



A UNIFIED
NATIONAL PROGRAM
FOR
FLOODPLAIN
MANAGEMENT
1994

HISTORY

TC
530
.U525
1994

Federal Interagency Floodplain Management Task Force

The Federal Interagency Floodplain Management Task Force was established in 1975 within the U.S. Water Resources Council to carry out the responsibility of the President to prepare for the Congress proposals necessary for a Unified National Program for Floodplain Management. In 1982 the Office of Management and Budget assigned responsibility for the Unified National Program to the Federal Emergency Management Agency, which assumed the role of chair of the Task Force.

Membership of the Task Force consists of the Departments of Agriculture, Army, Commerce, Energy, Housing and Urban Development, Interior, and Transportation; the Environmental Protection Agency; and the Tennessee Valley Authority.

Since its inception, the Task Force has pursued conceptual improvements in the Unified National Program, provided a forum for airing interagency issues, established working coalitions with professional organizations, and been a vehicle for carrying out specific projects. Besides this revision to the Unified National Program and an earlier one in 1986, the Task Force has undertaken a number of important initiatives and studies, including the 1992 *Floodplain Management in the United States: An Assessment Report*—the first comprehensive examination of floodplain management activity in the country in over 25 years. Some of its other works include *Evaluating the Effectiveness of Floodplain Management Techniques and Community Programs* (1985); *Floodplain Management Handbook* (1981); *Floodplain Management Guidelines for Implementing E.O. 11988* (1978); *Further Advice on Executive Order 11988, Floodplain Management* (1987); *Regulation of Flood Hazard Areas to Reduce Flood Losses* (1982); and *State and Local Acquisition of Floodplains and Wetlands* (1981).



Robert White

**A UNIFIED NATIONAL
PROGRAM
FOR
FLOODPLAIN
MANAGEMENT
1994**

**The Federal Interagency Floodplain
Management Task Force**

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release

March 6, 1995

TO THE CONGRESS OF THE UNITED STATES:

It is with great pleasure that I transmit A Unified National Program for Floodplain Management to the Congress. The Unified National Program responds to section 1302(c) of the National Flood Insurance Act of 1968 (Public Law 90-448), which calls upon the President to report to the Congress on a Unified National Program. The report sets forth a conceptual framework for managing the Nation's floodplains to achieve the dual goals of reducing the loss of life and property caused by floods and protecting and restoring the natural resources of floodplains. This document was prepared by the Federal Interagency Floodplain Management Task Force, which is chaired by FEMA.

This report differs from the 1986 and 1979 versions in that it recommends four national goals with supporting objectives for improving the implementation of floodplain management at all levels of government. It also urges the formulation of a more comprehensive, coordinated approach to protecting and managing human and natural systems to ensure sustainable development relative to long-term economic and ecological health. This report was prepared independent of Sharing the Challenge: Floodplain Management Into the 21st Century developed by the Floodplain Management Review Committee, which was established following the Great Midwest Flood of 1993. However, these two reports complement and reinforce each other by the commonality of their findings and recommendations. For example, both reports recognize the importance of continuing to improve our efforts to reduce the loss of life and property caused by floods and to preserve and restore the natural resources and functions of floodplains in an economically and environmentally sound manner. This is significant in that the natural resources and functions of our riverine and coastal floodplains help to maintain the viability of natural systems and provide multiple benefits for people.

Effective implementation of the Unified National Program for Floodplain Management will mitigate the tragic loss of life and property, and disruption of families and communities, that are caused by floods every year in the United States. It will also mitigate the unacceptable losses of natural resources and result in a reduction in the financial burdens placed upon governments to compensate for flood damages caused by unwise land use decisions made by individuals, as well as governments.

WILLIAM J. CLINTON

THE WHITE HOUSE,
March 6, 1995.



Federal Emergency Management Agency

Washington, D.C. 20472

The Honorable William J. Clinton
President of the United States
The White House
Washington, D.C. 20500

Dear Mr. President:

I am pleased to commend to you for transmission to the Congress the very timely report, *A Unified National Program for Floodplain Management*. The Unified National Program responds to Section 1302(c) of the National Flood Insurance Act of 1968 (P.L. 90-448) and updates the 1979 and 1986 reports of the same title. This document was prepared by the Federal Interagency Floodplain Management Task Force and concurred in by the 10 member agencies.

In contrast to prior reports, which emphasized voluntary coordination of authorities, this *Unified National Program* document focuses on achieving national floodplain management goals that are both measurable and specific. Drawing upon the findings of the 1992 report *Floodplain Management in the United States: An Assessment Report*, this Unified National Program document also discusses the economic, environmental, and social trends affecting decisions that determine floodplain use, as well as the successes and deficiencies in the Nation's approaches to floodplain management.

Although preparation of this updated *Unified National Program* document was essentially completed before the catastrophic 1993 Midwest floods, its recommendations are especially significant now, not only to help mitigate similar disasters in the future, but also to improve our ongoing efforts to achieve the goals of floodplain management. The content and recommended goals of this document were prepared prior to, and independent of, the 1994 report, *Sharing the Challenge: Floodplain Management Into the 21st Century*, developed by the Floodplain Management Review Committee established by the Administration. The Committee reviewed the information and strategies outlined in the *Unified National Program* and cited it in their report. These two documents reinforce each other by the commonality of their findings and recommendations. For example, both reports recognize the importance of continuing to improve our efforts to reduce the loss of life and property caused by floods and to preserve and restore the natural resources and functions of floodplains in an economically and environmentally sound manner. Further, the conceptual framework and proposals presented in this *Unified National Program* document are consistent with the National Performance Review's recent report, *Reinventing Environmental Management*.

Finally, effective implementation of the Unified National Program for Floodplain Management will mitigate the tragic loss of life and property and disruption of families and communities, as well as the demand for increased Federal disaster relief expenditures caused by floods, for current and future generations.

Respectfully,

James L. Witt
Director

Enclosures

FOREWORD

In the 25 years since Congress first called for a unified national program to reduce flood losses, the Nation has made great progress in

- recognizing the wide range of human and natural resources that are at risk in floodprone areas;
- accepting nonstructural mitigation measures as cost-effective components of floodplain management efforts;
- assessing the status of floodplain management in the United States and using those evaluations as a foundation for improvement of management approaches and measures; and
- achieving experience with and acceptance of mitigation as a principal means of reducing losses.

However, the floods and severe storms of the last few years have been a sobering reminder of work yet to be done to further reduce the vulnerability of the residents of the United States to extreme natural events, and to more closely safeguard the valuable natural resources and functions that are found within the Nation's floodplains.

The Nation is entering a new era in hazards and emergency management—one in which a comprehensive multi-hazard, multidisciplinary approach, a stronger emphasis on mitigation, and use of technological tools like geographic information systems, will play leading roles. This updated *Unified National Program for Floodplain Management* can be a benchmark for that new era. Management of flooding and, more recently, of floodplains, has been an important focus of programs within numerous Federal and state agencies for many decades. The considerable achievements of the floodplain management community in devising a conceptual framework, establishing intergovernmental coordination, cooperating with the private sector, improving technical standards, conducting evaluations of progress, and setting long-term national goals, are reflected in this document. Yet none of the methods or goals presented here is incompatible with a much-needed and broader multi-hazards mitigation approach. In fact, some technical and regulatory standards for flood risks are already being developed in conjunction with those for other hazards, notably wind and coastal erosion. This *Unified National Program for Floodplain Management* points the way for effective all-hazards management and mitigation on a national scale.



Richard T. Moore
Associate Director for Mitigation
Federal Emergency Management Agency

PREFACE

This updated version of *A Unified National Program for Floodplain Management* responds to the directive in Section 1302(c) of the National Flood Insurance Act of 1968 that the President transmit to Congress any further proposals needed for a unified national program. Prior reports in response to this directive were submitted in 1976, 1979, and 1986. That another such update is needed at this time has been made clear in at least three ways.

First, a number of trends—economic, environmental, social, and others—have altered the external world within which floodplain management takes place. For example, intensified public concern for environmental protection now makes the resource protection aspects of floodplain management not only more attractive to decisionmakers, but also an essential part of any successful project. This update identifies and takes account of these changes.

Second, it responds to a number of concerns raised during the nationwide assessment of the status of floodplain management, which was completed in 1992. The final product, *Floodplain Management in the United States: An Assessment Report*, pointed out numerous deficiencies in the Nation's approach to managing its floodprone lands. Paramount among these were (1) a clear definition of floodplain management, that would encompass the manifold aspects of the technique but still provide focus; (2) a set of achievable national goals that would provide both a sense of direction and a means by which to measure progress or lack of it; and (3) a schedule for the completion of those goals. This update provides all three.

Third, this update addresses the criticism levelled at the Unified National Program by the National Review Committee, a panel of floodplain and resource management experts that assisted in the Assessment project, reviewed the draft report, and compiled a short report ("An Action Agenda for Managing the Nation's Floodplains") that reflects observations of the existing floodplain management situation and recommendations for improvement. Several of the Review Committee's suggestions were incorporated into the *Assessment Report*, as noted above, but an additional observation was that the Unified National Program is "neither unified nor national." Although the Program cannot create unity in the sense of consolidating authority—that is for Congress to direct—this update does take what is hoped will be a significant step in remedying those twin deficiencies. It shifts the focus of the program from individual agency missions to emphasize instead a set of national goals toward which agencies at all levels of government and in the private sector can work, each within its own mission and role.

The conceptual framework of this update focuses on the need for (1) reducing the loss of life, disruption, and damages caused by floods, and (2) preserving and restoring the natural resources and functions of floodplains. It reflects a recognition that the protection of the natural resources of floodplains deserves a level of consideration equal to that given to reducing damages to human systems. A new operating principle of "wise use" has been introduced to provide a conceptual target for management. Finally, this update emphasizes that protecting natural resources is not just an end in itself, but an effective means of reducing human losses as well.



Frank H. Thomas
Federal Emergency Management Agency
Chair, Federal Interagency Floodplain Management Task Force

ACKNOWLEDGEMENTS

The conceptual framework and content of this updated *Unified National Program for Floodplain Management* were developed by the Federal Interagency Floodplain Management Task Force. Previous editions of the *Unified National Program* and the information and findings presented in the 1992 *Floodplain Management in the United States: An Assessment Report* were used as a basis for this report. The Task Force was assisted by the Natural Hazards Research and Applications Information Center, University of Colorado at Boulder, and by Jacquelyn L. Monday, who was instrumental in preparing the report and bringing it to its final form. The design and production of the document were directed by David Butler of the Natural Hazards Center and John McShane of FEMA.

A special work group of the Task Force was formed to oversee the development of this document. It included:

Billy Colson, U.S. Geological Survey

Cory Giacobbe, U.S. Environmental Protection Agency

James Ross MacKay, Federal Emergency Management Agency

John H. McShane, Federal Emergency Management Agency

Doug Plasencia, Association of State Floodplain Managers, Inc.

Robert Plott, U.S. Army Corps of Engineers

Frank H. Thomas, Federal Emergency Management Agency

Don von Wolffradt, Soil Conservation Service

James M. Wright, Tennessee Valley Authority

EXECUTIVE SUMMARY

After several decades of work and a multibillion dollar investment to address flood problems in the United States, the average annual death rate from floods appears to have been stabilized, but flood losses (public and private property damage, injuries, disruption, and disaster relief) continue to rise, and the natural resources provided by floodplains are still being destroyed. The recent devastating floods were a harsh reminder of the high price that must be paid for unwise land use decisions, failure to account for natural forces, and lack of preparedness.

Floodplains throughout the United States today are managed through the decisions of countless groups and individuals, from property owners to elected officials to hired specialists. Their choices are subject to Federal, state, and local laws, programs, and policies for flood control, water resources management, economic development, environmental protection, disaster assistance, and other objectives. The Unified National Program for Floodplain Management is the Federal government's means of focusing these disparate perspectives toward the national good. It does this by setting out a conceptual framework for floodplain management that includes a statement of overall purpose, definitions, working and general principles, and management strategies and tools; by setting national goals and a timetable for their achievement; by providing for periodic evaluations of the status of floodplain management in the Nation; and by defining the roles and responsibilities of each level of government and the private sector.

Floodplain management aims to achieve

- A reduction in the loss of life, disruption, and damage caused by floods; and
- The preservation and restoration of the natural resources and functions of floodplains (which, in turn, lessens damage potential).

When both of those purposes are achieved within a given floodplain—that is, when the activities that take place within it are compatible with *both* the risks to human life and property posed by floods *and* the risks to the floodplain's natural functions posed by the human activities—it is said that the floodplain is being put to “wise use.” Floodplain management, therefore, is defined as *a decision-making process that aims to achieve the wise use of the Nation's floodplains.*

There are four main strategies for managing floodplains: (1) modifying human susceptibility to flood damage and disruption; (2) modifying the impact of flooding on individuals and the community; (3) modifying flooding; and (4) preserving and restoring the natural resources of floodplains. Each strategy is supported by an array of tools (local ordinances, hazard and resource identification programs, control structures, development/redevelopment policies, public awareness campaigns, etc.).

Under this framework, the decisions of floodplain managers involve choosing the best mixture of strategies and tools, balancing competing uses, weighing costs and benefits, and evaluating various alternatives—always keeping in mind the physical characteristics of the floodplain in question, the needs and desires of the people who have an interest in it, and the potential impact proposed uses will have on the future.

To ensure that the result of this ongoing, nationwide decisionmaking process is *improvement* of the status of the Nation's floodplains, four broad goals have been recommended, along with a list of objectives that must be accomplished to reach them. A schedule for their achievement has also been outlined. A mechanism for evaluating progress and for setting additional, more specific goals will be formalized by 1995, and a national forum in 1996 is expected to solidify participation in this procedure among the Federal, state, local, and private decisionmakers and professional groups concerned with floodprone areas.

- Goal 1. Formalize a national goal-setting and monitoring system for floodplain management.
- Goal 2. Reduce, by at least half, the risks to life, property, and the natural resources of the nation's floodplains.
- Goal 3. Develop and implement a process to encourage positive attitudes toward floodplain management.
- Goal 4. Establish in-house floodplain management capability nationwide.

This update of the Unified National Program draws upon previous versions, the floodplain management experience gained at all levels of government over the past several decades, and the findings and recommendations detailed in Chapter 16 of the 1992 *Floodplain Management in the United States: An Assessment Report*. It differs from prior proposals for a Unified National Program in that it focuses on the need to work toward national goals, rather than simply calling for better coordination and consolidation of authorities. This update is the first Unified National Program document to set out measurable, action-oriented goals, specific objectives by which they may be reached, a timetable for their achievement, and a mechanism for evaluating progress.

During the last decade, several trends have altered the circumstances within which floodplain management takes place. There now is stronger public sentiment for resource protection, and an even more compelling need for it. Increased scientific knowledge and technological capabilities will improve large-scale, comprehensive floodplain management undertakings. Shifts in responsibilities and capabilities among the levels of government and the private sector have resulted in more active participation by states and localities. These and other developments have placed the United States in a position to carry out a unified approach to managing floodplains and their resources. By focusing the attention of all levels of government and the private sector on the national need for an integrated, sustainable approach to managing the human resources and natural functions of the Nation's floodplain lands, and by working toward achieving the long-term goals set out here, the vision of a unified national program for floodplain management can be realized.

CONTENTS

Foreword.....	v
Preface.....	vi
Acknowledgements.....	vii
Executive Summary.....	viii
Section I. Introduction.....	3
Section II. A Description of Floodplain Management.....	7
Why Should Floodplains Be “Managed”?.....	7
The Federal Interest.....	7
What is Floodplain Management?.....	8
The Concept of Wise Use.....	8
Strategies for Floodplain Management.....	9
Section III. Evolution to Date.....	13
History of Floodplain Management and the Unified National Program.....	13
Recent Trends affecting Floodplain Management.....	16
Demographic Trends.....	17
Institutional Trends.....	17
Environmental Trends.....	18
Technological Trends.....	18
Socioeconomic Trends.....	18
Global Trends.....	19
Section IV. Implementing the Unified National Program.....	23
Past Progress in Implementing a Unified National Program.....	23
Criticism and Responses.....	23
Institutionalized Plan for Implementation.....	24
Roles and Responsibilities.....	24
The Private Sector.....	24
Communities.....	25
States.....	25
Federal Agencies.....	25
Beyond Coordination.....	26
Procedure for Evaluating Progress into the Next Century.....	27
Section V. Recommended Goals for the Unified National Program, 1995-2025.....	31
Section VI. Summary and View of the Future.....	37
References.....	39
Appendix A: Natural Resources of Floodplains	
Appendix B: An Update of the Strategies and Tools for Floodplain Management	

SECTION I
INTRODUCTION



INTRODUCTION

The floodprone areas of the United States cover approximately 150,000 square miles (94 million acres) or roughly 7% of the country. At least 9.6 million households and \$390 billion in property are at risk in those areas today. In addition, the Nation's floodplain lands comprise many of the Nation's most beautiful landscapes, productive wetlands, fertile soils, rare and endangered plants and animals, and sites of archaeological and historic significance. Disturbingly, the rate of urban growth in floodplains is about twice that of the rest of the country. Although the average annual loss of life from floods appears to have been stabilized, annual flood losses (public and private property damage, injuries, disruption, and disaster relief) continue to rise, and the natural resources provided by floodplains are still being destroyed at unacceptable rates.

The recent devastating floods have once again provided a harsh reminder of the high price the Nation must pay for unwise land use decisions, unawareness of the power of natural forces, and lack of preparedness. After decades of numerous and varied efforts to cope with the Nation's flood problems, there is still a pressing need for a comprehensive and coordinated approach to dealing with floodprone areas.

Decisions about which human activities will or will not take place on floodplains throughout the United States today are made by countless groups and individuals, from property owners to elected officials to hired specialists. Their decisions, in turn, are subject to a coalescence of Federal, state, and local laws, programs, and policies, and to the constituencies for flood control, water resources management, economic development, environmental protection, disaster assistance, and other wide-ranging objectives. This complex decision-making arena is the result of the coexistence of, on the one hand, a free enterprise system that values private property rights and, on the other, geographic settings (floodplains) that offer not only attractive resources that can benefit society but also risks that can harm it.

The Unified National Program for Floodplain Management articulates the means for marshalling the policies and programs that address this array of interests and ensuring that

The natural resources and functions of our riverine and coastal floodplains maintain the viability of natural systems and provide multiple benefits for people, both material and spiritual.



Bob Cox

Wetlands and other natural resources of floodplains are increasingly recognized as valuable national assets.

they are directed toward the common good. An ideal Unified National Program would encompass four principal components:

- A universally applicable conceptual framework that includes a statement of overall purpose, widely accepted definitions of terms, general and working principles, and explanations of management strategies and tools;
- Measurable national goals and a timetable for their completion;
- An efficient mechanism for assessing progress toward existing goals and agreeing upon additional new ones, along with a means for periodically evaluating the status of floodplain management throughout the Nation; and
- Recognition by each level of government and the private sector of its individual role and responsibility under the Program, and a willingness to work toward improving national well-being as embodied in the Program goals.

Ideas about what constitutes a unified national program have evolved over the past 25 years. In accord with the mandate of Section 1302(c) of the National Flood Insurance Act of 1968, the document describing the program is updated periodically in response to newly identified national needs, technological advancements, or shifts in public attitudes and sensitivities. This update of the Unified National Program is based in part upon the findings of the 1992 national assessment, *Floodplain Management in the United States*, and upon the recommendations of the National Review Committee established to provide advice during the assessment process.

The conceptual framework presented here takes a broader view than that of past versions. It sets out a more disciplined approach to implementation by articulating national goals, setting a timetable for their achievement, and providing ways to measure progress. It continues to treat floods as only one characteristic of floodplains and acknowledges the much broader relationship between human systems and the complex floodplain environment. The

traditional strategies for coping with floods are now presented in the context of finding a balance between benefiting from the resources of floodplain lands and minimizing the risks they also pose. It also recognizes that preserving and restoring the natural resources of floodplains are effective ways to reduce the damages to, and disruption of, human activities caused by floods. Finally, this update is another significant step toward achieving a unified national program for floodplain management.



John McShane

Bikepaths along the floodplain in Boulder, Colorado, provide recreational opportunities.

SECTION II
A DESCRIPTION OF
FLOODPLAIN MANAGEMENT



A DESCRIPTION OF FLOODPLAIN MANAGEMENT

Floodplains are the relatively low areas adjacent to rivers, lakes, and oceans that are periodically inundated. Floodplain lands and adjacent waters combine to form a complex, dynamic physical and biological system that supports a multitude of water resources, living resources, and societal resources. Floodplains provide the Nation with natural flood and erosion control, natural water filtering processes, a wide variety of habitats for flora and fauna, places for recreation and scientific study, and historic and archeological sites. They are also the locus of a variety of human activities, including commerce, agriculture, residence, and infrastructure.

Why Should Floodplains be "Managed"?

Throughout the Nation's history, people have settled on the banks of the country's oceans, rivers, and streams to take advantage of the water supply, transportation, energy source, abundant wildlife, beauty, the agricultural value of the highly productive alluvial soils, and other benefits that come from living near the water. Unfortunately, human development on floodplains usually results in flood damage and disruption to people and the infrastructure they create, as well as adverse alteration of natural systems. The costs and limitations of trying to control flooding have been enormous and well-documented and the extent of the harm this approach has caused to natural systems is only now beginning to be fully understood. Human use of floodplains is significant and will likely continue for the foreseeable future. Fortunately, we now know that there are ways to reconcile competing uses of floodplains, and that much damage and disruption can be avoided with proper planning and management.

In short, floodplains need special attention because experience has shown that if we are not careful—if uncontrolled development and use of floodprone lands by unsuspecting or ill-informed people is allowed—we end up with unacceptable loss of life and property, and often irreparable harm to the natural functions of floodplains upon which we rely. Wise land use practices—delineation of sensitive areas, planning, management, and restoration—are essential for allowing the continued use of valuable floodplain assets while at the same time safeguarding them against abuse.

The Federal Interest

The Federal government's involvement with floods and floodplains began with its interest in maintaining the navigability of the Nation's waterways to facilitate interstate commerce. In the 1800s the focus of this effort was making channel and harbor modifications to improve navigation, but over the years the responsibility grew to encompass building levees on major waterways, notably the Mississippi River, and constructing dams in an attempt to control floods to protect people, provide water for irrigation, and for power generation. In addition, starting in the 19th century, many policies and programs of the Federal government encouraged both human settlement of floodplains and the drainage of wetlands for agriculture.

Although most decisions about how floodplain lands will be used are made at the local level, sometimes with state guidance, the Federal government's participation is still extensive. It maintains and improves projects and programs begun in previous decades (or centuries), takes the lead on technical and policy issues, funds some state and local mitigation activities, and is the principal provider of major, nationwide programs that either require uniformity of

*As used in this report, the phrase **natural resources of floodplains** encompasses all of the resources and benefits provided by floodplains under natural (or nearly natural) conditions, along with the biologic and hydrologic functions that floodplains normally perform. These resources and functions are often grouped into three categories: water resources, biologic resources, and societal resources. A list can be found in Appendix A.*

The management of floodprone lands has a twofold purpose:

- *Floodplain management should reduce the loss of life, the disruption, and the damages caused by floods.*
- *Floodplain management should preserve and restore the natural resources of the Nation's floodplains.*

Floodplain management is a decision-making process that aims to achieve the wise use of the Nation's floodplains.

approach (such as mapping of flood hazard areas) or are too sweeping for states or localities to handle (such as national flood insurance, or major disaster assistance). With regard to private floodplain lands, the Federal government identifies the hazard and encourages the public and institutions to consider the risks they incur in conducting their business there. The Federal government also has floodplains to manage in the public lands set aside for national forests, parks, seashores, and rangelands.

What is Floodplain Management?

Although the term "floodplain management" often has been used in a narrow sense as a synonym for flood control projects, flood loss reduction regulations, flood insurance, and other program- or agency-specific techniques, it is in fact quite a broad concept. It is a *continuous process of making decisions about whether and how floodplain lands and waters are to be used*. It encompasses the choices made by owners of floodplain homes and businesses, decisions made by officials at all levels of government, development plans made by owners of commercial floodprone land and the judgements of farmers with pastures and fields stretching to the riverbanks. The process also focuses the attention of decisionmakers on the relationship between human use and the conservation of natural resources.

Floodplain management at any scale requires information in order to be carried out successfully, but it is not a data-gathering activity. Rather, the process of floodplain management draws upon data to improve the likelihood of making sound decisions about what uses to make of floodplain land. Repeated calls for additional and better data about floods, floodplains, and related issues are justified. But effective management also requires making prompt decisions that are compatible with the risks and resources inherent to floodplains, before unwise development or other uses occur that will prove unacceptably costly in the long run.

At its best, floodplain management focuses simultaneously on the present, near-future, and long-term viability of the floodplain as an integral part of the human community, the watershed, the shoreline, or the coastal system. When proposed uses conflict, the relative costs and benefits of each need to be balanced to decide how the lands and waters will be best "used." The process of choosing among these competing uses, balancing them against the various costs—both monetary and intangible, immediate and long-term—and making a decision that is the wisest one for that particular floodplain within its social, natural, physical, and economic context, is what floodplain management is all about. Floodplain management seeks the *wise use* of floodplain lands and waters.

The Concept of Wise Use

A floodplain is being put to wise use when the activities that take place on it are compatible with *both* the risks to human life and property from floods *and* the risks to the floodplain's natural functions posed by the human activities. The concept of wise use, as embodied in accepted resource management principles, emphasizes the physical reality of the floodplain itself—its geography, natural functions, periodic inundation, nexus to the watershed, etc.—and focuses the attention of the decisionmakers on the potential interaction of the natural resources and functions with existing or proposed human activities.

GENERAL PRINCIPLES OF FLOODPLAIN MANAGEMENT

- The Federal government has a fundamental interest in how the Nation's floodplains are managed, but the basic responsibility for regulating floodplains lies with the state and local governments.
- Floodplains must be considered in the context of total community, regional, and national planning and management.
- Flood loss reduction should be viewed in the larger context of floodplain management, rather than as an objective in itself.
- Resource management and protection typically focus on the specific resource, which may or may not occur entirely within the floodplain.
- Sound floodplain management embodies:
 - Goals (wise use, preservation and restoration, and development of resources);
 - Objectives (economic efficiency, environmental quality, and social well-being);
 - Consideration of future needs and the role of the floodplain;
 - Evaluation of alternative strategies;
 - Accounting for benefits, costs, and interrelated impacts of floodplain management actions;
 - Motivation of decisionmakers;
 - Coordination of agencies at all levels for all aspects of floodplain management and involvement of the private sector; and
 - Evaluation through continuous monitoring and reporting to the public.

The definition of *wise use* provides its own self-test. In theory, floodplain decisionmakers can ask themselves, "If this development (or other activity) is located in a floodplain, is it possible to minimize the loss of life and damage from flooding?" If the answer to this is, "No," then the activity may not be a wise use of the floodplain land. If the risk to life and property can be mitigated, there is a second question, "Does locating this development in the floodplain allow for maintaining the floodplain's natural functions?" If it does not, then the activity may not be a wise use of the floodplain, even if the first test was met. In other words, the answer to both questions must be "Yes." In practice, however, these issues are often not of primary concern to most decisionmakers. Fortunately, although many activities are not particularly appropriate for floodplain sites, steps often can be taken to reduce the risk sufficiently to make them acceptable. Further, there may be existing uses of activities on a floodplain that are considered unsuitable for that site (the result of unwise decisions in previous years), but because a long-term plan has been adopted to encourage relocation or protection, the risk is accepted in the interim.

Thus, a wisely used floodplain is the product of a challenging process of evaluating and balancing the costs and benefits of sometimes competing uses, the short- and long-term value of the floodplain's natural resources, the other activities that are taking place elsewhere on the floodplain and within the watershed, and the likely impact of today's decisions on the future.

Strategies for Floodplain Management

Floodplain management encompasses both the process of making decisions and the continuous challenge of seeking out and developing new strategies and tools to encourage the wise use of floodplain lands.

There are four strategies for managing floodplains. Using one or more of these strategies (and the tools that implement them) helps bring existing or proposed activities into compatibility with the risks to human resources and the risks to natural resources.

- Modify human susceptibility to flood damage and disruption,
- Modify the impact of flooding on individuals and the community,
- Modify flooding.
- Preserve and restore the natural resources and functions of floodplains.

Each strategy is supported by an array of tools, such as local floodplain management ordinances, resource protection programs, flood control structures, development and redevelopment policies, flood insurance, and relocation and acquisition.¹

In most cases, no single technique will be sufficient; rather, a combination will be needed to reduce the risks to acceptable levels. By selecting the best mix of these strategies and tools, decisionmakers can tailor a floodplain management approach to the characteristics of a specific floodplain and to the needs of its constituents. The combination chosen by a community, an agency, or an individual needs to be based on what is available, practicable, affordable, and likely to be successful for the floodplain in question, always keeping in mind

¹ A complete list of the strategies and tools appears in Appendix B. A detailed description of the floodplain management strategies and the tools that support them can be found in Chapters 11-14 of *Floodplain Management in the United States: An Assessment Report*, listed in the References.

The "100-year" flood, also known as the **1% annual chance flood** or **base flood**, is a flood of the magnitude that has a 1% chance of being equalled or exceeded in any given year. This is the standard most commonly used in the United States for floodplain management and regulatory purposes.

Wise use of floodplains means enjoying the benefits of floodplain lands and waters **while still** minimizing the loss of life and damage from flooding **and at the same time** preserving and restoring the natural resources of floodplains as much as possible. *Wise use* thus is any activity or set of activities that is compatible with both the risks to the natural resources of floodplains and the risks to human resources (life and property).

the dual purposes of floodplain management: reducing loss of life, disruption, and damages; and preserving and restoring natural resources and functions.

There will always be a wide variety in the ways floodplains across the nation are managed by the communities, property owners, and others who have responsibility for them. The "wise use" will vary from place to place, ranging from relatively intensive use in developed areas, to passive use in the case of undisturbed floodplains whose natural conditions are purposely being preserved. In each situation, the decisions about how the floodplain will be used needs to be based upon a careful consideration of all the impacts of a given action across both time (into the future) and space (throughout the floodplain and downstream). Finally, it is important to note that a relatively undisturbed floodplain provides natural flood control because its flood storage and conveyance function is maintained. This in turn benefits not only the biological and water resources of floodplains, but also minimizes potential flood damages to homes, businesses, and infrastructures while still providing for appropriate economic development and recreational use.

SECTION III
EVOLUTION TO DATE



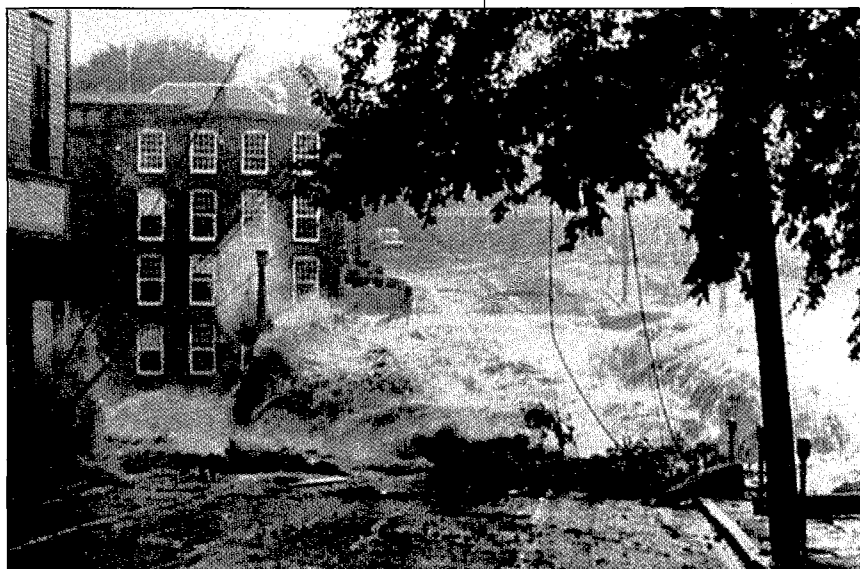
EVOLUTION TO DATE

The conceptual framework for floodplain management is the result of many years of experience, work, and study by numerous experts. This section provides the historical background that brought the Nation to this point, and identifies recent trends that underlie this update of the Unified National Program.

History of Floodplain Management and the Unified National Program

Floodplain management in the first half of this century was marked by efforts, largely Federal, to reduce flood losses by controlling floods. The Nation focused its attention on flood losses after dramatic flood disasters, usually by responding with structural projects such as dams, levees, and floodwalls. Beginning in 1917, the U.S. Army Corps of Engineers was assigned increasing responsibility for flood control, culminating in assumption by the Federal government in the 1930s of the full cost of building and maintaining dams, channel modifications, and rectification projects for all navigable rivers of the Nation. The Tennessee Valley Authority began a sweeping regional program of resource development that included the construction of multi-purpose dams, including flood control. The Bureau of Reclamation and the U.S. Department of Agriculture began including flood control with other considerations in their projects. Floodplain lands, waters, and natural resources received protection, if at all, only under a handful of laws and programs for preserving special areas as public parks, forests, and wetlands. During this period, human and natural resources were managed separately. The Federal government was the principal actor simply because it was the best organized, could tackle interjurisdictional problems, and marshalled adequate personnel and financial resources.

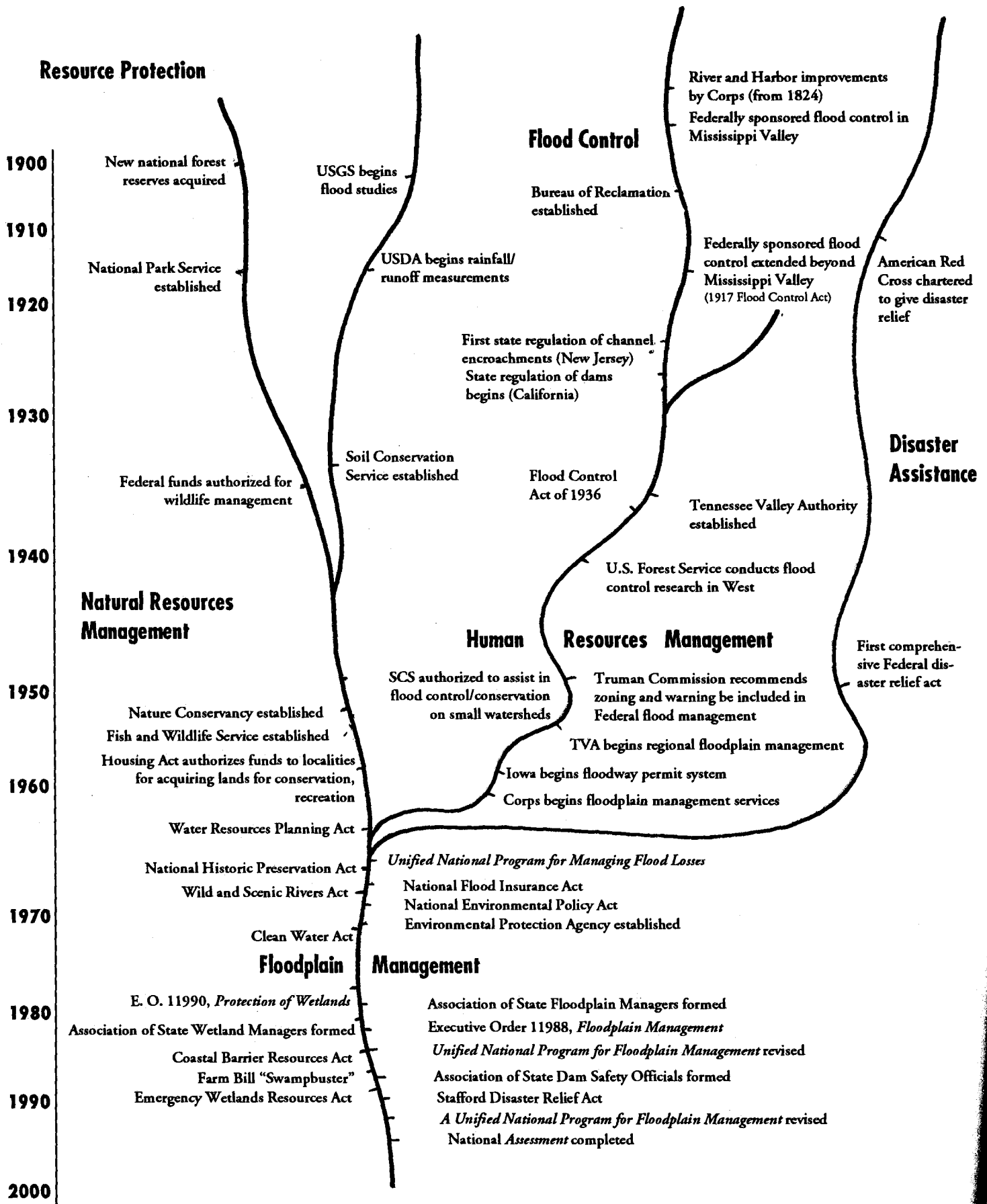
“Floodplain management” was not a generally used term during the early and middle decades of the 20th century. Nevertheless, a number of diverse efforts were being undertaken that would later be recognized as precursors to contemporary floodplain management. The Corps of Engineers and the U.S. Geological Survey continued to set up stream gage networks during this period. The U.S. Forest Service studied the relationship between timber harvest and runoff. A national program for the study and management of upstream watersheds was authorized. The U.S. Soil Conservation Service helped individual landowners and operators apply conservation measures (including flood prevention) in 2,600 soil conservation districts. The Forest Service began major research on flooding in the intermountain region. The U.S. Fish and Wildlife Service provided grants to state fish and game departments for land acquisition, development, and research on managing or restoring fish and wildlife habitats. The National Park Service continued to set aside and manage lands for public use, some of which included floodplain areas. A few states adopted limited floodplain management regulations, mostly to prevent channel encroachments. Localities and special districts continued to build levees and modify and maintain small channels. In 1953, the Tennessee Valley Authority initiated a comprehensive regional floodplain management program, and during the early 1960s the Corps began offering floodplain management services nationally. But in the absence of a unifying concept or direction, unfortunately, this period



U.S. Army Corps of Engineers

Quinebaug River, Putnam, Connecticut, after Hurricane Diane, 1955.

Evolution of Floodplain Management in the United States



HISTORY OF A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

In 1966, *A Unified National Program for Managing Flood Losses* (House Document 465) was submitted to Congress. It had been prepared by the Task Force on Flood Control Policy at the administration's request in an attempt to arrest the mounting national toll of flood losses, unchecked by a more-than \$7 billion investment in flood control projects since 1936. The document recognized the need for a unified approach and for new planning, and made recommendations for initial Federal actions, including legislation, specific studies, and new programs for collecting and disseminating flood-related information.

A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT, 1976

In response to a 1968 Bureau of the Budget request, and to a 1975 U.S. General Accounting Office report criticizing House Document 465 and Executive Order 11296, the U.S. Water Resources Council submitted to the President *A Unified National Program for Floodplain Management* in 1976. This document, whose title change reflected a significant recognition that more than flood losses were involved, established a more detailed framework for the program, described the greatly changed context in which it would be implemented (numerous changes in flood-related Federal programs had taken place), and added management strategies and tools for Federal, state, and local decision-makers to use. The report focused on the need for improved coordination.

1979 REVISION OF THE UNIFIED NATIONAL PROGRAM

Several executive-level actions—Executive Orders 11988 and 11990, and President Carter's floodplain management policy and 1978 water policy initiatives—soon made the 1976 program obsolete. The Federal Interagency Task Force on Floodplain Management updated and refined the Unified National Program in a report submitted by the Water Resources Council in 1979. This revision incorporated Federal concern with the "natural and beneficial values" of floodplains, responded to the President's policy directives, expanded the strategies, tools, and conceptual framework accordingly, and emphasized the "lack of adequate technical and procedural information to guide floodplain decision-makers."

1986 REVISION OF THE UNIFIED NATIONAL PROGRAM

The Interagency Task Force submitted an updated Unified National Program in 1986, noting that the earlier version had become "dated by the relative success and changes in Federal programs and by the strengthening of floodplain management capability at the state and local levels." Some of these changes were the use of the Federal interagency hazard mitigation teams pursuant to an Office of Management and the Budget memorandum and subsequent agreement among 12 Federal agencies, passage of the 1982 Coastal Barrier Resources Act restricting Federal expenditures that might encourage development of coastal barriers, and completion of two major National Science Foundation studies on flood hazard mitigation. The report made explicit recommendations for Federal support of state and local initiatives.

1994 REVISION OF THE UNIFIED NATIONAL PROGRAM

One of the recommendations of the 1986 report was that a comprehensive assessment be made of progress in floodplain management throughout the nation. The completion of that work in 1992 confirmed both advancements and deficiencies in floodplain management and made it clear that an update of the Unified National Program was again in order. The 1994 program includes a revised conceptual framework that calls for managing floodplains as integrated systems of both human activities and natural functions. It also lists specific national goals, sets a timetable for their completion, and incorporates benchmarks by which progress can be measured.

A UNIFIED NATIONAL PROGRAM
FOR MANAGING FLOOD LOSSES

COMMUNICATION

FROM

THE PRESIDENT OF THE UNITED STATES

TRANSMITTING

A REPORT BY THE TASK FORCE ON FEDERAL FLOOD
CONTROL POLICY



AUGUST 10, 1966.—Referred to the Committee on Public Works, and
ordered to be printed with illustrations

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1966

* 67-583

was marked by fragmentation of responsibility, differing and conflicting missions and roles, and even a certain amount of competition among agencies at the Federal level.

During the 1960s, ideas about the best ways to reduce flood losses began to change. Continually rising flood losses in spite of a substantial investment in flood control, coupled with an emerging environmental ethic, made the time ripe for shifts in thinking about floodplains. In Section 1302(c) of the National Flood Insurance Act of 1968 (P.L. 90-448), Congress directed the President to formalize a framework for managing the Nation's floodplain areas. The result was a report prepared by the U.S. Water Resources Council, *A Unified National Program for Floodplain Management*. Released in 1976, this document set forth the first conceptual framework for managing the Nation's floodplains (not just the losses resulting from flooding), identified strategies and tools for doing so, and made recommendations for recognition and acceptance of the program at all levels of government. Much of the thinking of the 1976 report was underlain by House Document 465, the report of a special Task Force on Flood Control Policy.² The document outlining the program was revised in 1979 and again in 1986, to reflect major changes in water resources policy, environmental legislation, and the increasing capability of states and localities to manage the floodplains within their jurisdictions.

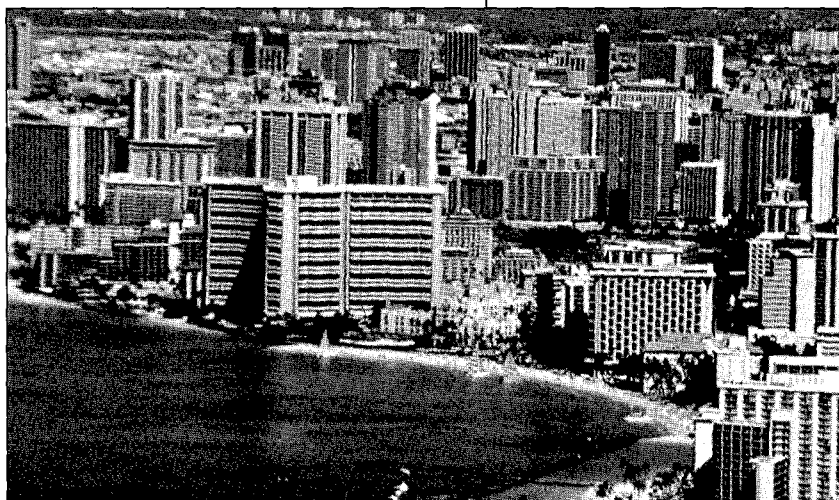
The growth of floodplain management since the 1960s has been phenomenal. An impressive number of Federal, state, local, and private initiatives in the form of legislation, executive orders, interagency and intergovernmental agreements, comprehensive plans, public awareness campaigns, land trusts, and scientific research all have combined to form a broad, thoroughly established foundation for intelligent handling of the Nation's floodprone lands.

Today, over 18,400 localities regulate their floodprone areas, making Federally administered flood insurance available to their citizens. There are Federal, state, and local environmental laws, regulations, and policies that protect critical environmental areas and recognize the importance of preserving the natural functions of floodplains to maintain the integrity of riparian ecosystems. State and local governments play key roles, with the Federal agencies acting in more of an advisory capacity than in previous decades. Regional warnings for floods and hurricanes are becoming almost universally available. Local and regional planning for stormwater management and watershed protection have become more common and

more sophisticated, especially in urban areas. A Federal-state-local-private system of disaster response and assistance now is in place. It is fair to say that over the past 35 years all of the components of a unified national effort have been developed and refined, albeit often separately. The potential for a truly integrated, effective program now exists.

Recent Trends Affecting Floodplain Management

In addition to the technological and management advances that have been made within the field of floodplain management itself, during the last 5-10 years a number of external factors have combined to make a unified program both more necessary and feasible than ever before.

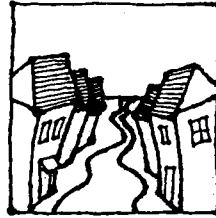


Increasingly dense coastal development, like this area in Honolulu, Hawaii, puts more people at risk from floods.

²A full discussion of the history of the Unified National Program for Floodplain Management can be found in chapter 5 of *Floodplain Management in the United States: An Assessment Report*.

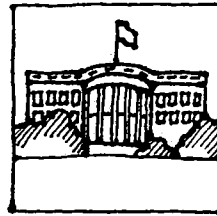
Demographic Trends

- The population of the United States has grown, and a disproportionate share has moved into coastal communities and sites adjacent to rivers and lakes. This shift has resulted in larger-scale, new development concentrated in high-hazard zones and in environmentally sensitive areas like wetlands and alluvial fans. Today's more urbanized population has less contact with natural systems and thus has a limited understanding of their normal functions and insufficient appreciation of their potential hazards. This is especially true of the many newcomers to coastal areas.
- At the same time, recent major disasters have improved the awareness of flood risk and mitigation in certain regions of the country.
- The public has become increasingly aware of the importance of the natural environment in creating and maintaining a high quality of life.



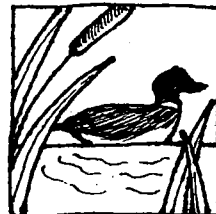
Institutional Trends

- The heavy debt faced by Federal, state, and local governments reduces their ability to raise funds for large capital intensive flood loss reduction measures (such as those to control flood waters). As a result, capital-disbursed measures to reduce flood losses (building codes, for example) are becoming more popular.
- The regional natural and human resource planning approaches of 1960-80 have been largely replaced by national regulatory schemes coupled with local planning, such as that embodied by the Clean Water Act, the National Flood Insurance Program, and programs for managing river corridors for multiple purposes (flood hazard, recreation, maintenance of natural functions, economic development, transportation, etc.).
- The Federal Coastal Zone Management Program, carried out through the state governments, has provided a continuous and consistent planning perspective since the early 1970s.
- Since 1968, the National Flood Insurance Program has emerged as a primary element of national floodplain management. E.O. 11988, *Floodplain Management*, extended the concepts of the National Flood Insurance Program to the activities of the Federal government. Formal organizational functions and scientific standards have been established. There has been increasing litigation over local government failures to enforce floodplain management ordinances.
- Many efforts, especially Federal projects, have begun using a well-balanced mixture of structural and nonstructural floodplain management tools.
- Since the late 1960s, the National Environmental Policy Act, the Clean Water Act, and other environmental laws have institutionalized the process of making decisions affecting the environment. E.O. 11990, *Protection of Wetlands*, established a policy of Federal action to mitigate wetland loss. Formal organizational functions and scientific standards have been established.



Environmental Trends

- National awareness of the value of the natural resources of floodplains continues to grow. Schools and the media have internalized environmental values and fewer uninformed decisions are made about the natural resources of floodplains.



- Ecologically productive and environmentally sensitive areas in floodplains (wetlands, riparian habitats, etc.) are still being destroyed or degraded. However, the rate of wetland losses has slowed in recent years.
- Management practices for sensitive and critical environmental areas are being developed and implemented with more frequency.
- Improved, and in some cases highly sophisticated, methods of resource assessment and impact analysis are now being used. The concepts of ecosystem management and environmental sustainability are gaining prominence and acceptance by scientists and the general public and being applied to a variety of settings.
- Many states and agencies have initiated wetland restoration programs.

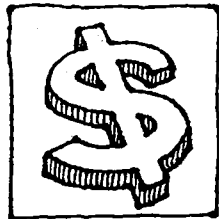
Technological Trends

- The widespread development of geographic information systems coupled with application of geopositioning systems has made it possible to conduct comprehensive inventories of floodplain conditions.
- Improved scientific knowledge and experience with natural resource mitigation are making preservation and restoration practical and feasible.
- Scientific knowledge and experience with new techniques for mitigating risks to human systems are reducing losses of life and property.
- Improved computer capabilities permit more sophisticated data management and analysis.



Socioeconomic Trends

- The balance between the public interest and private property rights is shifting perceptibly toward stronger public rights as the costs of legal nuisances become unacceptably high. Chemical, radiological, and biological hazards are now more pervasive and considered more important than they were a decade ago. Their visibility reinforces treating natural hazards like area-wide risks (or nuisances). Experience with such localized nuisances as house fires has been consolidated and put to use in, for example, insurance rating systems and building codes. The positions of the legislatures and the courts are slowly evolving to reflect public nuisance concerns and redefine pertinent rights and procedures. The Clean Water Act and the Clean Air Act are good examples of this tendency.
- Ever-increasing population densities in urban and metropolitan areas make the interdependence of people's economic and social activities more obvious.
- The strategy of modifying flooding with structural measures is receiving less Federal emphasis. When such measures are undertaken now, local governments or private interests are more likely to be the driving forces.
- There is a greater public and professional awareness of the wisdom of multi-hazard approaches to planning and mitigation.
- Government payments for disaster assistance have been increasing.



Global Trends

- Current predictions are that the average number of hurricanes striking the Atlantic and Gulf coasts annually will increase in the coming years.
- The National Academy of Sciences has concluded that the accelerated rate of sea level rise, which is a result of climate change, would raise sea levels from 0 to 2 feet above what would otherwise have been expected by 2100.
- International exchange of information is increasing and is expected to be accelerated through the programs of the International Decade for Natural Disaster Reduction.



Taken as a whole, these trends have changed the circumstances within which floodplain management takes place. There is stronger public sentiment for resource protection, and an even more compelling need for it. Increased scientific knowledge and technological capabilities will improve large-scale and comprehensive floodplain management, mitigation, and resource protection undertakings. There have been inevitable shifts in responsibilities for floodplain management tasks among the levels of government and the private sector, but there now seems to be a climate of willingness to cooperate and to “get things done.” It has become possible to formulate a management approach that is politically, economically, and technologically achievable as well as capable of providing the Nation with floodplains on which human uses and natural functions can coexist in a sustainable system.

SECTION IV
IMPLEMENTING THE
UNIFIED NATIONAL
PROGRAM



Photo previous page: Structural elevation is one proven means of flood mitigation (FEMA)

IMPLEMENTING THE UNIFIED NATIONAL PROGRAM

This section gives an overview of the means by which the Unified National Program is carried out. Historical difficulties and progress are described first, followed by a description of the institutionalized framework for managing floodplains in this country, and a look at modifications proposed to better achieve a Unified National Program.

Past Progress in Implementing a Unified National Program

It would be misleading to suggest that the initial proposal for a Unified National Program in 1968 subsequently revolutionized the Nation's approach to managing floodprone areas. The Program concept has been a positive force for coordinating and expanding upon public and private programs that were already aimed at floodplain issues, but these effects were gradual and at first quite narrowly dispersed. Many of the developments and refinements of approach and technology that have been made since then would likely have developed on their own anyway. The environmental initiatives that are now utilized to protect floodplain resources, in particular, grew primarily out of the environmental consciousness of the 1970s, which sprung up wholly apart from concern for floodplains themselves.

Some successful initiatives, however, can be traced directly to the existence of the Unified National Program. Notable among these are Executive Order 11988, *Floodplain Management*, and the integration of approaches to managing the natural resources of floodplains with existing flood loss reduction initiatives. The strategies and tools for floodplain management as described in the Unified National Program have been widely used and combined in innovative ways, as intended. And, of the 16 original recommendations made in the 1966 Task Force report (the precursor to the Unified National Program), only one—data collection—remains largely unimplemented. The others have been partly or fully realized and given rise, in turn, to a set of new goals for the next few decades.

Criticism and Response

One recommendation made in the 1986 Unified National Program was that an assessment be made of the status of floodplain management throughout the Nation. The completion in 1992 of *Floodplain Management in the United States: An Assessment Report* made it clear that another revision of the Program was in order. The *Assessment* noted that programmatic and national unity was not being achieved, except on specific technical issues, such as the base flood standard. In fact, the project's National Review Committee stated flatly that "... the Unified National Program is neither unified nor national."³ Partly to remedy this, the *Assessment* called for clarification of the concept of floodplain management and a new set of long-term national goals.

It is true that, so far, the Program has fallen short of the accomplishments that had been envisioned for it. It is instructive, however, to examine some of the conditions that have constrained more dramatic progress. The responsibility for preparing proposals for a Unified National Program was initially assigned to the U.S. Water Resources Council. To assist in that effort, a Federal Interagency Floodplain Management Task Force was created. Responsibility for the Program was transferred to the Federal Emergency Management Agency in 1982. The Task Force remains a voluntary coalition whose active participants are really representatives of their respective agencies. They therefore are limited by their statutory

ACTION AGENDA FOR MANAGING THE NATION'S FLOODPLAINS

A Review of
*Floodplain Management in the United States:
An Assessment Report*

National Review Committee

Raymond J. Burby
Gerald E. Galloway
James E. Goddard
James G. Gosselink
H. James Owen
Rutherford H. Platt
William E. Riebsame, Vice-Chair
John R. Sheaffer
French Wetmore
Gilbert F. White, Chair
Stanley M. Williams

Special Publication 25
Natural Hazards Research and Applications
Information Center

³ Page F-8 of *Floodplain Management in the United States: An Assessment Report*.

responsibilities and cannot exceed that authority for the sake of national floodplain management goals—however laudable—that are not officially accounted for in their respective agencies' enabling legislation or authorized budgets. In short, the Task Force does not have authority to compel action to implement the Program.

It should also be recognized that, in a federal system, no program of this complexity is likely to operate as effectively as a singular entity would. A certain amount of friction among the levels of government, and among the various agencies within those levels, is inevitable because of their differing views and missions. The public and private sectors maintain a fragile alliance at best. Yet the participation of all interested and affected parties is essential to successful floodplain management on a national scale. By the same token, it is axiomatic that there is never enough money or people to accomplish as much as is needed.

Whatever its limitations, the Unified National Program has continued to supply the vital, Congressionally mandated blueprint for floodplain management throughout the country. This was a formidable challenge, given the need for the design and implementation of a multiplicity of program elements for both the private sector and the different levels of government. The Unified National Program has remained the central expression of the Nation's philosophy, concept, goals, and techniques for sound floodplain management. With the addition of the goals, timetable, and evaluation mechanisms introduced in this revision, the Unified National Program for Floodplain Management supplies a much-needed sense of national accomplishment and direction. This is something no other program, project, or entity provides.

Institutionalized Plan for Implementation

The Unified National Program is underlain by the implicit expectation that its implementation will be carried out largely through the existing programs, activities, and policies of the Federal, state, and local agencies, and professional groups with responsibility for or interest in floodprone areas. Within the framework of the Program, it is intended that the government and private sector will set their own specific objectives that will both meet their individual needs and also help achieve the national goals. Each entity can lend additional momentum to the Program by demonstrating exemplary floodplain management through its own actions. The basic scheme for implementation is sketched below, and objectives related to each major goal are highlighted in the section on goals. Each agency or organization will need to augment its own programs to further the goals and to advance the concepts of wise floodplain use.

Roles and Responsibilities

Floodplain management in the United States is carried out through a partitioned system of government within which authority and responsibility are shared among the private sector and local, state, and Federal governments; through a free-enterprise economy with a foundation in private property rights; and across highly distinctive geographic regions that require flexibility in management approaches. Within each level of government, each private group, and each region of the country, responsibility is further divided among organizational units. Because no unit can dictate what others will undertake, a premium is placed upon unifying mechanisms that help develop coordination and cooperation.

The Private Sector. Because of its capacity to make and influence the final decisions about the use of floodplain lands, the private sector exerts significant influence in directing the Nation toward the wise use of its floodplains. The private sector has the responsibility of raising the viewpoints of its many special interest groups, thereby supplying a crucial balancing force. Through this avenue, individual citizens, homeowners, floodplain property owners, business leaders, conservation groups, agriculturalists, and others contribute to—and greatly influence—decisions about the use of floodplains and thus to the overall management of the Nation's floodprone lands.

Communities. The local role in the Unified National Program is that of making land use decisions and implementing them. Local governments have the greatest opportunity and responsibility to encourage and ensure sound floodplain management decisions. Through exercise of the authority delegated to them by the state, they guide the placement of infrastructure and ensuing development to avoid adverse impacts to life and property and to natural floodplain functions. In many cases, only a specific request from the local government can trigger the provision by the state or Federal government of technical expertise, planning assistance, and financial support.

States. In a national scheme of floodplain management, state governments primarily guide local decisions and coordinate among other levels of government. States set the tone for localities through the scope and quality of floodplain management authority that they delegate. Some states have legislatively derived authorities, funding, and staffing to carry out active and effective floodplain management programs, delegate very little floodplain management authority, and exempt certain activities (like agriculture or mining) from floodplain regulations altogether. Other states delegate strong land use regulatory authority to their localities and support them with sophisticated in-house programs for technical and financial assistance.

No matter what their current orientation, states can endorse the spirit of the Unified National Program by adopting its concept of floodplain management and promoting whatever mix of strategies and tools best fits overall state goals and the needs of their flood-prone jurisdictions. Coordination with other states, through professional groups or other mechanisms, improves floodplain management capability and allows the sharing of positive experiences. States also are encouraged to examine the Program goals and to consider what steps can be taken to make progress toward their achievement. One example of potential state effort is the need for professional standards for floodplain management practitioners. A few states have incorporated floodplain management training into their building certification and natural resources programs.



John McShane

**Floodplain Management in a Unified
National Program Entails a True
Federal/State/Local Partnership:**

Federal: *guidance and assistance*

State: *initiative, involvement,
coordination, leadership*

Local: *responsibility, decisionmaking,
management*

Federal Agencies. The role of the Federal government has changed dramatically over the past few decades. At first it was the main—and sometimes only—purveyor of flood loss reduction and resource protection programs and activities. Then it took the lead in setting policy and establishing programs, with the states and localities following its example. Now the Federal government is largely a provider of technical expertise and financial assistance. Especially in light of increasing state and local capabilities, the Federal role in implementing the Unified National Program will be one of setting an example, establishing standards, and supplying services not otherwise available to state and local floodplain management programs. The latter includes flood hazard mapping, developing and testing flood-resistant designs and materials, and training opportunities.

Beyond Coordination

Coordination is an essential cornerstone for implementation of a national program for managing floodplains. Being aware of the activities and plans of other players in the floodplain management scene is the first step toward taking well-considered individual action, and a precursor to any joint endeavor. Mutual recognition and understanding of programs, expenditures, policies, and goals is the best way to avoid duplication of effort and make the most effective use of resources. Routine coordination is also a way of sharing ideas and solutions to common problems. One-to-one coordination and cooperation between state and Federal agency personnel has always been one of the most effective ways in which local, state, and Federal goals and policies for floodplain management are reconciled. In a situation that is often highly political, coordination has the additional advantage of ensuring consistency and yielding positive results. A commitment to coordinate one's own actions or those of one's company or agency costs little or nothing, in either political or monetary terms.

But this revision asks more of the key players in floodplain management than that they simply coordinate the activities that are already underway. Effectiveness on a nationwide scale will require that every level of government, every agency, every private organization, and every floodplain resident or property owner make a commitment to taking actions that will move us closer to meeting the national goals described in the next section. This may entail shifting priorities, reallocating funds or personnel, increasing revenues, or re-examining policies, procedures, and missions.

Two issues should be mentioned here because, although they are not under the direct purview of the Unified National Program, they can affect its progress. The first is that those who choose to live or do business in hazardous areas are not at present paying a proportionate share of the costs of that decision. Instead, the public essentially subsidizes these unwise decisions. Second, national policy on disaster response and assistance must be consistent with the policy for floodplain management so that floodplain residents will be aware of their risk and act accordingly. As a result of grants and other forms of postflood recovery assistance, there exist few incentives or requirements for floodplain residents or their local governments to take preventative or mitigative measures.

Procedure for Evaluating Progress into the Next Century

This Unified National Program document focuses on achieving unification in floodplain management through concurrence and the pursuit of national goals, in contrast to earlier proposals, which emphasized coordination of authorities. One specific feature absent from previous Unified National Program proposals was a mechanism for determining how much progress had been made from year to year. This was due in part to the fact that clear, measurable goals had not been established, and in part to the difficulty of making meaningful nationwide assessments of the progress attributable to sound management, and isolating it from changes that would have taken place otherwise.

Measurability problems will always beset complex undertakings, but steps have been taken to remedy this shortcoming through the establishment of a set of goals along with standards by which their achievement can be estimated, and a deadline for achieving them. This is a significant undertaking, and somewhat risky, especially in light of the limited funding and lack of authoritative leadership for implementation of the Program. Nevertheless, given the extent of cooperation among agencies at all levels, the momentum generated by the activities of the past several years, and the growth of technical expertise, there is a good chance for success, and the prospect for making considerable progress, at least, is likely.

One of the goals described in the following section is the convening of a national forum to assess, plan for, and prepare to evaluate the progress of floodplain management in the early part of the 21st century. This first forum is proposed to be held in 1996, and one of its principal aims will be the refinement of an evaluation procedure.

SECTION V
RECOMMENDED GOALS



Photo previous page: Tennessee Valley Authority

RECOMMENDED GOALS FOR THE UNIFIED NATIONAL PROGRAM, 1995-2025

This section sets out intermediate- and long-term goals that will bring the Nation closer to using its floodplains wisely. These goals are based in part on the opportunities identified in Chapter 16 of the *Assessment Report* and in other documents and forums, and in part on the national and global trends analyzed above. They also reflect a recognition that making wise use of each and every floodplain in the country is a fairly distant ambition, but that, when aggregated, a number of independent improvements may represent significant overall progress. Objectives necessary to achieving each goal are identified, and a target date is set for completing them. The goals and objectives are precisely phrased to set an action agenda and to make estimates of progress as feasible as possible. Further refinement of the various objectives, precise definitions of their components, and methods for measuring progress will need to be addressed as the Program proceeds.

Goal 1. *Formalize a national goal-setting and monitoring system.*

Statements of national goals are insufficient by themselves. They must be couched in an institutionalized process that includes a formal system for setting goals, monitoring and evaluating progress, and recalibrating the approaches as necessary. Moreover, the partitioning of authority for floodplain management decisions among the local, state, and Federal governments and the private sector demands an integrated goal-setting mechanism involving representatives of each level of authority and each interest group. A national leadership strategy needs to be established to encourage acceptance of responsibility and initiative. A multidisciplinary approach must be taken, with coordination among the various fields of expertise that contribute to effective floodplain management.

- Objective a. Devise a mechanism for setting, monitoring, and revising national floodplain management goals, by 1995.
- Objective b. Hold a national forum on "Floodplain Management for the First Quarter of the 21st Century," by 1996, to discuss and modify the mechanism outlined in Objective a.
- Objective c. Institutionalize the mechanism with appropriate legal, legislative, or administrative measures, by 1997.

Goal 2. *Reduce by at least half the risks to life and property and the risks to the natural resources of the Nation's floodplains.*

Mitigating the risk to human life and property and to the natural resources of floodplains requires a baseline inventory of these resources. It also requires development of a data collection and management system that assures that mitigation actions can be rapidly undertaken in pre- or post-disaster situations. So far, the methods for identifying and evaluating human resources are more readily available than methods for assessing natural resources, but significant progress has been made in this area in recent years.

- Objective a. For all metropolitan floodplains, complete an inventory of
 - all existing structures, by 1996;
 - all natural resources, by 2000.
- Objective b. For all nonmetropolitan floodplains,
 - inventory all existing structures, by 2000;
 - identify areas with high potential for development, by 2000;
 - inventory all natural resources, by 2005.

Goals of a Unified National Program for Floodplain Management 1995-2025

- 1) *Formalize a national goal-setting and monitoring system.*
Complete by 1997
- 2) *Reduce by at least half, the risks to life, property, and the natural resources of the Nation's floodplains.*
Complete by 2020
- 3) *Develop and implement a process to encourage positive attitudes toward floodplain management*
Complete by 1997
- 4) *Establish in-house floodplain management capability nationwide.*
Complete by 2000

Objective c. Mitigate the risk of flood damage to at least half the Nation's highest-risk floodplain structures, by 2020.

Objective d. Reduce by at least half the risk of degradation of the most important natural resources of the Nation's floodplains, by 2020.

Goal 3. *Develop and implement a process to encourage positive attitudes toward flood-plain management.*

General public support is essential to making wise use of the Nation's floodplains. Recent Supreme Court decisions have balanced public and private rights that affect floodplain land use; yet many citizens still seem unaware of the adverse impacts that individual actions may have on other floodplain occupants. Special attention should be given to forward-looking governments and private organizations that have accepted leadership roles in making floodplain management decisions. This may require new institutional arrangements to encompass Federal, state, and local governments and the private sector.

Objective a. Develop a concept and definition of floodplain management that will improve public understanding and support, by 1996.

Objective b. Lay out a national leadership strategy to encourage acceptance of responsibility and initiative, by 1996. This effort would focus on the special interest groups with roles in floodplain management, concentrate on building consensus on selected issues before the 1996 forum, and during the forum would refine and disseminate concepts for sharing tasks and apportioning responsibilities.

Objective c. Establish new incentives that give credit for integrating different floodplain management programs, strategies, and tools, by 1996.

Objective d. Devise a national strategy to create public understanding that mitigating action is required when floodplain development potentially damages public or private property or natural resources, by 1997.

Goal 4. *Establish in-house floodplain management capability nationwide.*

The development and utilization of skilled personnel is a prerequisite to achieving national floodplain management goals. Many states and large communities already are capable of employing permanent, knowledgeable floodplain management staff, although so far not all of them see the wisdom of doing so. Smaller communities and rural areas usually must obtain floodplain management expertise—if at all—through the states or by arrangement with adjacent larger communities.

Objective a. Make available enhanced training, especially that which takes a comprehensive view of floodplain management, by 1996.

Objective b. Establish in-house, floodplain management capability in all states and in all metropolitan areas, by 1998. Such capability should encompass expertise in managing both human resources and the natural resources of floodplains.

Objective c. Provide improved floodplain management services to non-metropolitan areas, by 2000. These services could be provided through the states or by cost-sharing for purchase of the services.

Objective d. Establish standards for floodplain management expertise, by 2000. Such standards might involve professional certification, and would recognize individuals who have by training and experience achieved a high level of skill.

A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

Action Agenda 1995-2025

Objective

Completion Date

Goal-Setting and Monitoring

- | | |
|---|------|
| a. Devise a mechanism for setting, monitoring, and revising national goals. | 1995 |
| b. Hold a national forum on "Floodplain Management for the First Quarter of the 21st Century," to discuss and modify the mechanism as needed. | 1996 |
| c. Institutionalize the mechanism through legal, legislative, or administrative measures. | 1997 |

Mitigation of Risk

- | | |
|--|----------------------|
| a. For all metropolitan floodplains, complete an inventory of <ul style="list-style-type: none">• all existing structures• all natural resources | 1996
2000 |
| b. For all nonmetropolitan floodplains, <ul style="list-style-type: none">• inventory all existing structures• identify areas with high potential for development• inventory all natural resources | 2000
2000
2005 |
| c. Mitigate the risk of flood damage for at least half the Nation's highest-risk floodplain structures. | 2020 |
| d. Reduce, by at least half, the risk of degradation of the most important natural resources of the Nation's floodplains. | 2020 |

Public Awareness

- | | |
|--|------|
| a. Develop a simple concept and definition of floodplain management that will improve public understanding and support. | 1996 |
| b. Lay out a leadership strategy to encourage initiative and acceptance of responsibility. | 1996 |
| c. Establish new incentives that give credit for integrating different floodplain management programs, strategies, and tools. | 1996 |
| d. Devise a national strategy to foster public understanding that mitigating action is required when floodplain development potentially damages public or private property or natural resources. | 1997 |

Professional Capability

- | | |
|---|------|
| a. Make available enhanced training, especially that which takes a comprehensive view of floodplain management. | 1996 |
| b. Establish in-house, professional floodplain management capability in all states and in all metropolitan areas. | 1998 |
| c. Provide professional floodplain management services to nonmetropolitan areas. | 2000 |
| d. Establish professional standards for floodplain management expertise. | 2000 |

SECTION VI
SUMMARY AND VIEW
OF THE FUTURE



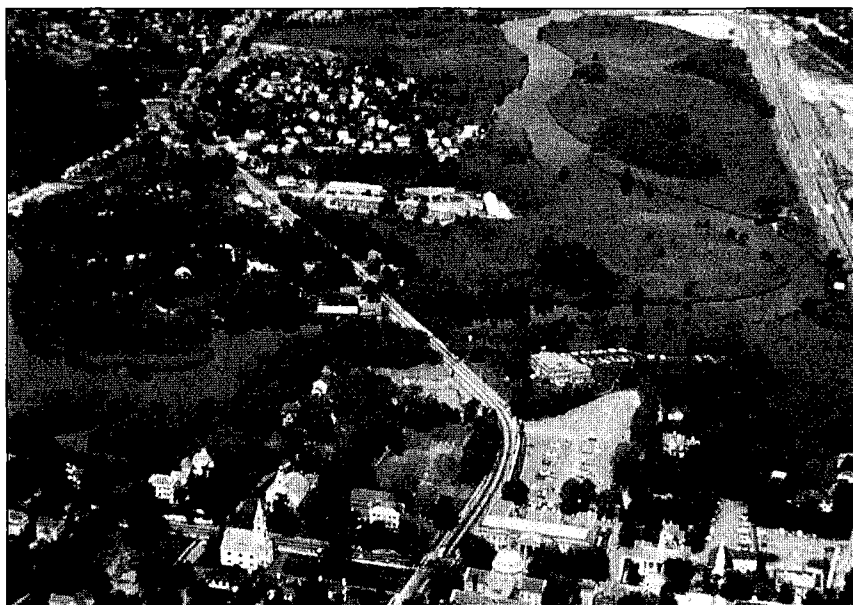
SUMMARY AND VIEW OF THE FUTURE

Now, perhaps more than ever, the United States stands poised to simultaneously reduce the damages caused by floods, restore degraded floodplain areas, and preserve and protect the resources and functions provided by those that are still relatively undisturbed. Mitigating flood hazards, protecting natural resources, and promoting wise use of the Nation's floodplains will not only have economic and environmental benefits, but will also enhance the quality of life for millions of Americans. A nationwide program for integrated management of floodplains in the United States could become a model for the sustainable, wise use of similar areas in other countries.

This update of the Unified National Program for Floodplain Management recognizes the importance of floodplain lands and waters to the national well-being, both economic and environmental. There is evidence that Americans, while still full of compassion and readiness to assist in times of true calamity, are becoming less willing to subsidize the costs of unwise floodplain occupancy as they grow more knowledgeable about and respectful of natural processes and ecological relationships. At the same time, it is clear that society will continue to demand the transportation, power generation, harbors, and other benefits provided by our oceans and interior waterways, as well as the aesthetic pleasures of clean water, natural environments, and wildlife habitats that floodplains can provide. It is also increasingly obvious that the multitude of less visible but vital functions carried out by natural floodplains must be safeguarded: providing natural conveyance and retention of flood waters, filtering nutrients and impurities in surface water, promoting aquifer recharge, maintaining biodiversity, and enhancing agricultural soils, to mention but a few.

The successes and failures of past attempts to cope with flood hazards have brought us to a fuller understanding of the need to manage these areas carefully and of the breadth of means for doing so that lie at our disposal. The experience of the last 25 years has demonstrated the wisdom—indeed, the absolute necessity—of approaching floodplain management from various perspectives simultaneously, of providing for local and regional conditions, coordinating the activities of various agencies, governments, and the private sector, and of educating the public. The narrow focus of the past has broadened to embrace the diverse contributors to the current status of floodplain lands. That is why floodplain management is now defined as a continuous decisionmaking process that aims to promote the wise use of floodplains. Whether a use is “wise” should be judged by the extent to which potential flood losses are diminished and natural floodplain resources preserved and restored.

Under this conceptual framework, decisionmakers at all levels—be they owners, residents, or hired or elected “managers” of floodplains—choose the best mixture of well-tested approaches to determine how floodplains are to be used. Making these decisions involves balancing competing uses and evaluating various alternatives, keeping in mind the needs, goals, and characteristics unique to each floodplain and the people who have an interest in it.



U.S. Army Corps of Engineers

Charles River watershed, with natural flood storage, near Dedham, Massachusetts.



Decade for Natural Disaster Reduction

The goals of the Unified National Program for Floodplain Management are in concert with the goals of the U.S. and International Decade for Natural Disaster Reduction to encourage activities that will minimize the impact of natural disasters on the Nation and the world.

To encourage a consistent nationwide effort, this update of the Unified National Program outlines four broad goals and provides details on the steps needed to attain each of them. A deadline has been proposed for achievement of each. A mechanism for evaluating progress toward the goals and for setting new ones is proposed to be formalized by 1996, and a national forum in that year is expected to solidify support for this procedure among the Federal, state, local, and private decisionmakers and professional groups concerned with the use of floodplains. In the interim, appropriate specific actions can be taken by all levels of government and the private sector to implement the goals described here.

The challenge now is to focus the attention of all levels of government and the private sector on the national need for an integrated, sustainable approach to managing human activities and natural resources of floodplains, and on the long-term goals that will move the Nation toward realization of that vision. The United States has the opportunity to move forward over the next decade to carry out a unified approach to managing its floodplains. Concurrence on the proposed national goals set out here and systematic tracking of their progress are two major steps toward successful implementation of a Unified National Program for Floodplain Management.

REFERENCES

- Changnon, Stanley A., Jr., William C. Ackermann, Gilbert F. White, and J. Loreena Ivens
1983 *A Plan for Research on Floods and their Mitigation in the United States*. Final report to the National Science Foundation, grant # NSF-PAG-81-17027. SWS Contract Report 302. Champaign, Ill.: Illinois State Water Survey Division. Department of Energy and Natural Resources.
- Federal Emergency Management Agency
1986 *A Unified National Program for Floodplain Management*. FEMA 100. Washington, D.C.: FEMA.
- Federal Insurance Administration
1992 *Learning from Hurricane Hugo: Implications for Public Policy*. Washington, D.C.: FIA, Federal Emergency Management Agency.
- Federal Interagency Floodplain Management Task Force
1992 *Floodplain Management in the United States: An Assessment Report Volume 1*, FIA-17. *Volume 2*, FIA-18. Washington, D.C.: the Task Force.
- Federal Interagency Floodplain Management Task Force
1987 "Further Advice on Executive Order 11988, Floodplain Management." Washington, D.C.: Federal Emergency Management Agency.
- Kusler, Jon A.
1982 *Regulation of Flood Hazard Areas to Reduce Flood Losses, Volume 3*. Washington, D.C.: U.S. Water Resources Council.
- Ralph M. Field Associates, Inc.
1981 *State and Local Acquisition of Floodplains and Wetlands*. Washington, D.C.: U.S. Water Resources Council.
- Task Force on Federal Flood Control Policy
1966 *House Document 465: A Unified National Program for Managing Flood Losses*. 89th Congress, 2d Session, Committee on Public Works. Washington, D.C.: U.S. Government Printing Office.
- Tennessee Valley Authority and Federal Interagency Floodplain Management Task Force
1985 *Evaluating the Effectiveness of Floodplain Management Techniques and Community Programs*. Special Publication #10. Boulder, Colo.: Natural Hazards Research and Applications Information Center.
- U.S. Water Resources Council
1981 *Floodplain Management Handbook*. Washington, D.C.: U.S. Government Printing Office.
- U.S. Water Resources Council
1979 *A Unified National Program for Flood Plain Management*. Washington, D.C.: WRC.
- U.S. Water Resources Council
1978 "Floodplain Management Guidelines for Implementing E.O. 11988." *Federal Register* 43 (29):6030-6055, February 10.
- U.S. Water Resources Council
1976 *A Unified National Program for Flood Plain Management*. Washington, D.C.: WRC.

NATURAL RESOURCES OF FLOODPLAINS

Floodplains that are relatively undisturbed (or have been restored to a nearly natural state) provide a wide range of benefits to both human and natural systems. These benefits take many forms: some are static conditions (like providing aesthetic pleasure) and some are active processes (like filtering nutrients). There is some ambiguity over which of these benefits are properly termed “functions,” which are “resources,” and where the terms overlap. A fairly well accepted (but not necessarily comprehensive) list follows. The resources and functions have been loosely grouped into three categories, and the categories have been labelled according to the primary recipient of the benefit or its relationship to a larger system. That is, “water resources” include those resources and functions of floodplains that are part of or provide a benefit to the hydrologic cycles on the earth’s surface and below ground; “biologic resources” are floodplain resources and functions that benefit plants and animals; and “societal resources” are floodplain resources and functions that directly benefit human society. Throughout the Unified National Program document, the term “natural resources” is used to refer to any or all of the resources and functions listed here.

Water Resources

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

Biologic Resources

Biological Productivity

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

Fish and Wildlife Habitats

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

Societal Resources

Harvest of Wild & Cultivated Products

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

Recreational Opportunities

- Provide 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

AN UPDATE OF THE STRATEGIES AND TOOLS FOR FLOODPLAIN MANAGEMENT

Part of the conceptual framework of the Unified National Program for Floodplain Management consists of a series of strategies and tools that can be used to manage floodplains to reduce losses to both human and natural resources. Over the years, these strategies and tools have been revised as needed, and some changes have been made in this 1994 update. A complete list of the current strategies and tools appears on the next page. Full discussions of how each can be used for floodplain management purposes can be found in the *Assessment Report*. The changes that have been made for this update are explained below.

Modify Human Susceptibility to Flood Damage and Disruption

One additional tool has been recognized: preservation and restoration of the natural resources of floodplains. This technique reduces the risk to human resources because many of the normal hydrologic and biologic functions of natural floodplains act to mitigate the intensity, extent, and damaging aspects of flooding. Note that this "tool" is also one of the two components of wise use; it is both a means and an end.

Modify Flooding

This strategy has been strengthened by the addition of one tool: shoreline protection measures. There are four main categories of such measures. The first includes structures such as seawalls, bulkheads, and revetments, which are designed to protect development along coastal areas by restricting wave impacts. The second category is made up of breakwaters and jetties, which are designed either to protect harbors and navigation channels from wave action or to stabilize inlets. The third category includes groin fields or segmented off-shore breakwaters, which provide shoreline protection by trapping sand. All of these structures have a tendency to induce erosion on their downdrift sides or in front of them if they have not been properly designed, constructed, or maintained. The fourth category of shoreline protection measures includes quasi-natural methods such as beach nourishment and building sand dunes. These approaches are often taken in an attempt to restore eroding beaches and also to protect existing development. They are generally more cost-effective than structural measures, but are sacrificial by design and must be periodically repeated.

The value of well-placed and properly implemented beach nourishment was demonstrated during Hurricane Hugo in 1989. In general, wider beaches and higher dunes mitigated damages to landward property during the storm, and at least one artificially nourished beach suffered less storm damage and recovered more quickly than an adjacent, unnourished one.⁴

Preserve and Restore Natural Resources of Floodplains

One tool has been added to this strategy; again it is that of beach nourishment and dune construction. A program of periodic replenishment of sand along a specified segment of shoreline can help remedy the interruption of natural sand transport caused by development activities or even by the incautious placement of structural protection measures. Likewise, building dunes by artificial means or increasing the height of damaged dunes can help preserve and restore the normal physical-biological interplay of the nearshore system, resulting in vastly enhanced aesthetic benefits, improved storm protection, and reduced costs for additional damage mitigation measures.

⁴ See the Federal Insurance Administration's report, *Learning from Hurricane Hugo*, listed in the References.

STRATEGIES AND TOOLS FOR FLOODPLAIN MANAGEMENT

STRATEGY: MODIFY HUMAN SUSCEPTIBILITY TO FLOOD DAMAGE AND DISRUPTION

- Floodplain Regulations
 - State regulations for flood hazard areas
 - Local regulations for flood hazard areas
 - Zoning
 - Subdivision regulations
 - Building codes
 - Sanitary and well codes
 - Other regulatory tools
- Development and Redevelopment Policies
 - Design and location of services, utilities, and critical facilities
 - Land acquisition and open space
 - Permanent relocation
- Disaster Preparedness
- Disaster Assistance
- Floodproofing
- Flood Forecasting and Warning Systems and Emergency Plans
- Preservation and Restoration of Natural Resources and Functions of Floodplains

STRATEGY: MODIFY THE IMPACT OF FLOODING ON INDIVIDUALS AND THE COMMUNITY

- Information and Education
- Flood Insurance
- Tax Adjustments
- Flood Emergency Measures
- Postflood Recovery

STRATEGY: MODIFY FLOODING

- Dams and Reservoirs
- Dikes, Levees, and Floodwalls
- Channel Alterations
- High-Flow Diversions
- Land Treatment
- On-site Detention
- Shoreline Protection Measures

STRATEGY: PRESERVE AND RESTORE THE NATURAL RESOURCES AND FUNCTIONS OF FLOODPLAINS

- Floodplain, Wetland, Coastal Barrier Resources Regulations
 - Federal regulations
 - State regulations
 - Local regulations
 - Zoning
 - Subdivision regulations
 - Building codes
 - Sanitary and well codes
 - Other regulations
- Development and Redevelopment Policies
 - Design and location of services, utilities, and critical facilities
 - Land acquisition and open space
 - Permanent relocation
 - Restoration of floodplains and wetlands
 - Preservation of natural functions and habitats
- Information and Education
- Tax Adjustments
- Administrative Measures
- Beach Nourishment and Dune Building

US ARMY CORPS. OF ENGINEERS



4 0233 0037345



Federal Emergency Management Agency

FEMA 248/June 1994