is currently a member of the Department of Homeland Security's National Social Science Research Center on Terrorism, and Vice Chair of the California Seismic Safety Commission. He received his Ph.D. in sociology from the University of Colorado in 1974, and his M.A.

and B.A. degrees in sociology were awarded in 1971 and 1968, respectively, from California State University at Los Angeles and the University of California at Los Angeles.

Edward T. Pasterick, Director, Program Marketing and Partnerships Division, Federal Insurance and Mitigation Administration has been with the **Federal Emergency Management Agency (FEMA)** since its formation in 1979, and prior to that, with the Federal Insurance Administration (FIA), the agency that initially administered the National Flood Insurance Program. Over the years, Ed has served as Assistant Administrator for Insurance Operations, overseeing day-to-day NFIP operations, as well as Director of the Finance and Administration Division. He has also served as FIA's Acting Executive Administrator. He is currently on the Industry Relations staff, where he is responsible for coordinating and overseeing the activities of private insurance writing flood insurance under the Write-Your-Own (WYO) Program. Ed is also a member of the WYO Standards Committee, which oversees the financial controls governing the performance of WYO companies. Pasterick has contributed articles on the NFIP to numerous publications, including the chapter on flood insurance for *Paying the Price: The Status and Role of Insurance Against Natural Disasters in the United States*, a study done under the auspices of the National Academy of Sciences. He regularly represents the agency to Congressional staff, at national forums on natural hazards, and international gatherings sponsored by NATO and others. He is also one of the program's primary spokesman to the media.

Tim Ramsaur is Division Manager for Pierce County [Washington] Public Works and Utilities—Water Programs Division, having previously worked for the Washington State Department of Transportation and the King County Surface Water Management Division. Ramsaur received his B.S. in Civil Engineering from the University of Washington, 1980, and his Professional Engineering Registration in 1985. Over the past 16 years with Pierce County he has held various positions. When he first joined Pierce County he reviewed development related plans and projects. He then managed Pierce County's River Improvement Division. It is with this division that many of the floodplain management programs and policies that exist today in their Water Programs Division were formulated and initiated. As Water Programs Division Manager he oversees the Capital Improvement Program, River and Pond Maintenance Program, National Pollutant Discharge Elimination System (NPDES) Program, and the Water Supply Program. Ramsaur served on the board of the Association of State Floodplain Managers (ASFPM) as a Regional Director for five years. He served as Secretary/Treasurer and as Chair of the Northwest Floodplain Management Association (NORFMA). He also served on the Community Rating System (CRS) Task Force for two years as a local representative. He is currently the CRS Coordinator for Pierce County. Pierce County is currently rated a Class 5 in the Community Rating System Program and Water Programs is the recipient of the James Lee Witt Local Award of Excellence of the ASFPM.

Francis V. Reilly, Federal Insurance Administration (retired) began his career in the Actuarial Department of the Mutual Insurance Rating Bureau in 1951. In 1973 he began his public service, with the Federal Insurance Administration, first as Assistant Administrator and Actuary and subsequently as Deputy Administrator and Chief Actuary. He served on FEMA's Executive Resources Board. He received the rank of Distinguished Executive in the Senior Executive Service from President Ronald Reagan in 1988. Since his retirement in 1993 he has provided consulting services on flood insurance issues, including serving on the Steering Committee of the Evaluation of Erosion Hazards conducted by the H. John Heinz III Center for Science, Economics and the Environment. He is an active member of his local homeowners' association in Palm City, Florida, serving as the chair of the Construction Defects Committee, which has been successful in having drainage requirements adopted for new local development. Reilly holds a B.S. in Mathematics from St. Francis College and has been a member of the American Academy of Actuaries since 1967.

Michael F. Robinson, Senior Consultant, Michael Baker, Jr., is an expert on floodplain management issues and the National Flood Insurance Program's (NFIP) Map Modernization initiative. Before joining Michael Baker, Jr. he was with the Federal Emergency Management Agency (FEMA) for

25 years in various management and senior policy positions, principally dealing with the development and implementation of NFIP floodplain management programs, policies, and regulations. Other projects at FEMA included development of the National Mitigation Strategy, the NFIP Repetitive Loss Strategy, a review of Executive Order 11988 for the Office of Management and Budget, various legislative initiatives and numerous special studies and publications. During 1994, he was a member and team leader on the committee that produced the report *Sharing the Challenge: Floodplain Management into the 21st Century* on the Midwest Flood. Before joining FEMA in 1980, Robinson was with the State of Minnesota Department of Natural Resources' Floodplain and Shoreland Management Programs. He holds an A.B. in History from Oberlin College and an M.S. in Water Resources Management with a specialization in Urban and Regional Planning from the University of Wisconsin at Madison.

Leonard A. Shabman is **Professor of Resources and Environmental Economics, Virginia Tech**, and his current research interests include the economics of wetlands mitigation banking and restoration; watershed water quality standards and assessment; multi-criteria water project evaluation methods; allowance trading for carbon emissions and water quality programs. Shabman's experience in water resource issues includes the U.S. Water Resources Council 1977-78; Office of the Assistant Secretary of Army for Civil Works, 1984-85; consultant to governmental and non-governmental organizations; and as a member/consultant to seven committees of the National Academy of Sciences, National Research Council.

Rennie H. Sherman is **Chief of the Policy Branch** in the Planning and Policy Division of Headquarters, **U.S. Army Corps of Engineers**. Sherman has more than 30 years of Corps experience, primarily in the areas of water resources planning and policy. She has worked in plan formulation and evaluation, planning program management and served as Deputy Chief, Planning Division. She currently serves as Leader of the Environment Business Program and Executive Secretary to the Chief of Engineers Environmental Advisory Board. Ms. Sherman graduated from the State University of New York at Stony Brook with a BA in Political Science and Economics. She earned a MA in Government (Urban and Regional Planning) from the George Washington University.

Paul Tertell, Civil Engineer, Federal Insurance and Mitigation Administration has worked in the response effort for major disasters including Hurricane Andrew and the Midwest Floods of 1993. In 1993, he moved to the newly formed Mitigation Directorate that provides increased attention to preventing disaster damages. Tertell has participated in numerous post-disaster investigations that have resulted in recommendations on how to reduce disaster damages from natural hazards.

Gilbert F. White (deceased) was the **Gustavson Distinguished Professor Emeritus of Geography at the University of Colorado Institute of Behavioral Science**. He served as Director of the Institute of Behavioral Science (1970-78) and as Director of the Natural Hazards Research and Applications Information Center (1978-84, 1992-94). He chaired the 1966 Task Force on Federal Flood Control Policy and served on a number of boards and commissions examining water resources including the Mississippi Valley Committee, the National Resources Planning Board, and the Bureau of the Budget in the Executive Office of the President. White was a Member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the Russian Academy of Sciences. He received the National Academy of Science's Public Welfare Medal. His publications on floods include *Human Adjustment to Floods: A Geographic Approach to the Flood Problem in the United States*, *Changes in Urban Occupancy of Flood Plains in the United States*, *Choice of Adjustment to Floods*, and *Water Science and Technology: Some Lessons from the 20th Century*.



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